Multidimensional Approach to Local Water Conflicts

A Study Based on the Afar Region of Ethiopia

By

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Abstract

Water is one of the most precious but least valued common property resource. Efficient ways of water resources management are vital to socio-economic development and the overall feat of societal stability. However, water conflicts have further exacerbated the access to water especially in low-income developing countries. Most notably, little attention has been given to studying water conflicts at the local level when compared to international water conflicts. As a result, there is insufficient information and theory on the exponentially increasing number of local water conflicts. In the Middle East, water was a tool for military purposes; in Asia disputes over water occur due to development-related activities, whilst in Africa, control over water resources has been the root cause of many conflicts affecting millions of vulnerable communities.

This research investigates the nature, causes and dimensions of local water conflicts in the context of low-income developing countries based on the Afar region, which is located in the Awash Trans-regional River Basin of Ethiopia. The research suggests a new multidimensional approach for pre-identification, early warning services and local water conflict neutralization. This approach also introduces preparedness techniques, which play a significant role in reducing potential risks and tensions that trigger local water conflicts between communities sharing the same water resources. The study further proposes a policy guideline matrix that would serve as a technique for reducing local water conflicts by providing new ways of thinking about the links between sustainable developments, local water conflict management and strategic partnerships.

The research is implemented through the process of designing a framework based on essential theoretical and practical findings supported by survey data of 134 household representatives of local communities and 26 institutions, together with 22 interviews. The introduced multipurpose framework is based on five fundamental parameters, namely: contribution to Sustainable **D**evelopment, **I**nformation, **P**reparedness, **T**olerance Capacity and **I**nteraction (DIPTI). The research proposes the “Sparkling Effects of Conflict”, a new approach in understanding and predicting the coverage of the effects of conflicts other than the primary conflicting parties and conflict location. In addition, two pillars of the conceptual frameworks emerged from the findings. First, the WEC (Water, Early Warning and Conflict) information pyramid, a framework designed to indicate the core components of local WEC-related information identification and management. Second, the Pillars of Conflict Pyramid, the simplest conceptual framework, easily helps to pre-identify the effects of local water conflicts with certain limitations. Besides, the study addressed six additional conflict neutralization and resolution inputs that incorporate the significance of the participation of women and other vulnerable members of communities. These findings also highlight the advantage of co-existence between useful traditional and modern practices in neutralizing conflicts. Overall, the study will assist local people, policy and decision makers and institutions in low-income developing countries with a similar context to that of the study area.

KEYWORDS: *Conflict, Water, Sustainable Development, Strategic Partnership, ‘Dhaagu’, Low-income Developing Countries, Early Warning, Preparedness, Vulnerable Communities, Ethiopia*

Dedication

Dedicated to Vulnerable Communities
Residing in Every Part of Our Planet.

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Acronyms and Abbreviations

AU	African Union
BBC	British Broadcasting Corporation
Birr	National Currency for Ethiopia
CSA	Ethiopian Central Statistical Authority
DIPTI	Contribution to sustainable **D**evelopment, **I**nformation, **P**reparedness, **T**olerance capacity and **I**nteractions
DPCT	Data Preparation, Cleaning and Transformation
DSS	Decisions Support System
EC	Ethiopian Calendar
ECA	Economic Commission for Africa (UN)
EU	European Union
EW	Early Warning
EWS	Early Warning Services
FAO	Food and Agriculture Organizations (United Nations)
GIS	Geographic Information System
Gov.	Government
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IWRM	Integrated Water Resources Management
LWC	Local Water Conflicts
MDG	Millennium Development Goals
MoWR	Ministry of Water Resources (Ethiopia)
NBI	Nile Basin Initiative
NCC	Communication, Networking and Cooperation
NGO	Non-Governmental Organizations
NT	Networking
RBM	River Basin Management
RCA	root cause analysis
RRC	Relief and Rehabilitation Commission (Ethiopia)
SEC	Sparkling Effects of Conflict
SEDF	Socio Economic Diversity Factors
SPSS	Statistical Package for the Social Sciences'
SRCDF	Sustainability of Resources and Conflict Diversity Factors
SWOT	Strength, Weakness, Opportunities and Threats
UN	United Nations
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOA	Voice of America
WaCoMa	Water conflict management
WCDF	Water Conflict Diversity Factors
WEC	Water, Early Warning Services and Conflict
WHO	World Health Organization
WR	Water Resources
WRD	Water Resources Development
WRM	Water Resources Management

Glossary/Definitions

Buta'a	Traditional ways of Afar community's prediction practices to search for a lost person and make market predictions for livestock.
Clan/race	Group of people related by blood or marriage (inherited).
Conflict	A strong disagreement or collision of values, needs, interests, or intensions among individuals, groups, organizations, communities, or nations (Doug Hovatter, 1997).
Dhaagu/Daagu	Afar community traditional ways of communication within the tribe members where each member of the tribe follows the rule to share and transfer information within the people.
Dispute	Short term disagreements that are relatively easy to resolve (John Burton, 1990).
Disagreement	A difference of opinion (Doug Hovatter, 1997).
Edir	Ethiopian traditional ways of association established within a group of communities or neighbours mainly targeted for helping each other during mourning (over the death of member's family or close relatives). Representatives are elected by members; equal monthly contribution of money among the members – (something like life insurance).
Equb	Ethiopian traditional ways of association for saving money within members of the communities who knew and trust each other where each contribution is divided into equal shares and the participants collect money based on a draw system or special request.
Fima	Unwritten traditional laws practiced by the Afar community. It is a shared traditional common law for all Afar clans. It is a communal law with very strong rules and regulations that helps to administer and control the use of water supplies, grazing, land use and others. It is also used during conflict and war times. It has also many branches depending upon different circumstances happening in the region.
Gignili	Male fortune-teller in Afar tradition used for the prediction of political, socio-economic and related events.
Gile	Traditional sabre used by pastoral Afar communities.
Hitokobiya	Traditional ways of astrology used for predicting the future of the local people and environment including development, disaster, war, etc.
Interstate conflict	A relatively small share of the armed conflict in the present international system (Gleditsch and Beadsley, 2004).
Kaluwale	Female fortune-teller in Afar tradition used for the prediction of political, socio-economic and related aspects.
Kebele	The low level of the modern local government structure throughout Ethiopia.
Kililoch (Singular-Kilil)	Regional States (administrative divisions). Ethiopia is divided in to 9 'Kililoch' and 3 chartered cities.
Mabilo	Traditional jury system practiced within Afar tribal communities.
Nations/country	A group of tribes/ethnicity (always have common identity).
Tribes/ethnicity	A group of clan/race (learned).
Violent	Always has negative actions including physical fighting and damage to resources.
Wereda	Equivalent to district, a collection of '*Kebele*'s.
Zone	Subdivision of a Kilil. Ethiopia is sub divided into over 63 Zones.

Chapter One
INTRODUCTION AND BACKGROUND

"Is personal happiness enough when there is so much suffering in the world?"
(James, 2007)

This chapter introduces a brief overview of background information, conflict trends and concepts of conflicts in relation to local water resources and other factors that trigger conflicts in low-income developing countries. It includes detailed explanations of research questions, research aims and objectives, the expected research outcomes, justification of the research and structure of the research. Moreover, the main concerns and the potential problems related to local water conflict in low-income countries as well as potential conflict powers are manifested.

1.1 Introduction and Motivation

So far, our planet has witnessed many wars and conflicts between groups of people at local, national and international levels where most of them are fighting over the uses of common natural resources such as, water, land, grass, food and energy. Water has been used as a political and military target or tool for over four thousand years (Gleick *et al.,* 2007). Because of such cumulative effects, most people fear and feel uncomfortable with any disagreements. At the same time, uncontrolled human needs and behaviour exposes people to a high level of conflict that brings challenges in the day-to-day activity of human life.

According to UN studies, by the year 2025 the condition of global water resources will worsen due to an increase in population and the effects of climate change. As a result, two of every three persons will be exposed to a high water stress situations. The former UN Secretary General, Kofi Annan, and others have often warned people that they should now forget about religious and communal wars and prepare for wars over water, which is the most precious commodity in the world (Postel and Wolf, 2001).

Many scholars believe that water-related conflicts contribute to the likelihood of internal political violence. Less attention has been given to managing water-related disagreements and to the pressures that are occurring at local levels. In contrast to this, many research projects and discussions have addressed international conflicts associated with trans-boundary rivers, lakes and aquifers. Thomasson (2005) stated that some local cases also have transboundary implications; upstream conflict tends to have repercussions on downstream and downstream is sometimes another nation.

The effects of local water conflicts have multi-dimensional problems and the crisis is more serious when it comes to low-income developing countries. The demand for a water supply is increasing in all parts of the world. Water is one of the most precious common property natural resources over which local conflicts are drastically increasing in many parts of low-income developing countries. Although, a proliferation of studies on water conflicts exists (Wolf, 2003;

Gleick, 2007; Castro, 2007), however, in particular, there is insufficient information regarding water conflicts at the local level. As a broader observation, two thirds of the local and international water conflicts in the world mainly occur in the Middle East, Asia and Africa, respectively. In the Middle East, water is a tool for military purposes; in Asia, disputes over water occur due to development-related activities and in Africa, control over water resources has been the root cause of local conflicts.

The data analysis on Gleick's (2009) water conflict chronology shows that the numbers of local water conflicts are increasing as compared to international water conflicts. However, many researchers have been focusing on conflicts that occurred in relation to transboundary river basins only. Because of this fact, little is known about local-level water conflicts that affect the sustainable development of vulnerable grass-roots communities whose daily life and economy is highly linked with water and other natural resources. In low-income developing countries, for example, in Afar region of Ethiopia, the rural communities are exposed to local conflicts due to a lack of early notification caused by the unavailability of efficient early warning systems.

Water is traditionally considered as a local resource (Gleick, 2007) and many rural and pastoral communities in the Awash basin firmly believe and defend their right to use it free. Traditionally, local communities own rural water supply resources in low-income developing countries. Besides, private traditional users and some local governments manage the resources. In urban areas of low-income developing countries, government is the major stakeholder and responsible institution in controlling the supply of water. In general, governments, the public and private people have direct involvement with conflicts arising in relation to water resources.

This research focuses on conflicts over local water resources in low-income developing countries. It introduces a new multidimensional approach to pre-identify, prepare for, establish a warning system and neutralize local water conflicts based on the study held in the Afar region. The Afar region, part of Awash River Basin, which is located in the central part of Ethiopia (see Figure 1-2 and Appendix A), was selected as a case study, testing location and data collection centre for this study. The research mainly provides a sustainable way of local water conflict pre-identification and preparedness processes through the DIPTI framework. Dimensions of water conflict have also been identified, as well as an approach for early identification of local water conflicts. In addition, the study introduces six additional tools for current conflict resolution processes mainly related to water conflicts.

The researcher identified that locally-based conflict studies are more sensitive and require adequate awareness about the livelihood of communities influenced by traditional practices. In most cases, local-based water conflicts are easily triggered by technical, administrative and natural factors. These factors are interrelated with problems associated with water resources

development projects, grazing, wetland, territory, local politics, economy, culture, ethnicities or races, health, drought, social issues or environmental problems. The study of a multidimensional approach and early warning services (EWS) for local water conflict is a newly emerging subject. Thus, the study plays a significant role in reducing the tensions caused by water-related conflicts between local communities sharing the same water resources. Additionally, it will help to create further awareness about the extent of the existing and future worldwide water supply problems.

1.2 Background and Context

1.2.1 Existing Facts Related to Local Water Conflicts

There are inadequate numbers of private, governmental and nongovernmental modern institutions working on water conflict and early-warning-related activities in the Afar region and in low-income developing countries in general. The existing institutions are limited and have a problem of coordination and communication among themselves and with traditional institutions. Besides, they have limited administrative capacity and unclear authority and functions. Lack of adequate transparency and fragmented institutional structures are other problems among these institutions. Figure 1-1 (below) shows the distribution of a number of institutions working on water conflict worldwide (for further details see Appendix D).

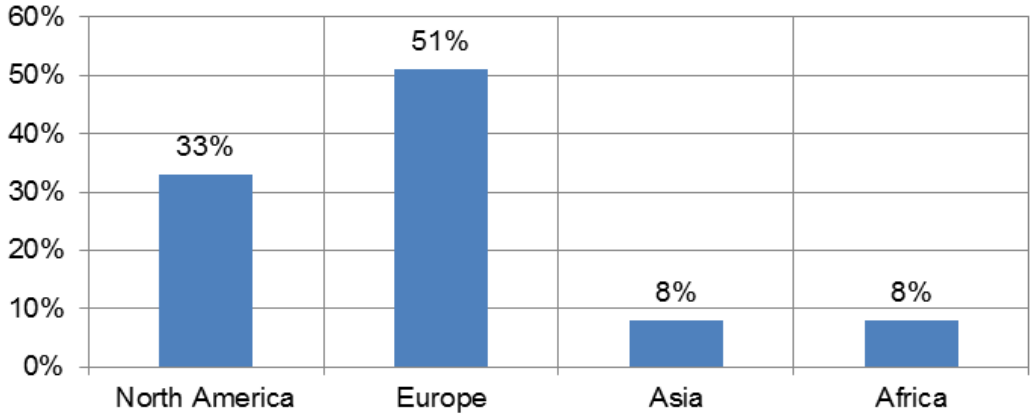


Figure 1-1: International institutions distribution working related to water conflict/war

The study has shown that there are very few professionals in the area of water conflicts and not much research has been done specifically on local water conflicts. For example, among these internationally recognized professionals, Peter Gleick[1] is working on international water conflicts over water resources; Aaron Wolf[2] on transboundary water resources pertaining to political conflict and cooperation and Falkenmark[3] is dealing with the problem of water scarcity in developing countries.

[1] Peter H. Gleick, Ph.D., is co-founder and president of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California.
[2] Aaron T. Wolf, Ph.D., is a Professor of Geography and Coordinator of the Transboundary Freshwater Dispute Database, Department of Geosciences, Oregon State University.
[3] Malin Falkenmark, Ph.D., is a Professor of Applied and International Hydrology is a globally renowned water expert and currently serves as Senior Scientific Advisor to the Stockholm International Water Institute (SIWI).

According to the reports from the Ethiopian Water Resources Ministry, the Awash River basin covers an area of 110,000km^2 consisting of Western and Eastern catchment areas. The length of the Awash River is about 1,200km; it rises from the central Ethiopian highlands at an altitude of 3,000m and ends up at Lake Abe in the Afar triangle at an elevation of 250m. The amount of mean annual water resources in the river basin is about 4,900Mm^3. The report from MoWR indicates that 21% of the water in the river basin sinks mainly in the Gedebassa swamps and other parts of the river system. The climate of the Awash River Basin is mainly sub-tropical. However, the lower valley, mainly located in the Afar region, has desert and semi-desert climatic conditions.

In addition to water resources, people in the river basin are mainly in conflict over wetland and grassland areas. The main concerns in the region are related to the frequent conflicts between the Afar and Issa tribes. The growing conflict with government projects working on development and the construction of water-related infrastructure and other common property resources is another dimension of local community concerns in the region. The other factors were related to inefficient ways of controlling, utilizing and managing farmlands, which was originally used as pasturage in the region.

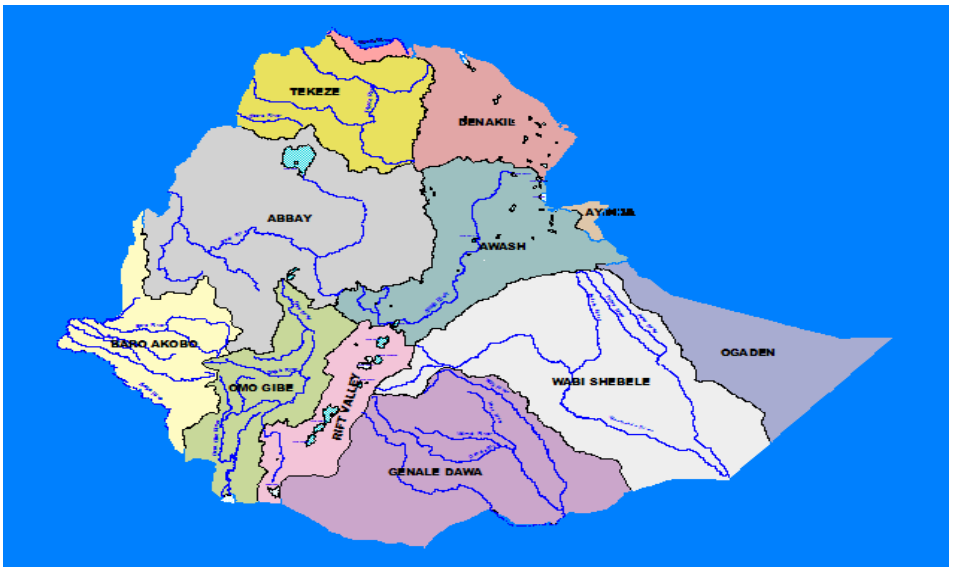
In the Afar region, a majority (90%) of the population in the lower valley are pastoralists predominantly raising camels and goats. The people in the river basin are repeatedly exposed to flooding, drought problems and seismically active land with the problem of occasional earthquakes. Lack of adequate grazing land for livestock and shortage of firewood and water are the main sources of problems in the region.

1.2.2 Facts about the Study Location

Research has shown that Ethiopia[4] has been involved in internal conflicts for the last 3,000 years. Although there are a few formal institutions working at different level of local activities, the local conflict problems associated with different factors such as water, land, grass and other natural resources have not been addressed unequivocally. Ethiopia is often considered as the ‘water tower’ of Eastern Africa because many (10 major) rivers are flowing to its neighbouring countries. Some of them are shared with two countries. The previous Minister of Ethiopian Water Resources, Mr. Asfaw Dingamo, linked Ethiopia’s water resources to "Ethiopia's oil”, in his interview with Norway's Fjeldstad (2009). On the other hand, water supplies and sanitation facilities in the country are among the lowest in Africa. For many, in a country having enormous water resources and potential, the scarcity problem seems unimaginable. For others, the resource utilization problems have been entangled with long-

[4] “The overall land mass of the country is hydrologically divided into 12 Basins. Eight of these are River Basins, one Lake Basin and three Dry Basins. Four of the River Basins, Abbay, Baro-Akobo, Mereb and Tekeze are part of Nile River System, flowing generally in the Western direction toward Sudan eventually terminating in the Mediterranean Sea. Five Basins, namely, the Omo-Ghibe, Awash, Rift-valley Lakes, Denakil and Aysha can be categorized as the Rift-valley system as all of them drain their water in the Great East African Rift Valley. The remaining three, Genale-Dawa, Wabishebelle and Ogaden are part of the Eastern Ethiopian Basin that generally flows in the South-easterly direction toward the Somali Republic and then to the Indian Ocean” (MoWR web site, 2007).

standing internal conflicts, political instability both in the country and in the region, climate change, weak resource management and the country's poor economic condition. Today, the country is facing escalating problems related to its trans-boundary and trans-regional rivers. Ethiopia has 12 Basins, eight of which are River Basins, one Lake Basin and the remaining three Dry Basins with insignificant flow out of the drainage system (MoWR, 2007).



Source: Ministry of Water Resources, Ethiopia, 2007

Figure 1-2: Map of river basins in Ethiopia

The Awash River basin is one of the eight river basins in the country located in the Great East African Rift Valley system. The Awash River is the most utilized trans-regional river and is a source for national hydroelectric power generation, irrigation, fishing and local consumption. The river basin covers 10% of the country (FAO, 1997) and there have been many local conflicts in the basin over the use and distribution of water. According to the 1994 Ethiopia population census, an estimated figure of over 9 million people were living in the upper, middle and lower valleys of the Awash River basin covering six ethnic-based political administrative regions: Oromiya (37.5%), Amhara (19%), Afar (10%), Somalia (7.5%), Addis Ababa (23%) and Dire Dawa (3%). According to the Awash Basin Master Plan, four main farming systems have been identified: (i) mixed-crop-livestock farming; (ii) large- and small-scale commercial irrigated farming enterprises; (iii) agro-pastoralism and (iv) pastoralism. Halcrow (1989) stated that the pastoralists, who currently form the main population group in this area, at present, are reluctant to adopt a more settled lifestyle. This evident change in land use requires the migration of the necessary workforce from other parts of Ethiopia.

The researcher selected the Afar region in the Awash River basin, as the testing area for the study due to complex local problems in the region in relation to water conflict. In the Afar region, the survey data indicates that 1 in 10 persons are directly involved in conflict; 1 in 5 persons or family members are affected by conflicts; 1 in 2 persons believe that there were

unresolved conflicts; 9 in 10 know the conflicting parties and 7 in 10 agree that they are in conflict with Somalia's Issa tribes.

The framework for the study encompasses the selection of appropriate research paradigms and will assist professionals, policy and decision makers working in the same and related sectors. It also encourages political commitment that prioritises better water resource management supporting the sustainable development of socio-economic activities of low-income countries. In this research, the initial activity focused on the identification of fundamental concepts of conflict and water conflict theories. It also includes the process of identification and fine-tuning of the relevant research methodologies; formulation of the research variables and units of analysis. The process of designing survey questionnaires for data collection and selection of SPSS software for data analysis is discussed in detail. This process generates and leads towards a positive expectation of pre-identification, early warning, preparedness and neutralization of local water conflict problems.

1.2.3 Operational Definitions on Water Conflicts

In this research, conflict is commonly considered as a serious disagreement leading to violent crises unless otherwise specifically stated. Often, violent water conflict leads to a sudden clash that leads to a war. Once people become involved in fighting, the reason why they are involved in war becomes more complicated and difficult to justify. Besides, it is hard to define conflict in any stable quantitative or qualitative way, but most people have an intuitive feeling of what it is when they encounter it (Thomasson, 2005). Thomasson further agrees that such feelings are an insufficient base for future evaluation and appraisal. Beardshaw and Palfreman (1990), also claim that conflict is something that is easy to recognise but difficult to define. The Oxford English Dictionary (1989) defines the term 'conflict' as a "serious disagreement or argument". The level and complexity of any conflict depends on the conflicting party valuing the tolerance of disagreement. Some people have a very low tolerance for disagreement (Whetten *et al.*, 1996:8) and others do not. In most cases, high tolerance generates constructive disagreements whereas low tolerance speeds up or maximizes destructive disagreements that lead to conflicts.

1.2.3.1 Previous Definition of Water Conflict

Many researchers defined and classified water conflict problems in different ways. The problems of local water conflicts mainly affect the vulnerable members of local communities at grassroots level. Wherever water conflict takes place, it primarily affects those at the local level.

According to Gleick *et al.* (2007:25), water conflicts appeared "as a military tool (state actors), military targets (state actors), terrorism - including cyber terrorism - (non-state actors) and development disputes (state and non-state actors)". However, an overview of the history of

attacks on water systems dates back 4,500 years to what was known as the “Lagash-Umma Border Dispute” (Gleick, 2007). Further to this, he noted that the dispute over the Gu’edena region begins with Urlama, King of Lagash from 2450 to 2400 B.C., diverting water from this region to boundary canals thereby drying up the boundary ditches to deprive Umma of water. Later, his son Il cut off the water supply to Girsu, a city in Umma (Gleick, 2007).

Thomasson also classified water conflicts at international, national and local levels. Similarly, Haftendorn (2000) emphasized that water conflicts can arise from the use of shared water resources and through pollution. Gleick (2009) claims that the chronology of conflicts shows a history of conflicts and tensions over water resources, the use of water systems as weapons during war, and the targeting of water systems during conflicts caused by other factors such as terrorism, development disputes and control over resources. Also, Gebremariam (2006) defined water conflicts as a disagreement occurring between a group of water users due to an existing water-stress situation, poor management of the resources and the availability of unfair water rights theories, separately or in combination. Shiva (2002b), in her book *Water Wars*, highlighted that the war between Israelis and Palestinians is, to some extent, a war over water-related issues involving the Jordan River and the groundwater of the West Bank, which is used in common by Israel, Jordan, Syria, Lebanon and the West Bank.

In Africa, Ethiopia has a long history of internal and external conflicts that have hindered the country’s development. Today, the situation continues. The country has the largest water reserves in Africa and many of its major rivers flow to neighbouring sub regions. The Nile River is one of these rivers, which has been exposed to international conflicts with Egypt and Sudan. Approximately 84% of Ethiopians live in rural areas within international river basin locations. In 1958, Egypt began building the Aswan Dam and displaced 100,000 Sudanese, which generated conflicts between Egypt and Sudan. Finally, the Sudanese were reconciled with the promise of more water. Ethiopia, contributing 86% of the total annual flow, was never consulted on the sharing of Nile waters and retaliated by declaring its right to use the Nile whichever way it chose (Shiva, 2002a).

In accordance with the concepts of game theory, Fisher *et al.* (2005) technically described the cause of water conflict utilization as when two or more parties with a claim to the same and shared water sources are seen as playing a zero-sum game. In this aspect, Fisher further explained that the water that one party gets is not available to the others, so that one party’s gain is the other party’s loss. Today, how and who is getting this water is the subject of formal and informal discussions, and the main concern of the vulnerable people of our planet.

Fradkin (1981) believes that water flows towards the powerful and the rich. In a local context, this belief is not necessarily true. This study has shown that the standards of living of the people of the lower Awash River Basin are lower than those living up-stream on the River. Moreover, history has taught us that the powerful and the rich may not remain the same.

Whatever a country's development status, all people require sustainable water resources that can be supported by reducing future water conflicts and associated problems, which has to become a common goal.

1.2.3.2 The Researcher's View on Water Conflict

The study identified the three factors that could cause and lead to water conflicts. These pillars depend on the types or numbers of communities or stakeholders (as the players), the adequacy of the water resources (as the playing field and object) and the type of practice, tradition or regulations implemented in the region for the utilization of the resources (as the rules of the game). The lessons learnt from the above pillars show that local water conflicts could be easily pre-identified depending on the type of the existing relationships, beliefs, traditions or regulatory frameworks among the stakeholders in the river basin. The necessary rules existing among the people and institutions participating at the local level in sharing, managing or controlling the resources are also other pillars. These pillars are also influenced by external factors related to local issues such as the involvement of stakeholders from other regions or federal movements.

1.2.4 Summary of Literature Gaps

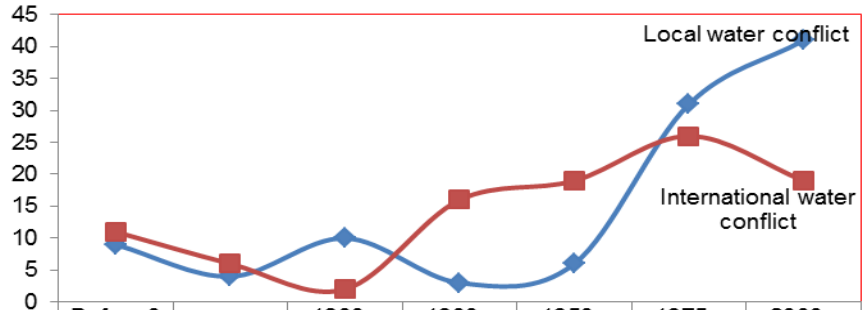
Based on the review, there are no adequate data, theories and information on local water conflicts. There are no well-documented information resources on how the past local water conflicts were resolved. The researcher did not find adequate, standard, uniform and integrated water conflict management information systems. Most literature refers to international conflicts with little being available on local water-conflict management practices in low-income developing countries. The highly fragmented existing literature on conflicts defines conflicts with confusing explanations and in controversial ways. There are no universally accepted definitions, especially on two terminologies: conflict and early-warning system. A lack of adequate professionals in this study field was another crucial gap that the researcher has identified. Lack of indicators that show the boundary line between constructive and destructive ways of disagreement was another gap in the literature. Approaches towards local conflicts did not get enough attention with respect to the links and contributions of the co-existence of modern and traditional practices. Many low-income developing countries do not have any developed strategic plans, policies and guidelines on the pre-identification and resolving of local conflicts. In the Literature Review Chapter (§ 2.7), the researcher further explains the potential gaps in the literature on local water conflicts and links them with the main framework of the study (Chapter 3).

1.3 Significance of the Research

In order to alleviate poverty and ensure the sustainable development of low-income developing countries, further preparedness is required on securing the food supply, which is highly linked with the security of the water supply. However, multiple effects of local and

international water conflict related problems have hampered the situation of water security in low-income developing countries.

Gleick's (2009) water conflict chronology data analysis confirms that the trend of past conflicts show local water conflicts to have been increasing since 1997 and exceeded the number of international water conflicts after the year 2000. The findings of the study indicate that international water conflicts were increasing in the 20th century and have started decreasing since the beginning of the 21st century. The trend of local water conflicts shows that it has been significantly increasing since the mid-20th century and continued to increase as displayed in Figure 1-3 and Table 1-1 below. Many researchers such as Gleick, Wolf and Thomasson have explained the potential for future water-related conflicts that lead to violent conflict. Furthermore, the Fourth World Water Forum in Mexico in March 2006 proclaimed that the next world war would be fought over water, which certainly caught the delegates' attention (Gleick *et al.*, 2007). Prior to this, in 2001, the former United Nations Secretary General, Kofi Annan, said that "fierce competition for fresh water may well become a source of conflict and wars in the future" (Postel and Wolf, 2001).



	Before 0 BC	0 - 1799	1800 - 1899	1900 - 1949	1950 - 1974	1975 - 1999	2000 - 2009
Local water conflict	9	4	10	3	6	31	41
International water conflict	11	6	2	16	19	26	19

Data source: Adapted from Gleick water conflict chronology, 2009

Figure 1-3: Comparison and trends of local and international water conflicts (2009)

The causes of water conflicts in the Middle East (26%) tend to have a military dimension; and in Asia (23%), water resources development is the major cause. In Africa (16%), conflicts tend to be based on the control of water resources whilst in North America (15%); it is the use of water for the purpose of terrorist activity. The distribution of the chronicled total number of water conflicts shows Europe 13%, South America 6% and Australia 1%. Today, over 203 water conflicts are registered and 40% of the world total population live in transboundary river basins. In Africa, local water-conflict-related problems are dramatically increasing. The recent studies show that armed conflict costs Africa around $18 billion (US Dollars) per year and on average shrinks the continent's economy by 15% (Hillier, 2007).

In many parts of Africa, millions are dying in conflicts, not only over resources like water but also over land and in political power struggles related to ethnicity. By the year 2006, in Somalia, 250 people were killed in clashes over water wells; In Ethiopia at least 12 people

died and over 20 were wounded in clashes over competition for water and pasture in the Somali border region (Gleick, 2006). Gleick noted that the war between Israel and Lebanon Hezbollah shows that rockets damaged a wastewater treatment plant in Israel. Similarly, it was reported that the Lebanese government also indicated that Israel attacked and damaged water systems throughout southern Lebanon, including tanks, pipes, pumping stations and facilities along the Litani River. In addition, Gleick (2006) noted that 20 people were arrested and many families forced to leave their homes due to a struggle between Hajja and Amran tribes over a water well located between the two administrative regions in Yemen. In Sri Lanka, the rebel groups blocked a water supply that serves to 60,000 people in a village in northeastern Trincomalee district for 19 days and over 50 people died (Anbarasan, 2006).

Table 1-1: Some useful conflict data at the global level

Description	Amount
Number of water conflicts as of 2009:	203
Number of international trans-boundary rivers as of 2002:	263
Number of international trans-freshwater treaties as of 2002	400
Nations having territory within a trans-boundary basin	145 (21 lie entirely within one)
Countries having more than 95% of their territory within one or more trans-boundary basins	12
Approximately one third of the 263 trans-boundary basins are shared by more than two countries	
1 in 10 rivers now run dry for part of the year, some due to climate change, many due to overuse	
Number of unresolved major international water conflicts	More than 15
Population living in trans-boundary river basins	40%
Number of dams as 2003	47,655
Historical water related events as of 1999	5800
Estimated total cost of African armed conflict as of 1990 - 2007	$300 billion (US Dollars)

Data Source: Azage (Compiled from Hillier, 2007; Gleick Chronology, 2009; Oregon State University, 2005; UNESCO, 2005; Ohilisson, 1995; Bonn International Centre for Conversion; Wolf *et al.,* 2003 and Jones, 2010)

A tribal conflict mainly between Ethiopia's Afar and Isa pastoralists frequently occurs because of lack of adequate clean water and shortage of grazing land. There is a minimum level of awareness of information relating to resources, conflicts and early warning situations in the region. A high level of exposure to risks associated with natural and manmade hazards is a critical problem in the Awash River basin. A minimum level of networking, communication and cooperation with neighbouring tribes in the river basin is another factor that hampers the socio-economic development of the region. There is a medium level of communities' and institutions' participation in, and satisfaction with, local activities related to the sustainable development of water resources.

The researcher has identified and presented the new findings on trends of local water conflicts in comparison to international transboundary conflicts. The study has also reflected on the new findings on the concepts of "the **S**parkling **E**ffects of Local **C**onflicts (SEC)" and DIPTI

framework model used for the purpose of local water conflict pre-identification, early warning and neutralization.

In order to achieve and check the applicability of the research, the researcher has selected the Afar region in the Awash River Basin as a study and testing area. Intensive desktop information assessment was used to investigate feasible facts and theories on the areas of study. The researcher has designed and developed a systematic questionnaire based on the complex conflict parameters that are targeted at local communities and stakeholder institutions in the region. Table 1-2, below, introduces and sums up the justification of the research in relation to its contribution to the sustainable development of low-income developing countries as well as the way it contributes in the strengthening of strategic relationships with developed countries.

Table 1-2: Designing the significance of the local water conflict research

Contribution of the Local Water Conflict Research Towards Sustainable Development				
Why Important	***To Whom Important***	***What Benefits will Occur***	***←The Link→***	***Sustainable Development***
To ensure sustainable development in low-income developing countries.	Primarily local people, policy makers and local institutions in low-income developing countries, secondly it promotes strategic business partnerships with developed countries (direct and indirect beneficiaries).	It reduces violent conflicts that leads to human crises; promotes peace and security by reducing water-related conflicts.	Local communities, traditions, regulations and institutions, strategic business partnerships [Framework of the Study (Chapter 3), SEC (Chapter 7 and 8), DIPTI Framework model (Chapters 7 and 8) and a policy guideline matrix (Chapter 8)].	Efficient ways of common property natural resources utilization and development; economic development; political stability, reduces poverty by securing food and securing water supply.
Assessment and Justification of the Problem Local conflicts over water and natural resources are increasing mainly between the Afar and Issa tribes as well as growing conflicts with government over resource utilization. The river basin is exposed to natural and manmade hazards. In the world, local conflicts are exponentially growing as compared to transboundary conflicts.				
The Research/Study				**Larger Issues**

1.4 Statement of the Problem

It is a great challenge that local water conflicts are exponentially increasing in most low-income developing countries of Africa and Asia. Moreover, the problem is more serious in the Afar region of the Awash River Basin in Ethiopia. There was a limited amount of research done on the area. Due to the cultural, social and political sensitivity of local problems, many researchers are mainly interested in studying conflicts related to international Transboundary rivers. As a result, the researcher is missing facts that are useful for pre-identification and preparedness for tackling local water conflict problems. The necessary data and theory for the preparation of an early warning system at the local level were not adequately available. There is no clear scientific system to identify and define the problem. In the meantime, conflict-

related problems primarily affect and hinder development. This has led to chronic food insecurity and water shortages are increasing due to rapid population growth, urbanization, industrialization, droughts and limited administrative capacities in the low-income developing countries. People in low-income countries are highly exposed to the effects of global climate change that have been occurring due to uncontrolled pollution problems. Consequently, the need for more water utilization is creating tensions that lead to conflicts among the user communities, governments and other service providers in the region. The next flow chart further explains the research problems.

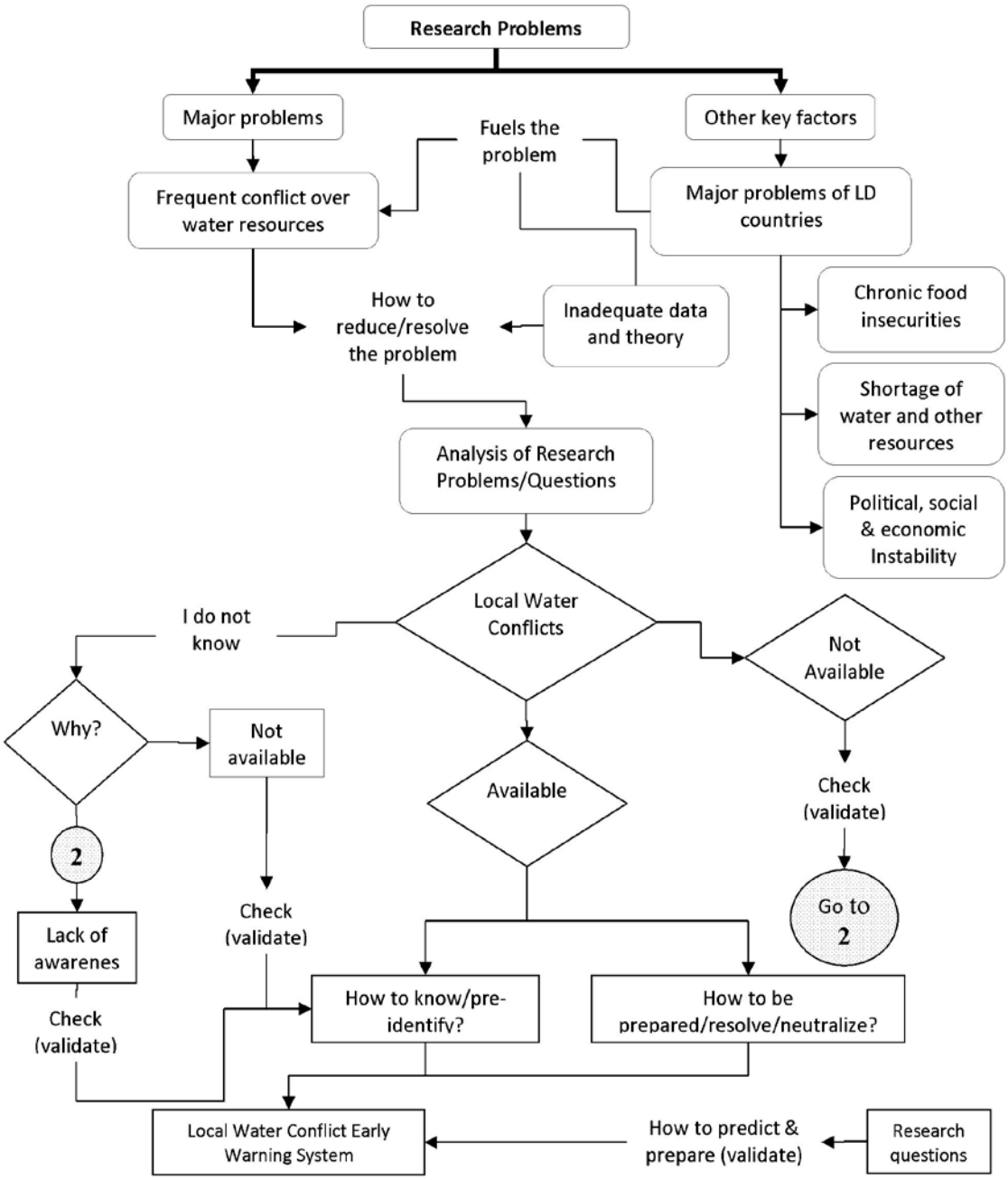


Figure 1-4: Analysis of research problems

1.5 Research Agenda

1.5.1 Research Questions

During the early stages of this research, the researcher has investigated a number of different unresolved conflict-related problems with a special focus on water. According to Brewer (2007), most people probably come to doctoral research with an idea of what they wish to do - what is needed is the refinement of the topic into viable, manageable and useful research questions. On the significance of research questions, Hart (2006) suggests that there may be no answer, in any definitive sense, to a question, but it can lead to advancements in understanding and clarification, which in themselves are worthwhile outcomes. In order to produce a clear basis for the research, one main research question and five key sub-questions have been developed for further explorations of local water conflict pre-identification, early warning and preparedness in low-income developing countries.

Main Question:

How can we pre-identify and prepare for local water conflicts in low-income developing countries*?*

The concern here is not with answering the research questions on local water conflict pre-identification and preparedness. Certainly, the controversial problem of the output of the research is that the effects of unpredictable, unnatural and more complex influences of external powerful groups from outside of the conflict-prone region may be due to special interests in the region mainly because of geopolitical, economic or any unpredictable reasons.

Under this main research question, five of the secondary questions and related concerns on each of them have been formulated and addressed as follows:

Key Question 1:

What type of frameworks, models or theories could be applied to pre-identify and prepare for local water related conflicts?

The concern here is with the complexity, validity, representativeness and applicability of the model to prove the functionality of the framework on local water conflict early warning and preparedness systems. The extent to which the findings of the model can be generalized so that it can be adapted to any water conflict-prone areas is another concern.

Key Question 2:

What are the available and relevant data, theories, literature and information on the pre-identification or management of local water related conflicts or war?

The concern here is that little was known about local water conflicts due to the absence of representative literature and information at the local level, though there was more literature and information on transboundary rivers related to the high level of water conflicts. Validity of data is also another part of the concern while the primary data collection was highly

dependent on individual respondents who are motivated by different phenomena and occasionally influenced by personal behaviour. The process of local level data acquisition in low-income developing countries is more difficult due to the sensitivity of the problem and political instability of the available regions in similar situations. In low-income developing countries, there was a lack of functioning facilities to collect information at the local level. For instance, there are limited modern communication and networking infrastructure facilities for data collection on the effects of vulnerable communities who are primarily affected by conflicts.

Key Question 3:

What are the types, roles, collaboration and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water conflict management areas?

The concern here is with the inadequate or weak level of collaboration among local, regional and international institutions in low-income developing countries. Indeed, the lack of adequate NCC facilities and structures for the integrated approaches among the direct or indirect stakeholders' participant communities in the region involved directly or indirectly in conflicts and conflict management processes are also parts of the researcher's concern.

Key Question 4:

What are the main hazards, risks and costs associated with local water-conflict-related problems?

The concern here is not directly with the type of the problems. It is about the level of the intensity and effects of hazards and risks in general while it highly depends on the level of local communities' vulnerability and institutional capacity for alleviating the problems. Another problem is the increasing level of dependency of the local people on the seasonally varying limited natural resources, which affects the capacities and tolerance of communities, especially pastoral communities and farmers.

Key Question 5:

How can tools like modelling (quantitative) and a policy indication guideline (qualitative) be applied in developing good local water conflict management frameworks in low-income developing countries?

The concern here is the level of local stakeholder institutions and members of the communities' capacity and tolerance for the application of the frameworks in the region. Due to the political sensitivity of the subject, the implementation of the framework also requires a high level of political willingness on the part of the ruling parties. In most cases, political willingness and improvement of stakeholders' capacity could be achieved depending on the

validity of the framework. This requires the testing of the system in different regions or countries.

1.5.2 Research Aim and Objectives

Generally, research is carried out to contribute to a particular discipline, to inform policy and/or to address a specific issue or problem (Wilkinson, 2000). Thus, the aim of this research project is to discover a sustainable technique of pre-identification, early warning and neutralization of local water conflicts and put forward appropriate recommendations that can be used to eliminate or reduce violence, deprivations and humanitarian crises that threaten sustainable development in low-income developing countries. Additionally, this research aims to create further awareness about the extent of the existing and future worldwide water supply problems through the study of local water conflicts.

The aim of the project will be achieved under the following four objectives (*OB*):

OB- 1: To investigate the state-of-the art in the local water conflicts and develop a pre-identification, preparedness, early warning and conflict neutralization framework model designed to assist policy makers, governments, international institutions, donors, military experts, at-risk vulnerable populations and other risk-affected stakeholders.

OB- 2: To examine the underlying problems, information and dimensions of local water conflicts by providing relevant and timely data supported by valid theoretical and practical findings.

OB- 3: To develop an approach that prioritizes better water resources management and encourages optimum political, social, economic and traditional commitments.

OB- 4: To contribute a policy guideline that helps to reduce local water conflicts in low-income developing countries mainly based on information generated from an appropriate pilot water-conflict study location.

1.5.3 Research Hypothesis

The need for a hypothesis was explained as follows: “If the research questions you want to answer in your research project suit you, you might express these as a hypothesis which you will then seek to either prove or disprove” (Blaxter *et al.,* 2006). The hypothesis helps to guide the direction of the study as well as to identify research variables, the frameworks of the study and research designs. Accordingly, the hypothesis of this research is:

“Local water conflict pre-identification and preparedness framework modelling will contribute towards the pre-identification, preparedness, neutralization and resolution of the risks

occurring due to local water conflicts, and will improve the efficiency of the sustainable use of the scarce water resources in low-income developing countries."

1.6 Research Target Groups

The research is based mainly on data collected from communities and stakeholder institutions working in the region. Also, the beneficiaries of the study are listed as follows:

- ***Local communities***: Mainly pastoralists and vulnerable community members in the Afar region of the Awash River Basin in Ethiopia, in particular, and low-income developing countries in general.
- ***Local leaders and experts***: Tribal leaders, local leaders, respected elders in the region and professionals, government authorities and policy makers.
- ***Stakeholder Institutions***: Modern and traditional local institutions directly or indirectly working in the region such as government institutions, business organizations, individuals that manage shared water resources, educators at all levels, professionals, current and future decision-makers, the beneficiary community and the private sector.
- ***Strategic partnerships****:* International business organizations or government institutions working on cooperation and understanding of the rationale of strategic partnership with developing countries in promoting sustainable development, international businesses and strengthening strategic alliances in today's complex and interconnected global environment. Moreover, it opens an opportunity for having the sustainable use, distribution and advancement of the dimensions of power and the development of resources.

1.7 Benefits and Expected Outcomes

The study will supply up-to-date theory, knowledge, data and information on local water conflicts in low-income developing countries. The main expected outcome of the research is that it provides a suitable multidimensional early warning framework model for the prediction of pre-identification and preparedness for local water conflicts between communities sharing the same water resources or between any at-risk populations and stakeholders. In addition, it will play a positive role in supporting the sustainable development of socio-economic activities in low-income developing countries. The study will also provide additional tools to promote peace and security. The following are some of the expected outputs of the research as parts of the thesis:

- **Framework model**: Designing a sustainable and multidimensional process-based local water conflict pre-identification, early warning, preparedness and neutralization framework model and to evaluate and test its practical application.

- **Dimensions of conflict**: Develop and justify variables that indicate the causes, effects and dimensions of 'local water conflicts', which are essential for local water conflict management (WaCoMa) information system (details on development of conflict management information system left for future works).
- **WEC data, database, and web information**: Collect local water conflict data, map the essential links of WEC variables, structure and group them with respect to a database organization suitable for the process of local water conflict pre-identification, preparedness and neutralization. In addition to that, indicate information on a list of key institutions and professionals working on water conflicts management areas including a database that shows conflict anatomy. The study also provides background information for designing web-based information.
- **Additional tools for conflict management and neutralization**: The study provides an additional six new tools as an approach for current conflict resolution processes, in particular, for better local water conflict management practices that help in reducing poverty and enhancing peace and security in low-income developing countries. The approach includes the concept of the Sparkling Effects of Conflicts (SEC), enhancing the participation of women and other vulnerable members of the community. The study also emphasises the use of a balanced approach between traditional and modern practices in sustainable development and in the process of resolving conflicts.
- **Pilot data collection location**: Identification of a representative location that shows the level of intensity of the main problems related to local water-conflict and early warning services in the Awash River Basin, Ethiopia; and preparation of background information to have an updated version of the list of local water conflict chronologies.
- **Strategic partnership**: The study also shows the link and the importance of a strategic business and development partnership and essential background information for the sustainable development of water-sector and investment activities in collaboration with local, national and international stakeholders.

1.8 Research Methodology

Due to the complex and politically sensitive nature of local water conflicts in low-income developing countries, multiple research methods have been investigated and integrated in order to identify appropriate local water conflict data supported by relevant conflict theories. Survey methods, root cause studies and grounded theory are the main types of research methods initially analysed and discussed within the main qualitative and quantitative frameworks of the research process (Chapter 4). The necessary variables that are compatible

with the theories of an early warning system for local water conflicts have been developed and integrated with the research methodology for its maximum acceptability.

The sampling strategy in this research is focused on a group of local people sharing the same water resources in the Afar region. The researcher has chosen purposive sampling and snowball sampling methods for collecting the survey data due to the difficulty of getting an adequate number of people living in conflict-prone zone pastoral communities and diverse local institutions as well as the intense political situations in the region. The Afar region was selected as a study area for data collection, field-testing and comparing feasible information for local water conflict research. The WEC data have been collected from 134 local community households (mainly pastoralists) and 26 government, NGO and private institutions (mainly government institutions). In general, the majority of the people are living in the upstream and lower stream locations within the basin. These include agrarians, pastoralists and nomads as well as some people working in different water and conflict-related institutions. SPSS and Ms-Excel software are used for data analysis. In conclusion, triangulation and mixed research approaches were adopted to identify and analyse the different perspectives of the local water conflicts in the Awash River Basin of the Afar region.

1.9 Contribution to New Knowledge

In the last sections (§8.5) of Chapter 8, the Conclusion and Implications, the researcher has presented 28 lists of the research's theoretical and practical contribution to new knowledge. These new findings includes details of the formulation of pillars of local water conflict, the WEC (Water, Early Warning and Conflict) information pyramid, DIPTI parameters and SEC sparkling effects of conflicts and alternative approaches in resolving conflicts. Most importantly, the researcher developed model frameworks useful for the pre-identification, early warning of and preparedness for, the effects of local water conflicts. The researcher has also included an alternative approach to redefining conflicts and local water conflicts.

1.10 Structure of the Thesis

This section presents details of the road map of the research. The thesis is organized in eight chapters, a glossary and the relevant appendices supported by a list of references and a bibliography. The research focuses on local water conflict pre-identification and early warning system preparation that helps to investigate the root causes of the problem and hence allows planning to take effective preventive actions to reduce, resolve and neutralize local water conflicts. The road map of the thesis is explained in Figure 1-5 below. It indicates the design of the thesis structure derived from the title, aim and objectives of the research project and was used as the fundamental baseline for the dissertation. The contents of the research

structure presented in the next flow chart show the road map of the research classified into five working procedures and refining stages, Phases 1 to 5 (P1-5).

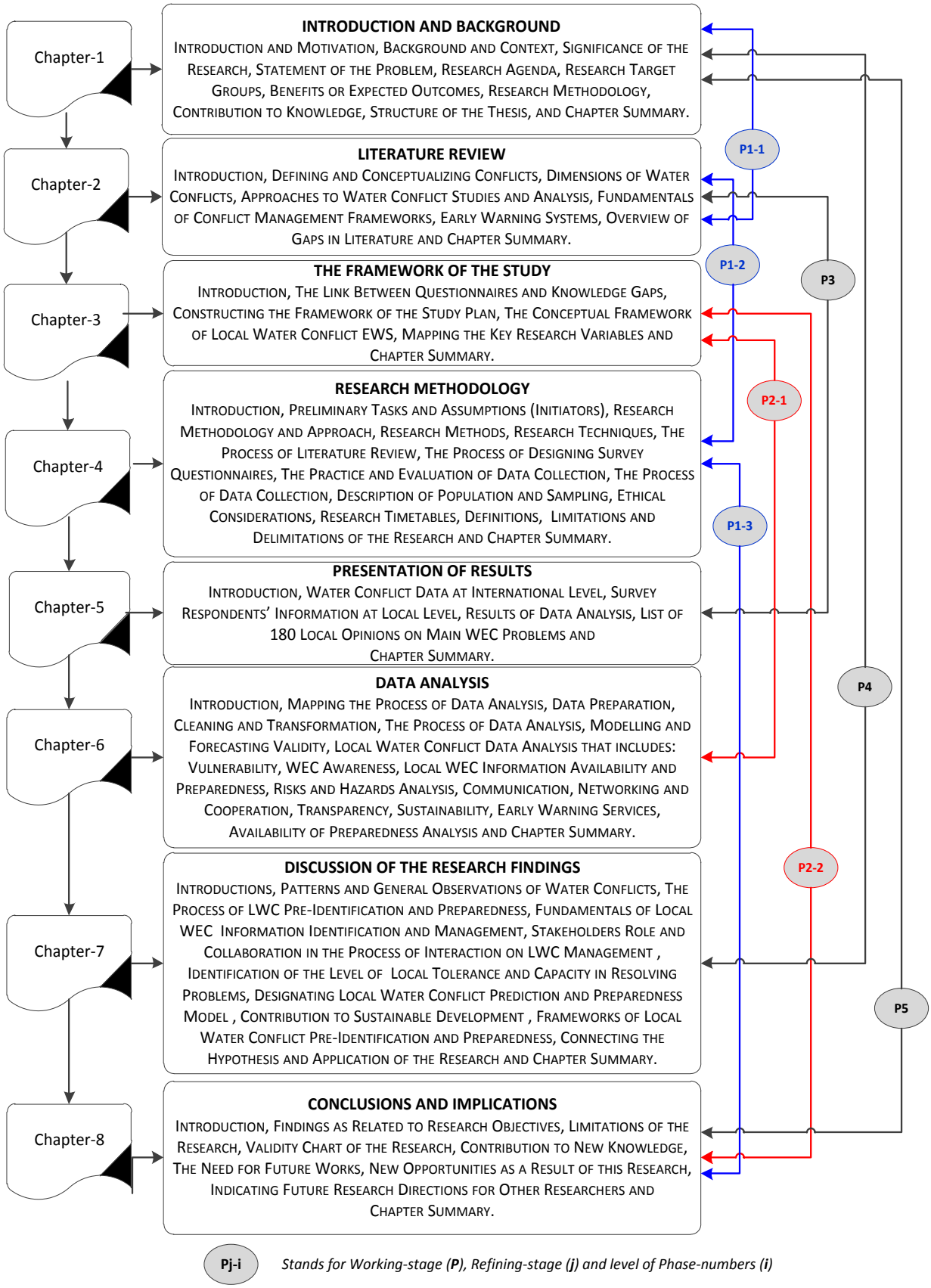


Figure 1-5: The design of the research road map

CHAPTER 1: *Introduction and Motivation*, introduces a brief overview of the background information, conflict trends and concepts of local conflicts in relation to local water resources and other factors that trigger conflicts. Furthermore, research questions, research aims and objectives, the expected research outcomes, justification of the research and structure of the research are all explained in this chapter. Moreover, the main concerns and the potential problems related to local water conflict in low-income countries as well as potential conflict powers are manifested in this section.

CHAPTER 2: *The Literature Review* presents a critical analysis of the previous relevant works. It reflects summaries of explanations and criticisms of the theoretical backgrounds on water and conflicts in general, conflict and organizations, life cycles of conflicts, early warning system, charts about the anatomy of conflicts, fundamental theories of conflicts and some alternative approaches to the study. Besides, an overview of water conflicts with respect to local, urban and international levels is clarified in order to understand and visualize the dimensions of the problem. The effect of ethnicities, politics, economy, health and drought in relation to water conflicts has been summarized to show the size of the problem in detail.

CHAPTER 3: *The Framework of the Study* indicates the design and the necessary parameters of the key elements of the research plan. It includes the link between questionnaires and knowledge gaps, constructing the framework of the study plan, the conceptual framework of local water conflicts, the key research variables and a chapter summary.

CHAPTER 4: *The Research Methodology* provides and discusses the research methodology and the process of building support for the research work. It includes information about the research paradigms and methodology, validity, variables, units of analysis, definitions and the limitations of the study. The data collection describes the process of data collection, the preparation of research questionnaires, data collection problems, description of population and sampling. It also explains the qualitative and quantitative data and variables used in gathering relevant information related to water, conflict, early warning situations, local communities and institutions.

CHAPTER 5: *Presentation of Results* indicates the positive and negative findings of the research without any interpretation of the analysis. The researcher has presented in a simple logical order the findings based on the output of the actual observation of data and data analysis. Mainly it includes the status of the survey respondents, the results of data analysis, mapping the local water conflict EWS variables and a list of 180 main problems in the Awash River Basin of the Afar region.

CHAPTER 6: *Data Analysis*, describes the main components and patterns of the local water conflict early warning system data mining that includes data preparation, cleaning, transformation, classification and analysis. In this chapter, the researcher has analysed

components of DIPTI parameters that include vulnerability, WEC awareness, local WEC information availability, risks and hazards, networking, communication and cooperation, transparency, sustainability, early warning services status and local availability of preparedness.

CHAPTER 7: *Discussion of Research Findings,* compares, discuses, interprets and studies the results of the data analysis described in the previous chapters based on the previous works, existing theories and traditional practices. It also introduces the most important parts of the findings of the research.

CHAPTER 8: *Conclusions and Implications*, shows the overall summaries and suggestions about each research question, the hypothesis, research problems, existing theories, policy, local traditions and practices and the limitations of the study. It also indicates the proposal for future research directions in the study of local water conflicts. It also highlights and puts forwards the directions of new opportunities that will occur as a result of the implementation of the results of this research.

1.11 Chapter Summary

This chapter provides background information, explains the existing and future environment of the local water conflicts in the Awash River Basin and the status of water conflicts in other parts of the world. It also indicates the main concerns of the research area - the increase in local water conflict in low-income developing countries. The study clearly identifies and explains the major research questions and reflects the concerns around each of the problems.

The researcher described the detail of the triggers of local water conflicts in low-income developing countries. The preparedness for potential risks of local water conflict and their relation to social, political and economic sector aspects were examined in a general context. The study introduced and discussed a preliminary conceptual understanding of water conflicts. The importance of survey data on local water conflicts in the Afar region and Peter Gleick's World Water Conflict Chronology were the basis for the study. The survey data was reanalysed in detail in order to fill the information gap on local water conflicts. Moreover, the predicted research outcome and justification of the research hints at the direction of the research work. The researcher has discussed the urgency of the call for the need for water security in low-income developing countries. Finally, the strategic importance of studying local water conflicts in enhancing global business partnership is highlighted. The issues mentioned here will lead towards further discussion in Chapter 2, the literature review.

Chapter Two
LITERATURE REVIEW

Newton's famous quote, 'If I have seen further, it is by standing upon the shoulders of giants' (Finn, 2005)

This chapter reviews and presents a critical analysis of previous relevant works. It reflects a synthesis of explanations and criticisms of the theoretical backgrounds on water and conflicts; conflict and organizations; life cycles of conflicts; anatomy of conflicts; early warning systems; fundamental theories of conflicts and some alternative approaches to the study. Besides, an overview of water conflicts with respect to local, urban and international levels is clarified in order to understand and visualise the dimension of the problem. The effects of ethnicities, politics, the economy, health and drought in relation to water conflicts have been summarised to give a picture of the problem in detail.

2.1 Introduction

Chapter 1 demonstrated a road map leading towards the description and analysis of local water conflicts. This chapter focuses on reviewing the theoretical backgrounds to the existing knowledge, understanding and concepts surrounding conflict and early warning systems. Moreover, it covers an in-depth review of conflicts with a special focus on local water conflicts. The researcher has also identified the gaps in the literature and the current debate on water conflicts.

So far, much of the literature, data and theories reviewed on local level water conflicts are limited. The study shows that many researchers in the literature focused on international Transboundary Rivers. Thomasson (2005) claimed that most research deals with shared freshwater resources, especially from a river basin perspective. The literature on the approaches and theories of conflict analysis focused on the game theory is more or less mathematical and can be seen as an "interactive decision making process" (Raiffa *et al*., 2002). Other papers recommended an approach using institutional and cognitive methods as supplementary analysis tools. Some researchers have also applied tools such as SWOT analysis.

The approaches to conflict analysis described in most of the literature are highly technical and professional, overlooking the simple traditional approaches in low-income developing countries. Although the modern approach is more useful, most of the traditional communities participating in conflict resolution processes are limited or do not have adequate awareness and capacity to understand such complicated technical issues. The lack of literature on integrating such useful technical issues of conflict analysis with the real traditional practices of the world has been identified as a serious oversight.

The reviewed literature and related websites show that over 90% of organizations that have been working on conflict management activities are established and located in developed countries in Europe and the USA, as compared to Africa, Asia and Middle East (see Appendix D). Recently, most papers and news headlines on conflict show that the day-to-day violent conflicts in low-income developing countries are increasing. Unfortunately, there are no adequate organizations working in the process of conflict negotiation or resolution activities in the conflict-prone, local areas of low-income developing countries.

2.2 Defining and Conceptualizing Conflicts

2.2.1 Fundamental Perceptions

In this section, further concepts and explanations of conflicts will be reviewed in addition to previously introduced (Chapter 1, section 1.2.3) operational definitions of conflicts. The Oxford English Dictionary defines the word 'conflict' as coming from the Latin word stem ‘conflīgĕre’; where ‘con’ means ‘together,’ and ‘flīgĕre’, means ‘to strike’(Garzon, 2005). This shows that the term conflict represents a sharp disagreement in terms of interests or ideas.

Conflict is part of our day-to-day life experience especially when we are dealing with opposing circumstances or different issues. In that regard, Emmit (2010) argues, conflict exists where there is an incompatibility of interests. However, Engel (2003) noted that, despite a millennium of preaching, conflict did not disappear. Today, most parts of the low-income developing countries are suffering an endless war as a result of such critical conflicts.

On conflicts related to construction projects, Yiu and Cheung (2007) stated that conflicts are inevitable in construction projects because of the fact that all construction projects involve complex human interactions. In the area of water, Wolf (2002) cited that indicators for areas of potential tension for international water conflicts include such things as climate, water stress, dependency on hydropower, dams, level of development and institutional capacity within a basin. Therefore, the researcher can deduce from the two authors that water-related construction projects are highly susceptible to conflicts.

Whetten *et al.* (1996) and Pondy (1967) explained conflicts in a more realistic and optimistic way. Whetten *et al.* correlates conflict as the life-blood of vibrant, progressive, stimulating organizations; it sparks creativity, motivates innovation and encourages personal improvements. Whetten *et al.* (1996*)* further reflect that some people have a very low tolerance level for disagreement. In that case, they argue that whether this is the result of inheritance, cultural values or personality characteristics, a high level of interpersonal conflict saps their energy and demoralizes their sprit. Likewise, Pondy (1967) recognizes that conflict is not necessarily bad or good but evaluated with respect to its individual and organizational functions and dysfunctions. In general, conflict generates pressures to reduce conflict, but

chronic conflict persists and is endured under certain conditions, and consciously created and managed by the politically astute administrator.

McNamara (1997) stated that conflict is not the problem in general but it is a problem when poorly managed since it is a mechanism to raise and address a problem. Moreover, he explained that conflict becomes a problem when it hampers productivity, lowers morale and causes more and continued conflicts, which might lead to inappropriate behaviours. In contrast to McNamara's view, the researcher considered that conflict is both a problem and a challenge.

Conflict is different from simple disagreement. However, the way people resolve conflicts determines whether there has to be positive impacts or not. In Figure 2-1, the researcher undertakes a further discussion and analysis of McNamara's approach in relation to conflict, problems and the effects of conflict that occur as a result of a time gap between the problem and its resolution process.

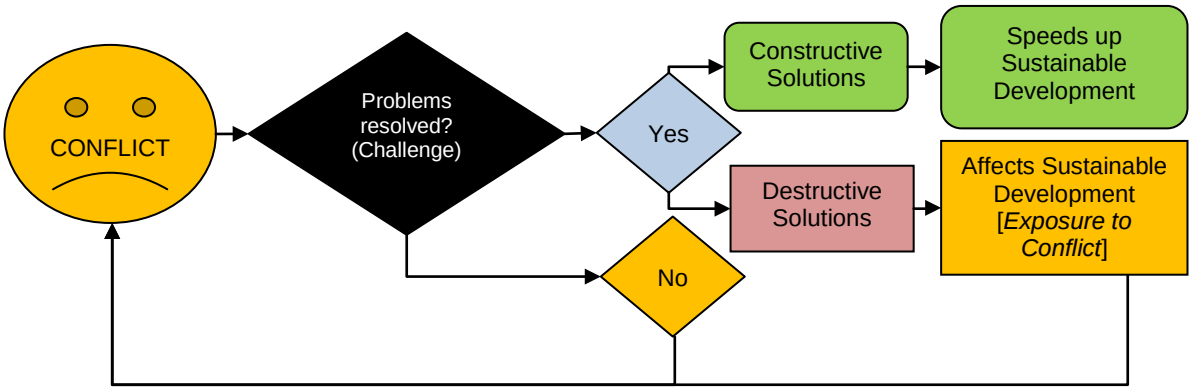


Figure 2-1: Conflict problems and resolution road map model

In considering the effects of conflict management, Pilgrim (2004) explains that conflict is an essential ingredient for growth but it is feared and avoided by many managers because they do not know how to manage the problem. Moreover, she compares unresolved conflicts as poisonous to the productivity of a company as is the virus to the computer. Additionally, conflict is described as a reality that was socially created and managed through communication (Jones, 2006). Furthermore, Whetten *et al*. (1996) state that without constructive conflict 'nothing happens', but there are also limits.

Mamo (1976) in his local Amharic language book on the Basic Skills of Writing a Novel describes conflicts occurring among human beings as follows (see Appendix N1 for the Amharic version of the text).

> "Human beings face with many conflicts. There are many types of conflicts where most of them could be categorized under the different types of conflicts. Among those conflict categories the basic ones are conflicts with his God, conflicts with another person, conflicts with society, conflicts with his own environment, conflicts with himself, conflicts with discipline of the social order and conflicts of ideology."

In Table 2-1 below, the researcher has critiques on seven of the major conflict definitions and approaches proposed by different authors in relation to water resources, communications, religious views, political views and other general views. At the end, the researcher's own definition of conflict has been formulated, which derives from the gap and the available facts of conflicts.

Table 2-1: Major conflict definitions, categories and comments

No.	Summary/category	Conflict definitions and sources	Comments
1	Conflict is a **natural disagreement** resulting from personality difference.	"Conflict is a natural disagreement resulting from individuals or groups that differ in attitudes, beliefs, values or needs. It can also originate from past rivalries and personality differences. Other causes of conflict include trying to negotiate before the timing is right or before needed information is available." (CTIC, 2000).	This definition lacks an explanation of the issue of tolerance, which is the key factor for occurrence as well as resolution of conflicts.
2	Conflict generates from **unrecognized differences** that can create an impact depending on the **communication** techniques.	"Conflict is a normal aspect of human interaction that often arises from unmet needs, unrecognized differences, and difficulties coping with life changes. Conflict can either produce positive or negative results depending on the communication techniques used. Confrontation that includes active listening and willingness to collaborate produces positive results and allows differences to be negotiated" (The GWU [Homepage of Conflict Resolution Centre at The George Washington University], [Online]. Available: http:// gwired.gwu.edu/crc/ [Accessed on April 29, 2007]).	Similar to the first definition, here also factors related to tolerance, intensity and pressure were not described further.
3	Conflict as a **struggle to resist or overcome.**	"Grazier defines conflict as "a struggle to resist or overcome; a contest of opposing forces; strife; battle; a state or condition of opposition; antagonism; discord; clash; collision" (Grazier, 1997).	The main conflict occurrence ingredients such as time, place and general condition are not explained in this definition.
4	Conflict as parts of a **political dialog.**	In political terms, "conflict refers to an on-going state of hostility between two or more groups of people". (Web definition) http://www.cleanlanguage.co.uk/articles/articles/251/1/Modelling-Conflict/Page1.html [Accessed on January 4, 2011]).	Conflict as an unpleasant fact, that is intensified and pressurized by different complex variables, was not described here.
5	The **religious** parts of conflict understanding.	"Conflict is a fact of life. God made each of us in his own image, but he also made us unique. Therefore, some of our views and opinions will differ from those of others. Conflict often occurs because of a lack of respect for one another's needs and views. In general, conflict happens when two or more people or groups have, or think they have, incompatible goals" (Blackman, 2007).	This definition describes conflict in a more moral way. It does not clearly explain the issue of natural and manmade intensity and pressure.
6	Conflict as **new ways of doing things.**	"Conflict means only this: We need a new way of doing things, the old way has failed. If two sides can define what they are fighting about, the chances increase that misperceptions will be clarified" (Srinivas, 2007).	This is a very positive definition that requires both parties' willingness and tolerance to do things in a new way and it is common in more developed countries but not in developing countries.
7	Conflict over **the use of water resource** utilization.	"Water conflict is a disagreement occurring between a group of water users due to an existing water stress situation, poor management of the resources and availability of unfair water rights theories, separately or in combination" (Gebremariam, 2006).	This definition is more specific to water conflict unlike the others, it describes the general approaches to conflict definition.

2.2.2 The researcher's new alternative definition of conflict

The above definitions confirm that there are many, sometimes inconsistent, definitions of conflict, depending on the context. Söderbaum (2008) advances that a conventional idea in science is that all concepts should be clearly defined, so that they can be measured in an undisputable way. While the ambition to define and measure in a clear way is reasonable, we should at the same time learn to deal with some concepts that are not so clear and not so easily measured.

The new definition incorporates both the missing elements and the existing facts justified by different scholars. Conflict is defined as a relational, problematic, unpleasant fact that depends on the tolerance capacity of disagreeing parties generating unusual intensity and pressure on the needs and views of one another. It is a factor of different complex variables varying according to the occurrence of the time of disagreement, situations or place and environmental conditions. Moreover, the process of its management can help to resolve or escalate the disagreement depending on the effective use of conflict resolution practices. Figure 2-2 below, shows the map of the new definition of conflict.

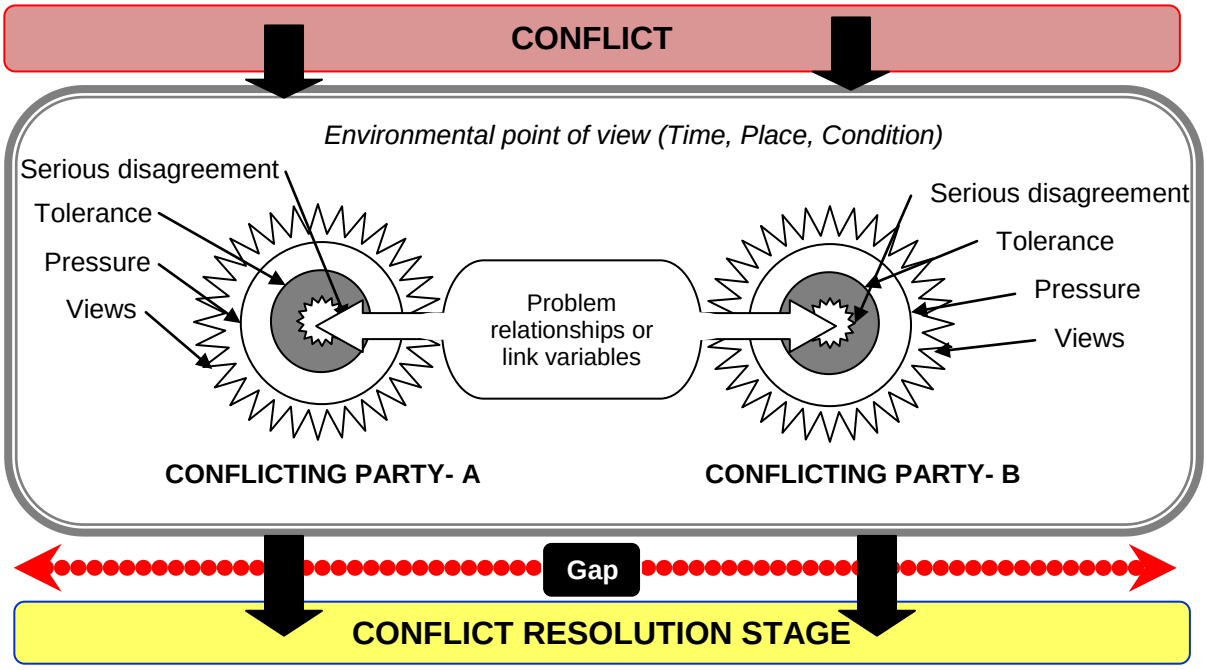


Figure 2-2: A conceptual map for a new definition of conflict

2.2.3 Theories on Causes and Indicators of Conflict

2.2.3.1 General Causes of Conflicts

Conflict is a challenging and controversial topic (Whetten *et al.,* 1996). Sandole (1987) explains, conflict is a natural and inevitable part of all human social relationships that occurs at all levels of society categorised as intra-psychic, interpersonal, intra-group, intra-national and international. Among these levels of conflicts, Whetten *et al.* (1996) identified the four causes

of interpersonal conflicts: *personal differences*, *information deficiency*, *role incompatibility* and *environmental stress*, which are further explained in Table 2-2 below.

Table 2-2: Sources of conflict

Sources of conflict	Focus of conflict
Personal differences	Perceptions and expectations
Information deficiency	Misinformation and misinterpretation
Role incompatibility	Goals and responsibility
Environmental stress	Resources scarcity and uncertainty

Source: Whetten *et al*. (1996:11)

2.2.3.2 Basic Causes of Water Conflicts

Wolf (2003), Falkenmark (1989) and Gleick (1993), professionals studying water conflicts, have justified indicators for the causes of, and vulnerability to, water conflicts. The first approach forwarded by Wolf (2003) is in relation to problems associated with management structures and cooperation affecting international basins. Wolf identified that the root causes of most water conflicts are reflected in two sets of indicators:

- internationalized basin, that includes the management structures of newly independent states;
- basins that include unilateral development projects and the absence of cooperative regimes.

Falkenmark *et al.* (2006) made an urgent call about the need for the minimization of non-productive water losses. Another approach to the conflict problems described in the context of figurative analysis formulated by Wolf *et al.* (2003) have cited Falkenmark (1989) saying that the *Water Stress Index*, which divides the volume of available water resources for each country by its population, an indication for conflict. Wolf *et al.* (2003) define the water stress index as follows:

- above 10,000m^3/person -limited management problems,
- 10,000-1,600m3/person -general management problems,
- 1,600-1000m3/person -water stress,
- 1000-500m3/person - chronic scarcity, and
- less than 500m3/person - beyond the management “water barrier”.

The third approach was defined by Gleick (1993) cited by Wolf *et al.* (2003). Gleick suggests four indices of vulnerability for regions at risk of international water conflicts:

- ratio of water demand to supply,
- water availability per person (Falkenmark’s water stress index),
- fraction of water supply originating outside a nation’s borders, and
- dependence on hydroelectricity as a fraction of the total electricity supply.

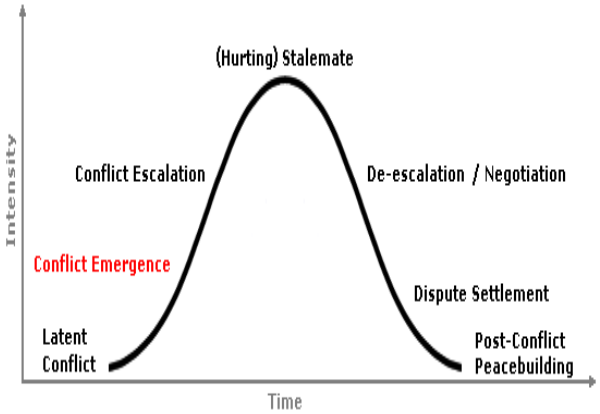
The three approaches include useful components to consider. Falkenmark *et al*. ’s justification directly related to the availability of resources converged to the local level. Wolf’s explanation

is more general and focuses on the international level. Gleick's parameters are more simplified and can be tested both at local and international levels.

2.2.4 Stages/Life Cycle of Conflict

Different scholars described stages of conflict concepts in different ways. However, all of them agree that conflict escalates at some point to reach its critical stages and then goes down to the level of conflict settlement. Two approaches to the definition of conflict stages are defined by Brahm's (2003) *stage of conflicts*, and Blackman's (2003) *life cycle of conflict*. They have similarities but different presentation styles on addressing the intensity and frequency of conflicts as displayed in Figure 2-3 (a) and (b) below. Both authors conceptually agree on two fundamental stages of conflicts. They mapped the same type of pre-conflict and post-conflict evolution stages but using different approaches. The figures show that the intensity of conflict is the same before and after the conflict climax stage.

Fig. (a)



Source: Brahm (2003)

Fig. (b)

Source: Blackman (2003)

Figure 2-3: Stages of conflict - Fig. (a) and life cycle of conflict - Fig. (b)

The author of this report disagrees slightly with the above conflict illustration designed by Brahm (2003). The hypothetical reason for this slight variation is illustrated in Figure 2-4 below, which needs further proof. In all approaches, specifically with regard to water conflict, no further analysis has been done on how and at what speed conflicts are transforming from one stage to the other. In relation to this, the resolving strategies of conflict at each stage are not explained in detail.

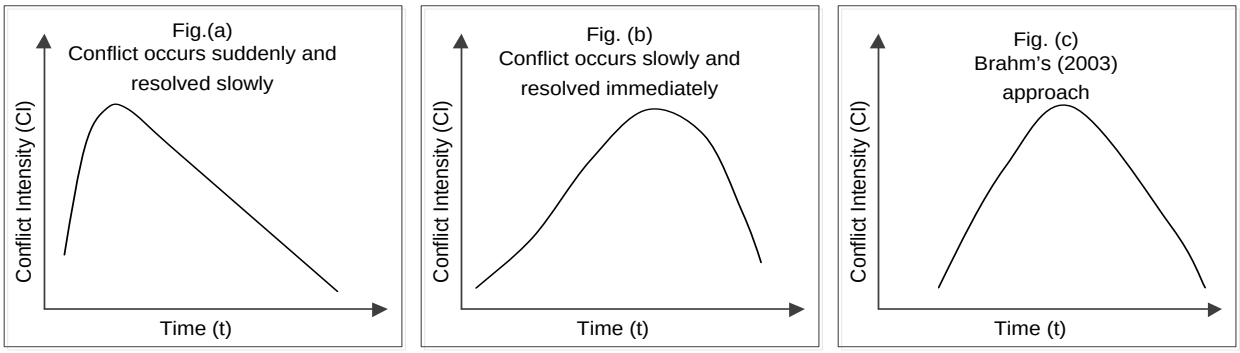


Figure 2-4: Hypothetical approaches to conflict analysis – Figures 'a', 'b' and 'c'

2.2.5 Anatomy of Conflict Map (Conflict Literature Review)

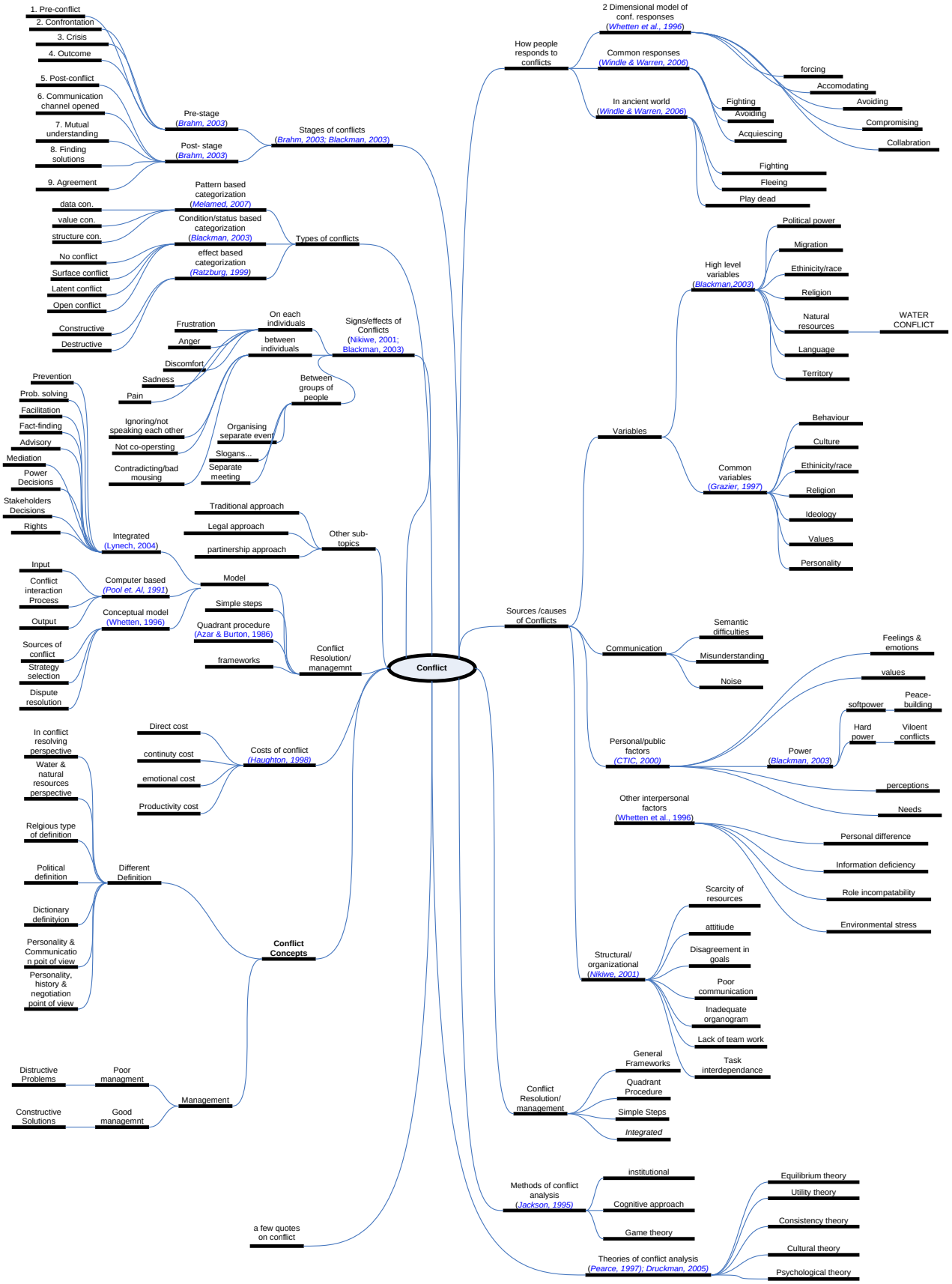


Figure 2-5: Anatomy of conflict concepts

2.2.6 Measuring the Costs of Conflict

Population increase and water shortage are among the potential factors that contribute to water conflicts and affect the growth of the economy. In economics, all water users are essentially buyers, whether they own the water themselves or purchase it from other party (Fisher *et al.*, 2005). Moreover, Fisher *et al.* emphasised the need "to have a careful attention to the economics of water and to the difference between water ownership and water usage. Where water balance shows a shortage, alarms are sounded and engineering or political solutions to secure additional sources are sought. Disputes over water are also generally thought of in this way".

Besides the human loss and suffering in developing countries, for example, the total measurable cost of the 1998-2000 Ethiopia-Eritrea war experienced by Ethiopia, one of the ten countries in the Nile basin, is estimated by the Ethiopian Economic Association at 25.4 billion Birr (about $3 billion US Dollars), excluding the un-recovered loans given by banks to deported Eritreans; this is equivalent to eighteen months of the national budget or nearly half of the annual GDP (Geda, 2004). Moreover, Dimbleby (BBC, 2007), in his interview with the current Ethiopian Prime Minister about effects of the conflict and war between Ethiopia and Eritrea, noted that the defence expenditure during the war was 15% of the GDP and now it was less than 2% of the GDP. The compatibilities and the gap between these two explanations require further analysis. Furthermore, in the Nile basin countries, Egypt's military expenses were found to be extremely high as compared to other basin countries mainly due to security reasons associated with the Nile River. The recent report on African conflict (see Table 1-1) shows that armed conflict costs Africa around $18 billion (US Dollars) per year and on average shrinks the continent's economy by 15% (Hillier, 2007).

Spector (2006) reported that India had 2 million wells thirty years ago; today, there are 23 million; as the population grows, the freshwater available to each resident decreases, and people have no choice but to dig deeper; drill too deep, though, and saltwater and arsenic can begin to seep in. In addition, Spector described that most of these water wells are not cleaned and maintained; people who drink this contaminated water might fall sick and die. Likewise, Gleick, (1998) explained that Chinese farmers from Hebei and Henan Provinces fought each other over limited water and natural resources. As a result, heavy artillery was used and nearly 100 villagers were injured; houses and facilities were damaged and the total loss reached one million US Dollars.

Roddick (2004) cited the United Nations as saying that, by 2025, increasing drought will mean that 5 billion - 2 out of 3 people in the world- will lack sufficient water, and millions more will starve. Failing to meet basic requirements is the direct cause of most water-related disease, resulting in high costs to both communities and governments (Gleick, 1998). Moreover, Gleick noted that in one early estimate water-related diseases cost over $125 billion per year.

Haughton (1998), cited by Nagarajan (1999), claimed that it could take up to ten years for a post-conflict country to return to normal level of economic and human development conditions. Similarly, Hoeffler and Reynal-Querol (2003) stated that the global data show that a civil war of five years reduces the average annual growth rate by more than two percents. Moreover, they pointed out that, after the fighting has stopped a peace dividend is by no means automatic. The economic recovery depends on the country's ability to implement considerable policy reforms. In addition, they adopted the following formula (Equation 2.1) to analyse the direct effect of civil wars on economic growth for a sample of 211 countries and data from 1960 to 1999 organized in intervals of five years. Equation (2.1) below, indicates Hoeffler and Reynal-Querol's (2003) findings on the effects of civil war on economic growth.

$$\mathbf{GROWTH_{it} = \alpha + \beta LNGDP0_{it} + {}_{j} X_{jit} + CW_{it} + u_{it}} \qquad (2.1)$$

where,

- i is the country index, t is the time index,
- GROWTH is the growth rate of GDP per capita over the five year periods, 1960-64, 1965-69, …, 1995-99 and
- LNGDP0 is the gross domestic product *per capita* in the initial year of each period, measured in 1960, 1965, …., 1995.
- The set of X's includes the ratio of real government consumption, to real GDP

Source: Hoeffler and Reynal-Querol (2003:19)

On the other hand, (Grazier, 1997) explained that the costs of conflict associates with how we currently resolve the conflict and describes it using four headings, as follows:

- **Direct Cost:** These costs are the fees of lawyers and other professionals. In 1994 alone, there were 18 million cases filed in US courts at a cost of 300 billion US Dollars.
- **Productivity cost**: The specified cost is the value of lost time, the cost of what those involved would otherwise be producing.
- **Continuity cost**: This is the eventual end of relationships that would have continued without the conflict.
- **Emotional cost**: Here, it reflects the pain of focusing on, and being held hostage by our emotions.

Contrary to Haughton and Grazier's idea of conflict costs, Pondy (1967:310) suggested that conflict is not necessarily a cost for the individual though some participants may actually enjoy the "heat of battle." Pondy explained, "Latency or perception of conflict should be treated as a cost, only if harmony and uniformity are highly valued. Tolerance of divergence is not generally a value widely shared in contemporary organizations, and under these conditions latent and perceived conflict is also likely to be treated as costly". Finally, the importance of economy was clearly emphasised by Crawford (1998) stating that economic strength

contributes to the institutional strength that mutes the political identity of culturally defined groups or channels identity politics to peaceful conflict resolution.

2.2.7 Debates on Water Conflicts: Are There Any Water Conflicts?

Today, low-income developing countries' conflict problems make news headlines worldwide. Water-related problems are among the main causes of local conflicts. That the potential for future water-related conflicts could create more violent conflicts, even war, is a view held by many professionals. Moreover, the Fourth World Water Forum in Mexico in March 2006 proclaimed that 'the next world war will be fought over water'; right or wrong, it certainly caught the delegates' attention and worried, irritated, and confronted them (Gleick *et al.*, 2007). Similar sentiments have been made by the former United Nation's General Secretary Mr. Kofi Annan that fierce competition for fresh water may well become a source of conflict and wars in the future (Postel *et al.*, 2001).

Another contentious theory held by Wolf *et al.* (2003) is that countries that cooperate in general, cooperate about water; countries that dispute in general, dispute over water. The authors did not clearly justify this generalised linkage between cooperation, dispute and water. However, Castro (2007:109) in his article on Water Governance in the Twenty-First Century stated,

> "This highly relevant debate on the potential for international water conflict and cooperation is far from being settled. However, there is a second dimension of water conflicts that continues to receive relatively less attention in the mainstream water policy literature: intra-national water conflicts. This characterization may be misleading, as in fact in many cases water conflicts have both an inter- and an intra-national dimension".

On the other hand, the information is limited about the level and effect of conflict at local level in low-income developing countries is limited as is the information on the capacity to resolve conflicts and to identify the type of cooperation necessary at grass roots level. This information is deemed necessary in the decision-making process. In Figure 2-6, the researcher has mapped the link between the probabilities of conflict with the amount of information available at the local level.

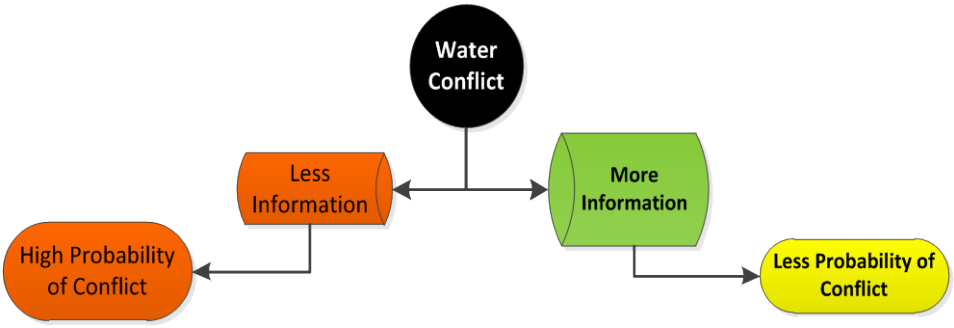


Figure 2-6: Conceptual map of information and probability of conflict

On the concept of the rationality and irrationality of war, Postel *et al.* (2001) stated that war over water is neither strategically rational, hydrologically effective nor economically viable. On

the other hand, Aumann (2005:351) claims the following notable views on the rationality of war in general, which requires further discussion.

> "A person's behaviour is rational if it is in his best interests, given his information. It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem."

The last argument stated by Gleick *et al.* (2007) indicates that unless international water meetings devoted to freshwater problems and big business in the last decade are carefully designed and focused in effort, there is a serious risk that they will distract water experts and divert the limited resources available for resolving problems.

2.3 Dimensions of Water Conflicts

Castro (2007) noted that interdisciplinary approaches that contribute towards developing water governance and management practices persuade that the notions of sustainability and social justice are among the most urgent challenges facing water governance in the 21st century. Schmandt *et al.* (2000) define sustainable development as "development that maximizes the long-term net benefits to humankind, taking into account the costs of environmental degradation". Sustainable consumption and production is broadly defined as "a holistic approach" to minimizing environmental impacts and maximizing social benefits related to production and consumption (EEA, 2007). However, the way to sustainable development has been hampered by water conflict problems in low-income developing countries. Similar to conflict, there is no universally accepted definition of sustainable development.

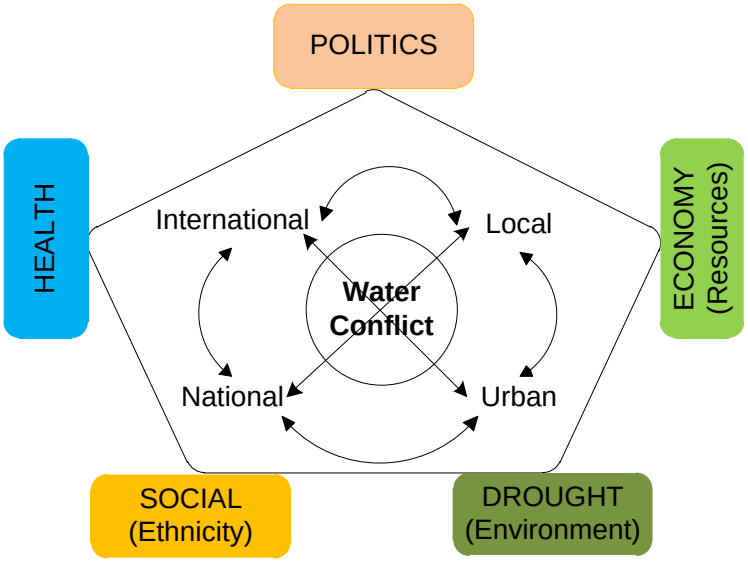


Figure 2-7: Local water-conflict sustainability diversity factors/dimensions

The researcher has formulated the key dimensions of the '*local water-conflict-diversity-factors*' or '*socio-economic diversity factors*' for data collection and analysis purposes as displayed in Figure 2-7 above. The diversity factors for local water conflict include and show the link

between politics, the economy, health, drought and social and geographical factors. The incoherent links between the geographical locations and socio-economic diversity factors can be considered as a primary means of measuring water conflicts. The geographical distribution shows that water conflict occurs at local, urban, national and international levels. In addition to the geographical locations, the above illustration helps to achieve one of the core purposes of the research and its contribution towards sustainable development. The components of the dimension will help as one of the major variables for data analysis.

2.3.1 Water and Local Conflicts

Water-related violence conflicts often occurs on the local rather than the international level, and the intensity of conflict is generally inversely related to geographic scale, and, while conflicts often remain local, they can also impact on stability at the national and regional levels (Carius *et al.*, 2005). For example, in India, Spector (2006) witnessed a situation in which groups of local people began pushing each other and fighting for water and this intensified every day between rich residents of overcrowded cities and their poorer neighbours, between cities and the rural territory that surrounds them. The large numbers of people in China and India who came out of poverty in recent years are living on 'borrowed water', in the sense that the economic growth and agricultural productivity of the North China plain and the Indo-Gangetic Basin are accompanied by falling groundwater levels and drying rivers (Gleick, 2007).

Hoeffler and Reynal-Querol (2003) noted that civil wars during the past forty years have not brought about positive social change but left a terrible legacy of high economic and social costs. For example, in East Africa there are many local conflicts among clans and ethnic groups in the region. The Awash River Basin of Ethiopia is one area where continuous local conflicts are occurring mainly in relation to water utilization, grazing, land use, politics and related matters. Wood (1993) noted that the main causes of conflict which occur over natural resources in Southern Ethiopia are either between ethnic groups or the state and its organizations and were mostly associated with key limited resources such as water, grazing lands and forests (see BOX -1 below).

BOX-1

CONFLICT AND NATURAL RESOURCES (ETHIOPIA)

In south-west Ethiopia, seven different types of natural resource conflicts can be identified in terms of the actors involved. These are:

- inter-group conflicts between different peoples or ethnic groups,
- intra-group conflicts between different socio-economic groups within an ethnic group,
- conflicts between the state and people,
- intra-government conflicts between different groups and organisations within the government,
- inter-regional and international conflicts between the south-west and other regions within and outside Ethiopia,
- Global conflicts in terms of the shared benefits from this region for all of mankind, especially in terms of biodiversity, and
- Temporal conflicts that include the involvement of the interests of present and future generations.

Source: Wood (1993)

Ethiopia is one of the low-income developing countries that does not fully utilize its enormous water resources that have made the country known as 'the water tower of Africa'. The country has many trans-regional and trans-boundary rivers that flow into the neighbouring countries. Among these, the Nile is the major trans-boundary river that constitutes 80-90% of the country's water resources. The Nile Basin Initiative (NBI) is one of the organizations, which started working for the benefit of the people living in the Nile Basin countries in a situation where Egypt and Sudan are utilizing and demanding 90% of the resources. The ECA (2000) reported that 97% of Egyptian and 81% of Sudanese water resources are incoming from other countries without the existence of any comparable alternative resources.

Most of the formal institutions working on conflict-management-related activities are found in developed countries. In Africa, there are traditional institutions that have been engaged in managing conflicts related to resources like water. Today, these traditional and social institutions are getting weak, and have reached at the stage of losing their acceptance among most of the young generation in the region. The following are some of the selected types of conflicts occurring at the local level as recorded in Gleick's (2009) water conflict chronology.

- Protests over water sharing: People were injured and some died as a result of on-going protests by farmers over allocations of water from the Indira Ghandi Irrigation Canal in India, 2004.
- Attacking water supply systems: Rebel groups blocked and cut the water supply systems that serve 60,000 residents in Sri Lanka, 2006.
- Fighting between clans: Clashes between clans over competition for water and pasture where at least 12 people died and over 20 were wounded in Ethiopia, 2006.
- Migration: Armed clashes between tribes over a water well in Yemen where many families had to leave their homes and migrate, 2006.
- Fighting between nomadic and settled communities: violent dispute between Kikuyu and Maasai groups over water. The tensions arose when Maasai herdsmen accused a local Kikuyu politician of diverting a river to irrigate his farm, depriving downstream livestock in Kenya, 2005.
- Shooting each other over water rights: Two farmers shot each other and died due to the rights to use water from a small spring for a corn irrigation system in Mexico, 2004.
- Bombing/sabotage/poisoning: Due to the civil war, bombings, sabotage and poisoning of water wells destroyed and contaminated the supply in Sudan, 2004.
- Civil unrest due to drought: Protests, riots, injuries, arrests and fatal accidents occurred due to ethnic conflicts over severe water shortages caused by the long-term drought in Pakistan, 2001.

- Clash with wild animals: “A clash between villagers and thirsty monkeys left eight apes dead and ten villagers wounded. The duel started after water tankers brought water to a drought-stricken area and monkeys desperate for water attacked the villagers in Kenya,” in 2000.

Thomasson (2005) classified the root causes of local conflicts over water under four headings:

- conflicts over a limited resource,
- conflicts over the control of the distribution,
- conflicts over the quality of the resource, and
- conflicts in large infrastructure projects.

The study presented by Thomasson (2005) does not clearly discuss whether local water resource management efficiency could be a part of the problem. On the other hand, the water shade campaign coordinated by the Conservation Technology Information Centre, CTIC (2000) categorized the five sources of disagreement within watershed partnerships describing them as an ingredient for conflicts between people, as indicated in Table 2-3 below. However, the level and amounts of these conflict ingredients with respect to conflict occurrence or prediction was not discussed and left open.

Table 2-3: Ingredients of conflict

Ingredients of conflict	How conflict occurs
Needs	When we ignore other needs
Perceptions	When people interpret reality differently
Power	The use of power to influence/manage disagreements
Values	When people have incompatible or unclear values
Feelings and emotions	When we ignore our own or others’ feelings and emotions

Grazier (1997) and Blackman (2003) classified the elements of the sources of conflict into the most common one and as a large-scale factor for disagreement (see Table 2-4 below). However, the clear boundaries, intensity and justification of these variables were not discussed.

Table 2-4: Variables for common and high-level of conflicts

COMMON VARIABLES (Sources of conflicts in general)	**HIGH LEVEL VARIABLES** (Issues of disagreement in recent large- scale conflicts)
Personality	Territory
Values	Language
Ideologies	Natural resources
Religion	Religion
Ethnicity or race	Ethnicity or race
Culture	Migration
Behaviour	Political power

Source: (Grazier, 1997) *Source: (*Blackman, 2003)

2.3.2 Urban Water Conflicts

The world population is becoming urbanized in parallel with economic development. Hence, water demands and problems associated with scarcity have been the main issues in the urban areas of fast-growing towns in developing countries where there is insufficient infrastructure to manage the situation. UNESCO (2006) reported that the historical causes of urban water conflicts in Europe were associated with water quality, wastewater collection and treatment, urban hydrology problems such as storm water control, water resources use and misuse. The report also noted financing investment issues, tariff setting and degrees of freedom left to urban dwellers in comparison with the services provided. The respective problems of urban water supply utilities in developing countries are more sophisticated and require a further review of the literature.

2.3.3 International Water Conflicts

People worldwide have been continuously and over a long time been fighting over natural resources such as water, oil, diamond and gold. Wolf (2002) underlined that trans-boundary water disputes occur whenever demand for water is shared by any sets of interests, be it political, economic, environmental or legal.

It has been projected that international water conflicts may not only increase quantitatively but may also become increasingly violent (Haftendorn, 2000). Ohilisson (1995), pointed out that there were more than 15 unresolved international water conflicts. Similarly, Gleick (2006) and UNESCO (2005), showed that 147 water-related conflicts were registered as of 2006; 263 international trans-boundary rivers were available as of 2002; approximately one third of the 263 trans-boundary basins are shared by more than two countries and 40% of the world's population are living in trans-boundary river basins. Shiva (2002b) claimed that the examination of the "water-war" of the 21st century would depend on the progressive privatisation by the multinational corporations of communal water rights while drought and desertification were intensifying around the world. Corporations are aggressively converting free-flowing water into bottled profits.

In the Middle East, water has become a scarcer resource than oil. Phillips *et al.* (2006:52) noted that in the Jordan River basin, tension has existed between a number of co-riparians for at least the last 40 years, and the allocation of water resources has been a frequently cited element of this conflict. Kirby (2000) argued that competition for water from the River Jordan was a major cause of the 1967 war between Israel and Palestine. The report also indicated that the Israelis in the West Bank use four times as much water as their Palestinian neighbours.

In Africa, national competition over water for irrigation and power generation in the Nile Basin incorporates ten countries. The problems related to over-utilization and flooding in the Zambezi River basin and environmental catastrophe as a result of the pollution of West Africa

Rivers are the critical concerns of the continent. In the particular case of the Sahel region and, more generally, of West Africa, the land has been subjected to a drought for more than 25 years, which has brought a marked decrease in rainfall and consequently in runoff (Servat *et al., 1*998), which was also true for the East African region. In the African continent, the shared river basin constitutes 61% of the total area of the continent; 77% of the population on the continent, and 93% of the total available water in Africa (Phillips *et al., 2*006).

In Asia, as a result of economic mismanagement of the Aral Sea in the former Soviet Union; the most scarce and depleted resources of the Ganges River in India and the severe pollution of the Yellow River in China are creating lots of problems and tensions among people residing in the basin countries, which require further international attention.

2.3.4 Water Conflicts and Ethnicity/Social Factors

Conflicts arise when local traditional practices are no longer viewed as legitimate or consistent with national policies, or when entities external to a community are able to pursue their interests, while ignoring the needs (Edossa *et al*., 2005). In particular, Thomasson (2005) defined water conflicts as a social situation in which a minimum of two actors strive to acquire, at the same time, a set of scarce water resources. Haftendorn (2000) explored the question of whether or not conflicts over scarce water resources are the source of international conflict. Further to this, he explored whether they contribute or intensifying conflicts which have arisen from other sources, such as ethnic conflicts. In most low-income developing countries of Africa, the political structure of the government has been based on ethnic and linguistic groups. In Ethiopia, this can be witnessed by the establishment of the administrative boundaries based on ethnic or linguistic structures, in which the languages of each group are respected and used as a tool for basic education and political administration. The main objective of this recognition was to accommodate conflicts that may arise as a result of social and political structures. On the other hand, the economic development and the natural distribution of water resources in the river basins of the region follow neither the political nor the ethnic structure. This can be a cause for strong disagreement. For example, Meskelu (2007) observed that in the southern region of Ethiopia, where there are many ethnic groups and where many different languages are spoken, there have been frequently-occurring local water conflicts.

2.3.5 Water and Politics

Any political party who controls the activities related to the water sector gets the attention of the majority. In many cases, water is used as a political tool. However, in an apparent paradox, governance, which is essentially a political entity, becomes depoliticised in the water policy literature (Castro, 2007). The management and the amount of water in a country can have a great impact on stabilising or destabilizing the political situation of a country. In support

of this view, Shiva (2002a) noted that in 1957, the historian Karl Wittfogel mentioned that control over water implies control over people.

The WRM needs a relatively higher capital investment, which is not an easy task for low-income developing countries. In most parts of the world, the water resources are controlled or monitored by the powerful and influential groups. As a result, WRM is getting better attention in national and international world politics, as it is frequently discussed within the governmental, non-governmental and private sectors.

There have been conflicting claims on existing water resources by different political entities as well as different types of water users (Fisher *et al.*, 2005). They continued by stating that conflict between political entities in countries, states or provinces is often predicted to be a likely cause of future wars. However, they also observed that water-user conflict is a very serious matter.

2.3.6 Water and the Economy

As a vital resource, water will continually decrease in the future as a result of economic development, population growth and the rise in the standard of living (Haftendorn, 2000). In many parts of the world, water is already used faster than natural hydrological processes can replenish (Gleick, 2007). The situation activates the use of limited resources in ways that are more economical. Gleick proposed that the concept of 'peak oil', in which the world is reaching a maximum level of production of oil, upon which the global economy depends, could be applied to ‘peak water’. Gleick argued that the world is approaching a maximum level of exploitation of the water on which all of human life depends. Furthermore, most often, international attention and resulting financing, is focused on a basin only after a crisis or flashpoint (Wolf, 1998).

The principles of economics take into consideration conflicts and the allocation and management of scarce water resources in different ways. Fisher *et al.* (2005) specified that water scarcity is a matter of cost and value; the value of water and its scarcity will be different in different locations. In addition, they also explained this concept in relation to microeconomics, which is about the allocation of scarce resources in the relation to the value of those resources to their scarcity and their allocation. A case study on the Ethiopian economy in relation to the conflict with Eritrea indicates, “years of conflict show either low or negative economic growth rates” (Geda, 2004). The Global Environment Facility (GEF), which provides grants to developing countries, allocated 990 Million US Dollars between March 1998 and June 2007 for 143 projects related solely to international water.

2.3.7 Water and Health

Most industrialized countries manage their water pollution problems associated with health and the environment. However, in January 2005, China’s Ministry of Water Resources released a report stating that more than 53% of the water in major systems is undrinkable,

with half the water in fifty-two lakes surveyed and 35% of groundwater deemed too polluted to drink (Gleick, 2007). A similar situation to China was reported in India. Many people in poor countries have a problem of getting clean water supply and sanitation. As a result, people living in such areas are dissatisfied with the services and are affected by water-related health problems. This situation creates a tension between the user communities, the government authorities and other stakeholders and provides scope for escalating any other conflicts, which may lead to violence. Moreover, Hoeffler and Reynal-Querol (2003) indicated that as a part of the war strategy, the country's public health infrastructure is destroyed and the civilian population are directly targeted. They also noted that the damage to the electricity grids is resulting in the stoppage of water and sewage pumping, resulting in many public health problems.

2.3.8 Water and Drought

Drought need not always lead to conflict. However, frequent droughts, in combination with other social and economic factors, have exacerbated vulnerability and conflicts among the local people in the West African Sahel (Nyong, 2005). Nyong and Charles (2005) also noted the three dimensions of drought-related conflicts that include family disputes, property disputes and inter-community conflicts. For instance, Piguet (2003) reported that the Afar pastoralists' vulnerability has increased with regard to cattle weaknesses, as those animals are much less drought resistant. In another report, Piguet (2003) indicated that drought and scarce resources intensify conflict potential and security problems in Afar region of Ethiopia. Webersik (2010) also noted that acute droughts could escalate or trigger civil conflicts. In addition, Levy (2007) claimed that severe and prolonged droughts are the strongest indicator of high level of conflicts. Besides, he also observed that cities could act as buffer zones for seasonal migration during the dry season. The East Africa region, especially Ethiopia, can be a good example to further discuss or justify Levy's theory.

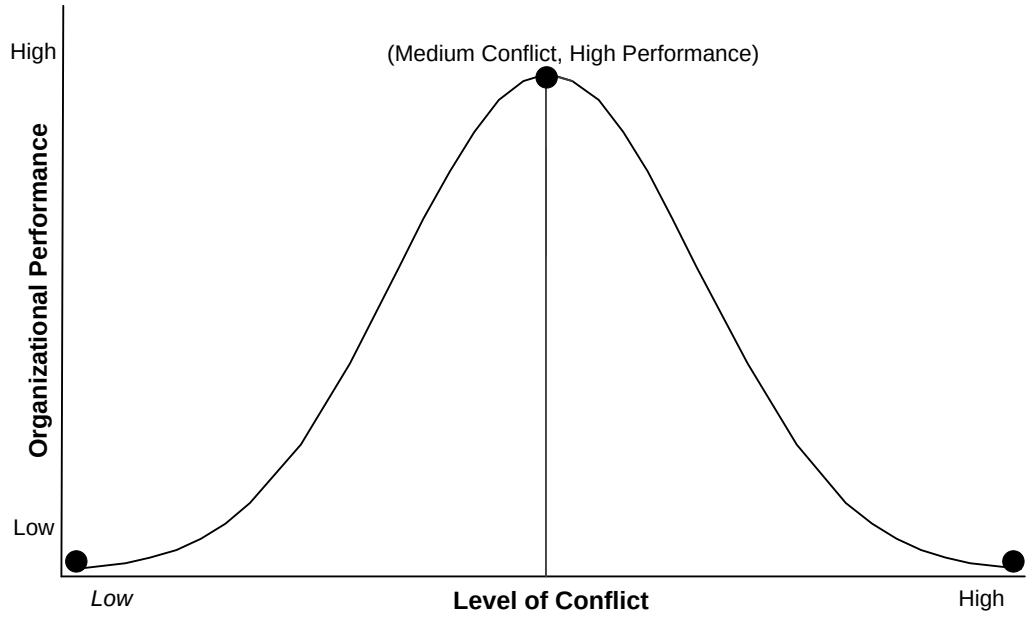
2.3.9 Conflict Management and Organization

The researcher has collected and prepared in a spreadsheet data containing lists of 40 international, and a few local organizations working on conflict-related activities as indicated in Appendix D. The figure shows that a few are working on conflict prevention, negotiation, peace and development. The majority of them are working on research and policy-related issues. Among these, those that are working on water conflict are very small in number.

Literature on conflict management shows a number of different approaches in conflict management studies, such as frameworks on negotiation theory, without considering–conflict signals (Thyne, 2006). However, some degree of conflict within any organization is inevitable, the existence of communication problems will make the management of conflict very difficult (Emmitt, 210).

Water conflict is highly linked to the key operating tools related to the management and organization of resources. Kliot *et al.* (2001) observed that the management of water resources confronts many obstacles because of the critical importance of water for human existence and its many uses. In addition, they acknowledged that its management is extremely difficult due to four additional features: scarcity, maldistribution, sharing and over-utilization and misuse.

Moreover, the work of Weber (2000) demonstrated that medium level conflict always stimulates the performance of an organization. Thus, he observed that the performance of the organization is low in a situation where there are no conflicts or high conflicts, as shown in Figure 2-8 below. However, the study is limited as an explanation of resolving the time-gap between conflicts and the beginning of organizational performance. Moreover, defining the effects of this time-gap was essential, as Weber does not appreciate the two extreme conflicts, high and low, as they are not useful for organizational performance. In addition, the justification was not supported by samples of statistical data.



Source: (Weber, 2000)

Figure 2-8: Conflict and organizational performance

On the other hand, as discussed in § 2.2.1, Pilgrim (2004) promotes all levels of conflicts as an essential ingredient for innovation and the development of an organization so long as they are managed effectively. The researcher partially agrees with both opinions because of the fact that some conflicts are full of risks and create many problems before they are managed and resolved effectively. Therefore, both Weber and Pilgrim failed to mention the existence of a gap between conflict and conflict management processes as drawn in Figure 2-9 below. Conflict management is highly related with time. Conflicts should be resolved based on their appropriate gap-time. Weber's opinion is feasible throughout the situation of disagreement and Pilgrim's outlook only works at some point at the start of the process of conflict management.

In addition, Weber's (2000) organizational performance description is highly related to the conflict, which can be seen as an input. The conflict-management-related approach justified by Pilgrim can be considered as an output of the process, which is the main approach difference between the two authors. Hence, the effect of disagreement on the productivity of any organization depends not only on the intensity and pressure of conflict but also on the proper timing of an effective conflict management process.

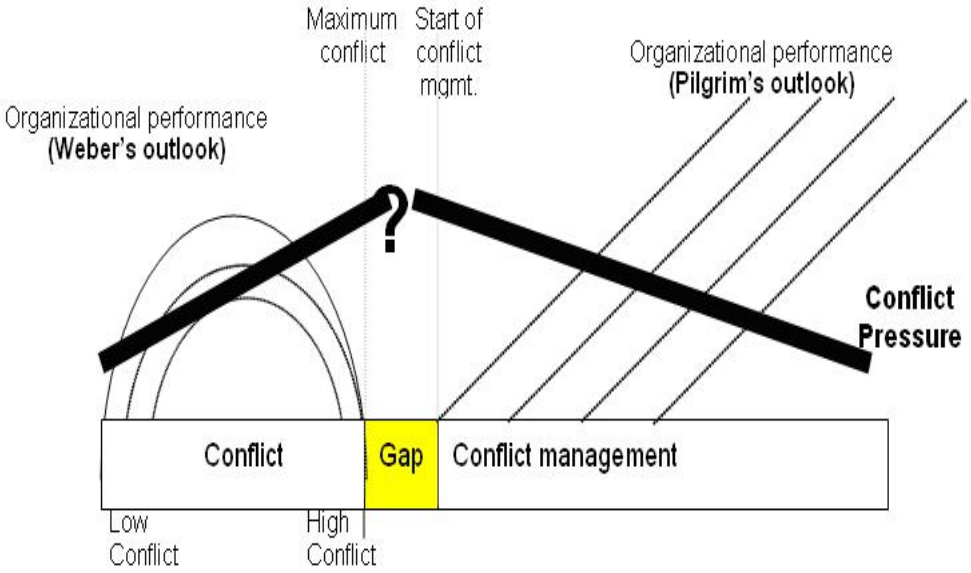


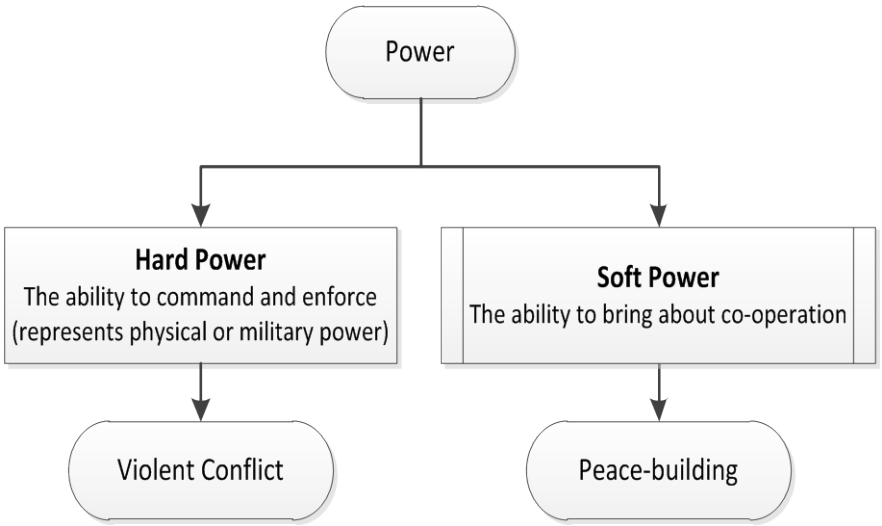
Figure 2-9: A conceptual time-gap between conflict and conflict management

On the other hand, Pondy (1967), defines individual and organizational conflicts as a factor of a conflict evaluation system, which depends on the condition for good and bad pressure generation. Pondy does not accept conflict as good or bad in general. However, his pressure-related definitions can be considered as one integral component of both the respective definitions advanced by Pilgrim and Weber. In general, Nikiwe (2001:2) describes the seven most common causes of organizational conflicts as listed below:

- scarcity of resources (finance, equipment, facilities, etc.);
- different attitudes, values or perceptions;
- disagreements about needs, goals, priorities and interests;
- poor communication;
- poor or inadequate organizational structure;
- lack of teamwork; and
- lack of clarity over roles and responsibilities.

However, it was observed that the above-listed causes of conflicts are not integrated to identify the availabilities of the conflict and prepare for resolving mechanisms before the problem occurs. In addition, the issue of power was not discussed. Indeed, Blackman (2003) states that conflict is stoked when there exists an unequal balance of power between diverse

groups. Furthermore, taking into consideration various factors, Blackman believes that power is not just military strength; it includes money, networks, information, authority, knowledge, security and access to resources, which can either be used to fuel conflict or build peace. Figure 2-10 below illustrates the conceptual analysis of conflict and power.



Source: Concept for the figure taken from Blackman (2003)

Figure 2-10: Conceptual analysis of hard and soft power

2.3.10 The Boundaries of Dispute, Conflict and Violence

In section 2.3.1 of the literature review, the researcher has emphasised some of the types and intensity of local water conflicts in the form of interchangeably related words like disagreement, disputes and violence. Lack of a clear understanding of the boundaries of these terminologies has a great impact on addressing the magnitude of local water conflicts. There are also quite a few problems with the approaches on using those terminologies in most of the literature. It is vital to carefully identify and make use of them in conflict management activities. Moreover, these two sentences can provide a good example.

- Parameters regularly identified as indicators of water conflict are actually only weakly linked to dispute (Wolf *et al.,* 2003)
- A long history exists of water-related violence and conflicts, including what must be categorised as environmental terrorism that targets water resources and infrastructure; the threat of future attacks is real (Gleick *et al*., 2007)

Hence, the terminologies are explained and the relationship between them analysed as follows.

- Disagreement: difference of opinion (Oxford English dictionary, 1989).
- Dispute: short-term disagreements that is relatively easy to resolve (Burton, 1990).
- Conflict: a strong disagreement or collision of values, needs, interests, or intensions among individuals, groups, organizations, communities, or nations (Hovatter, 1997).

- Violence: always has a negative action including physical fighting and damage of resources. In 2002, an estimated 1.6 million people worldwide died as a result of violence, WHO (2007). Moreover, the report indicates that violence is among the leading causes of death for people aged 15-44 years worldwide, accounting for 14% of deaths among males and 7% of deaths among females.

The diagram below, Figure 2-11, indicates the integrated boundaries and spheres of disagreements, disputes, conflicts and violence and the representations of each letter from 'A' to 'F' are explained as follows:

- 'E' and 'F' in the figure describe positive and negative parts of any disagreement, respectively;
- 'D' stands for a conflict that was not resolved and a cause for a new dispute; and unresolved disputes that converted to serious conflicts;

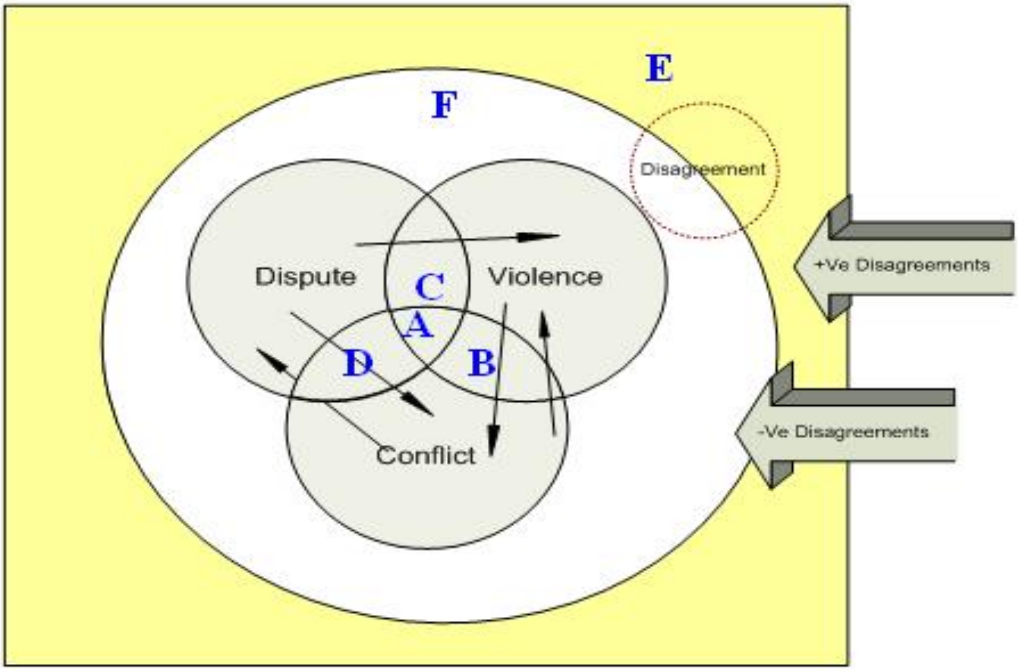


Figure 2-11: The conceptual boundaries of disagreement, dispute, conflict, and violence

- 'C' represents unresolved disputes that suddenly grow into violence;
- 'B' illustrates deep-rooted conflict that immediately transfers to violence. Likewise, deep-rooted repetitive violence, which is not effectively resolved, remains with potential conflicts;
- 'A' designates when problems that are more complex occur in addition to the existing conflicts and are exacerbated by a new dispute leading to violence or the other ways.

In Figures 2-11 and 2-12, below, the researcher has illustrated a summary visualization of the processes and boundaries of conflicts that lead to conceptual mapping of the links among the terminologies.

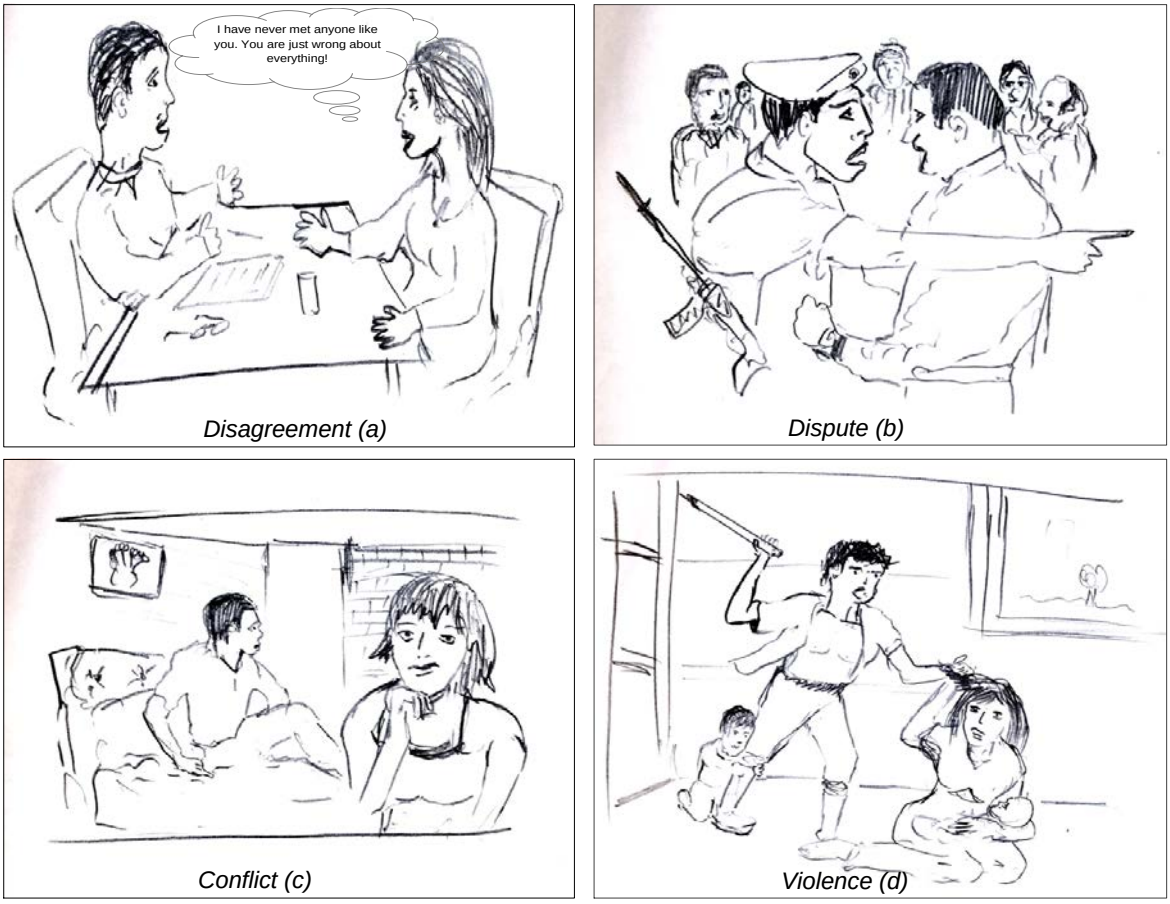


Figure 2-12: Visualization of the process/boundaries of (a) disagreement, (b) dispute, (c) conflict and (d) violence

In most cases, people are not clearly considering the boundaries among the terminologies such as, disagreement, conflict, dispute and violence. The author of this report designed the relationships and the differences among them as mentioned in Figure 2-13 below.

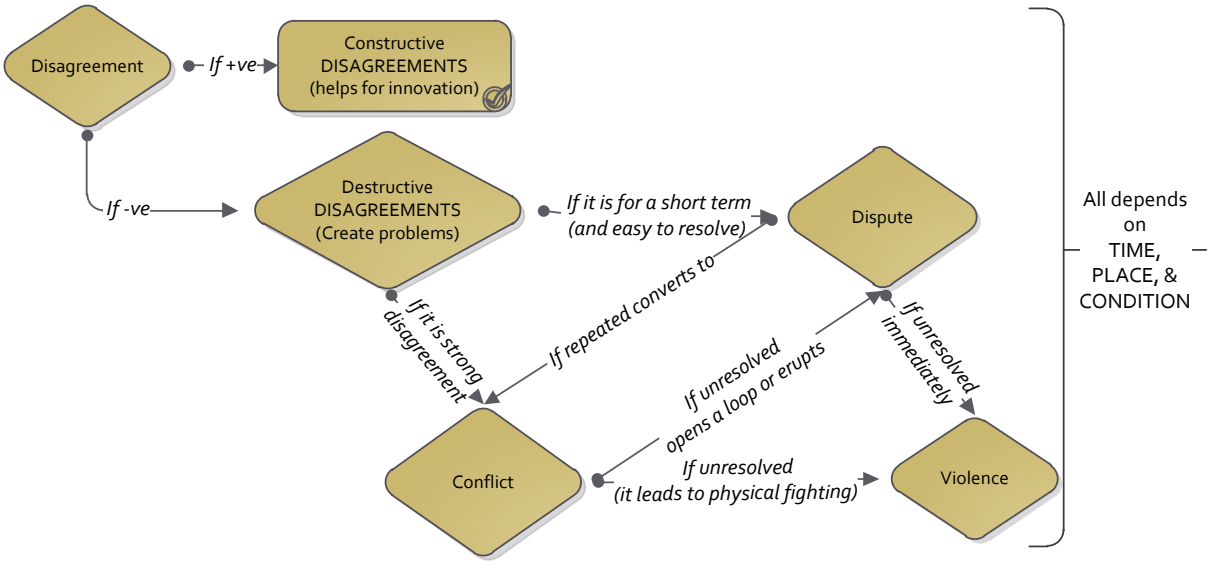


Figure 2-13: Conceptual map of the link between disagreement, dispute and conflict (conflict parallelogram)

2.4 Approaches to Water Conflict Studies and Analysis

2.4.1 Approaches to Conflict Studies

Aumann (2005), a Noble Prize winner in economics for his role in enhancing the understanding of conflict and cooperation through game-theory analysis, suggests that people should change direction in their efforts to bring about world peace by studying war in general. Alternatively, the idea of reducing conflicts over water without having standard conflict resolution approaches was proposed by Phillips *et al.* (2006). Phillips *et al.* argue that there are no generic solutions to trans-boundary water management suggesting that each basin should be taken as a case study since the scenarios available for economic improvement rely on a unique mix of interventions. Such a study can be seen as one that would open a door for a discussion about having cost-effective ways for standardisation and generalization. On the other hand, a different approach for studying conflicts was proposed by Aumann (2005:350):

> "I would like to suggest that we should perhaps change direction in our efforts to bring about world peace. Up to now all the efforts has been put into resolving specific conflicts: India-Pakistan, North-South Ireland, various African wars, Balkan wars, Russia-Chechnya, Israel-Arab, etc., etc. I'd like to suggest that we should shift emphases and study war in general."

The author of this report appreciates both approaches instead of sticking to one method. Aumann's (2005) approach could help to develop general theoretical frameworks that would lead to certain specific focal areas. The approach of Phillips *et al.(2006)* could help to study, test, implement and lead from the specific to the development of a more general theory. Moreover, both theories have the ability to flow within the same environment as conflicts have negative sparkling effects on their surroundings regardless of the conflicting parties. The researcher has presented the conceptual analysis of both approaches in the below Figure 2-14 by including the new concept of the Sparkling Effects of Conflict (SEC).

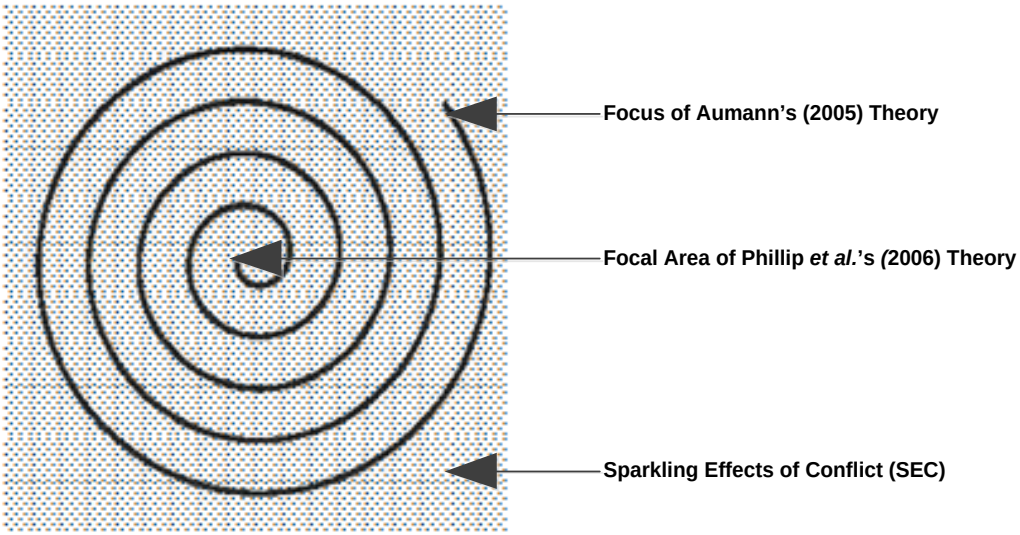


Figure 2-14: Conceptual map of SEC - prepared based on the gap analysis on Aumann's (2005) and Phillip *et al.*'s (2006) conflict study approach

On the other hand, other scholars also propose the SWOT (Strength, Weakness, Opportunities and Threats) analysis for studying conflicts between parties involved in a disagreement. The researcher has reviewed the status of conflict studies in the world's two largest universities, Harvard and Cambridge (Harvard University, 2009; University of Cambridge Counselling Service, 2009). The findings show that Harvard University is focused on high-level negotiation and conflict in general and at a high level. Cambridge University provides awareness for staff and students on conflict resolution and negotiation at low, start-up levels. There is no integrated approach for conflict studies as compared to Harvard. In both universities, the researcher did not find studies on local water conflicts. Table 2-5 displays a summary of conflict-related activities in both universities.

Table 2-5: Summary of conflict studies at Harvard and Cambridge universities (2009)

University	Main focus	Gap/remark
Harvard University	Different programs on negotiation Keywords: *Conflict Negotiation, dispute, Law School*	• No water-conflict-related issues • Dealing with more general, important and global issues • Has an independent unit • Focus on global issues *(High Level)*
Cambridge University	Provide a good awareness for staff and students on conflict resolution and negotiation. The approach was not integrated for the conflict studies as compared to the Harvard School of Law. Keywords: *Conflict Negotiation and resolution, Conflict laws, Counselling service, Staff development, conflict and wild life*	• No water conflict related issues • Dealing with low-level, cost effective, conflict-studies issues • Provide an awareness for staff • No independent body that organizes the subject but it is a good start • Focus on selected environmental conflicts *(Low/Start-up Level)*

Data Source: (Harvard University, 2009; University of Cambridge Counselling Service, 2009)

2.4.2 Theories of Conflict Analysis

Population growth, economic development, and changing regional values have intensified competition over natural resources, leading to predictions of increasing future conflicts over shared water supplies (Wolf, 2002). Competition over shared and limited water resources has been exposed to serious disagreements that lead to conflicts. Existence of competition necessitates and increases our needs for the resources for which people are competing. In support to this concept, Cialdini (2001), further explained the impacts of competition in such a way that ‘not only do we want the same item more when it is scarce, we want it most when we are in competition for it’.

The approaches or theories on conflict analysis and resolution arising as a result of such ‘unfriendly’ competition over scarce resources between the users; will be examined using related theories on conflict analysis such as those of Druckman and Jackson. Likewise, Jackson (1995) and Druckman (2005) indicated different approaches but interrelated methods of conflict analysis and resolution theories. A technical approach by Jackson (1995), which

was cited by Pearce (1997), suggests that there are three different sequential approaches to theories of conflict analysis: the game theory approach, the cognitive and the institutional approach as described below:

- **Game theory** looks at conflict arising from rational decision-making in competitive and cooperative systems,
- The **cognitive approach** focuses on individual differences, such as conflict style,
- The **institutional approach** concentrates on societal structures and processes in the generalization and expression of conflict.

Druckman (2005) emphasized the availability of 20 lists of conflict analysis theories and grouped them into five major categories depending on the ideas they contribute towards the understanding of the conflict. These are equilibrium theory, utility theory, consistency theory, cultural theory and psychological theory (see Table 2-6 below).

Druckman's detailed study of theories of conflict analysis conceptually includes Jackson's specific approaches to conflicts. For example, game theory is incorporated in Druckman's Equilibrium and Utility theory; the cognitive approach is also mentioned in consistency and psychological theory; and the institutional approach in utility and cultural theory. However, Jackson suggests the need for a sequential approach to conflict analysis, as explained and defined below. For a comparison of the two approaches, Druckman's (2005) view is presented in the table below.

Table 2-6: Druckman's conflict analysis and resolution theories

Druckman's theories	Description	Examples
Equilibrium theory	It posits cyclical processes that bounce back toward a stasis or ideal state.	Game theory, exchange theory, the dual concern model, and (at macro level) structural-functional theories.
Utility theory	It posits rational, calculating actors, who are moved to action by incentives.	Social learning or reinforcement theories, decision and game theory, and various forms of contingency theory.
Consistency theory	Emphasizes tensions between competing cognitions and the accompanying motivation to reduce these tensions.	These theories are pitched at both a micro- (cognitive dissonance) and macro-level (rank disequilibrium, structural violence) as well as bridging the levels (relative deprivation).
Cultural theory	Stresses identities, ideologies and worldviews and includes the various perspectives on social identity as well as discourse analysis.	
Psychological theory	Focuses primarily on the individual and tends toward being reductionist.	Human needs, psychoanalysis and frustration-aggression.

Source: Adapted from Druckman (2005: 37-38), Pearce (1997:30)

2.4.2.1 Game Theory

A. Theoretical Backgrounds

In a river basin where there is conflict over water supply resources, a group of different user-communities make a decision to utilize the water supply in a competitive situation. Each user decides in favour of his own advantage. Game theory, which follows a cooperative or non-cooperative approach, is a good method to analyse and model the situations in water conflicts. In game theory, it is possible to find out the desired optimal decisions among the conflicting bodies. Nash equilibrium introduced by Webb (2007) is one of the best approaches to balance the conflict of interest within a game.

During the application of this game theory, the users of water resources that are referred to as 'players' can be two or more in a defined basin. In a shared water resource, the use of water by one party that will be referred as 'payoff' can correspond with a loss by another. Owen (1969) mathematically explained two-person zero-sum games as a closed system in the following ways: A game Ψ is said to be zero-sum if, and only if, at each terminal vertex the payoff function (p_1, …, p_n) satisfies the following zero-sum game function (Equation 2.2).

$$\sum_{i=1}^{n} \boldsymbol{p_i} = \mathbf{0}. \qquad (2.2)$$

where, p_i is the payoff function

The analysis of the conflicts between two or more parties arising due to limited water resources highly depends on the strategies implemented by an individual. Owen (1969) proved for his mathematical theorem that any finite, n-person, non-cooperative game has at least one equilibrium n-tuple of mixed strategy. In support of Owen's idea, Thomas (1984) explains that any two-person game with a finite number of pure strategies has at least one equilibrium pair. Some of the commonly known types of game theories are explained below in the context of competition over the utilization of water resources.

The Nash equilibrium has been used as a pure strategy that leads to a central solution in game theory among two or more co-operative or non-cooperative players. The Nash equilibrium is a kind of mixed strategy that dominates each player's own strategy. Webb (2007) mathematically defines a Nash equilibrium (for two-player games) as a pair of strategies ($_1^*$, $_2$*) as indicated in equation (2.3) below, the Nash equilibrium for two players.

$$\pi_1 (\sigma_1^*, \sigma_2^*) \geq \pi_1 (\sigma_1, \sigma_2^*) \quad \forall \sigma_1 \in \Sigma_1 \text{ and}$$
$$\pi_2 (\sigma_1^*, \sigma_2^*) \geq \pi_2 (\sigma_1^*, \sigma_2) \quad \forall \sigma_2 \in \Sigma_2 \qquad (2.3)$$

where, σ_1 and σ_2 represents the two players

He further explains that, irrespective of the strategy adopted by the other player, neither player could do strictly better (i.e., increase their payoff) by adopting another strategy. In shared water resources where people in the area have been exposed to conflicts, the Nash equilibrium approach has a great importance and has to be applied in this research.

In a basin where the users are more than two groups (n users), theories of Nash equilibrium can be implemented further by developing a model that leads to the output of a strategically equivalent use of water resources. Thomas (1984) defined and proved n-person games indicated in the equation (2.4) of Nash Equilibrium for 'n' players.. According to his definition, in an n-person non-cooperative game, the n-tuple of strategies $x_1^*, x_2^*, \ldots, x_n^*$, where player i plays the mixed strategy x_i^*, is an equilibrium n-tuple for all other strategies $y_1, y_2, \ldots, y_n$:

$$e_i (x_1^*, x_2^*, \ldots x_i^*, \ldots, x_n^*,) \geq e_i (x_1^*, x_2^*, \ldots, y_i, \ldots, x_n^*,), \quad 1 \leq i \leq n \qquad (2.4)$$

where, e_i is the equilibrium payoff for i

B. Game Theories on Conflict Identification and Resolution

Games are described as theoretical models of a conflict of interests because we can identify easily the conflicts of interest in recreational games (Thomas, 1984). A model is an abstraction we use to understand our observations and experiences (Osborne, 2004). Game theory consists of a collection of models (Osborne, 2004) and ways of analysing these problems (Thomas, 1984). Game theory is concerned with the actions of decision makers who are conscious that their actions affect each other (Rasmusen, 2007). According to Rasmusen's findings, the essential elements of a game are PAPI (players, actions, payoffs, and information), collectively called the rules of the game. Since conflict has an impact on both parties, this theory can be applied for the further analysis and modelling of the conflict. In this case, water conflict or war has been considered as a game between concerned stakeholders in the same basin countries. In relation to this research, a few elements of the game theory are highlighted and exemplified in the next table.

Table 2-7: Comparing Rasmusen's (2007) game theory with local water conflicts

Rules of the game	Theoretical references	Description of local water conflicts
Players	Players are individuals who make decisions; each player's goal is to maximize his utility by choice of actions (Rasmusen, 2007).	Participants (decision-makers): - Upstream and downstream users - Government and local communities - Region A with region B, etc.
Actions	An action or a move by a player is a choice he can make (Rasmusen, 2007).	It can be the action that leads in having the best or worst utilization of the water resources or can be other choices. A set of possible events/interactions between players where each of them is affected by the actions of all players. - The maximum use of all water resources - Fair distribution - Limited access for water resources, etc. - No access to resources.
Payoffs	The payment that each player receives at the end of the climax of a narrative or sequence of events (Rasmusen, 2007).	- Upstream users may get more water and less downstream - The powerful community may have access to water resources and the minorities will be exposed to less usage
Information	A games information structure is like the order of its moves (Rasmusen, 2007).	Information is again divided into sets and partitions: - Water-use regulatory aspects - Culture of water use.

C. Examples of Simple Game Theory Approach

Consider a water resources distribution between two parties[5] one upstream and the other downstream. In order to use the game matrix assume A and B stands for users of the same resources found in the upstream and downstream areas respectively.

Action	Output for each user
Resource availability	Best
Scarcity	Bad

In order to set the preference options of the resource utilization, it is obvious that each of the upstream and downstream users would like the following ordering:

Preference ordering of A in the function f(A, B)	(Best, Best) > (Best, Worst) > (Worst, Best), > (Worst, Worst) and representing in assumed number..3 >2>1>0
Preference ordering of B in the function f(A, B)	(Best, Best) > (Worst, Best) > (Best, Worst) > (Worst, Worst) and representing in assumed number: 3 >2>1>0

The result of the game matrix below shows both parties are exposed to three options: (3) the best use of the resources depending on availability, (2) exposed to scarcity or (1) both of them compromise or cooperate for effective resource use and allocation.

		Downstream	
		Best	Worst
Upstream	Best	3 / 3	1 / 2
	Worst	2 / 1	0 / 0

2.4.2.2 The Cognitive Approaches

The cognitive approach to conflict management considers personal reactions rather than a problem-resolving perspective (Warehime, 1980). Jönsson (1982) explains the advantage of the cognitive approach in comparison to game theory:

> "When it comes to the study of international negotiation processes, **game theory has certain shortcomings. It is basically static in nature**; it tends to homogenize actors and 'black box' information processing; and it assumes unitary actors. This article suggests a cognitive approach to the study of international negotiation processes as one way to overcome these shortcomings. The suggested model regards information processing as the link between inter-state negotiation and decision-making within the state, and emphasizes the role of belief systems in shaping expectations and interpretations. Specifically, the negotiating actors' images of the adversary, self-images, and images of [the] situation are singled out as suitable objects of study. Relevant insights and hypotheses concerning the relationship between different parts of the actors' belief systems are identified."

Mediation is one good example of the cognitive conflict management method. During the process of mediation, many interpersonal problems are included and managed.

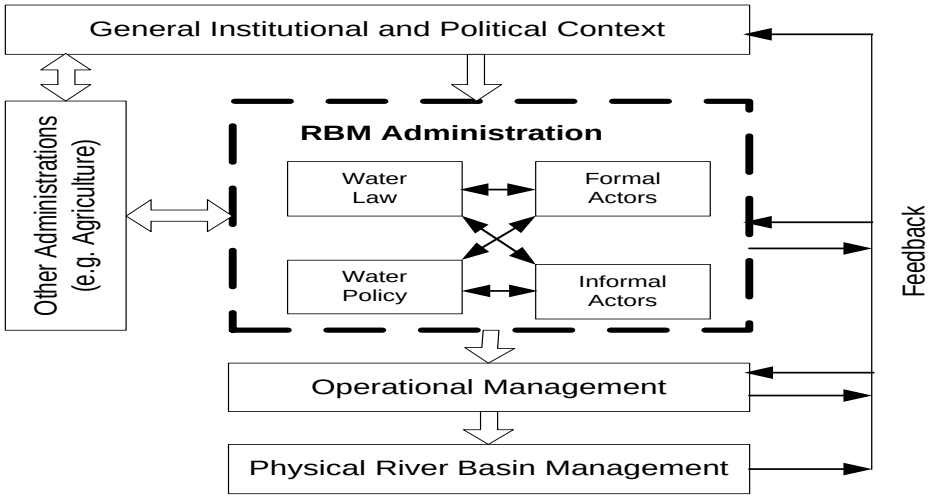
[5] The game theory is applied for more than two users (N users).

2.4.2.3 Institutional Approaches

According to Jackson (1995) and Pearce (1997), the institutional approach is the third of the alternative approaches to the conflict resolution process in addition to game theory and cognitive approaches. However, the literature on how the formal institutions at the local level are actively participating in managing water conflicts is limited. Communities are concerned with any rules imposed on institutions. Hence, institutional approaches have to be taken as key tools for resolving conflicts depending on the type of disagreement. Crawford (1998) states “Cultural conflict escalates into violence when these ‘cultural-group’ institutions are weakened, disrupted, or transformed in ways that undermine the commitment to uphold these contracts or repress dissent.” One of the reasons for conflict in low-income developing countries that have been highly escalated in today’s world may be due to the weakening of cultural groups, as pointed out by Crawford.

In low-income developing countries, conflicts associated with the arrangement of formal and informal institutions have a major impact on socio-economic development. It was witnessed that most of the institutional frameworks of low-income developing countries or those exposed to serious conflicts do not satisfactorily accommodate the interests of the community. In a country where there are many natural resources, ethnic diversity and the availability of different institutions at local, national and international levels simultaneously play a great role in either settling or escalating the conflicts. The main reason for this is that the existence of any institution is highly related to the information such as water resources data, management and knowledge that leads to the decision support system (DSS).

The European Commission Transboundary River Basin Management report prepared by Raadgever and Mostert (2005) indicates that politics, technical cooperation and institutions are considered as the three pillars of an IWRM for sharing international water resources. However, sharing water resources in an equitable way may reduce the conflict but it cannot resolve the problem in a more sustainable way due to the availabilities of limited water resources as well as its related pollution problems. Enhancing capacities of institutions for searching alternative or additional resources or reducing the use of water through research and science development can also be the fourth pillar for proper sharing of water resources with minimum conflict. The strength of the economy of the country can also be another factor. In a situation where there is resource scarcity, the issue of sharing this limited resource will be questioned. On the other hand, both authors showed the analytical framework of the general, institutional and political context of Transboundary River Basin Management (RBM) as described in the Figure 2-15.



Source: Raadgever and Mostert (2005)

Figure 2-15: Framework for analysing transboundary RBM

Raadgever and Mostert (2005) in their research paper showed that changes in the institutions that manage water resources have been very slow as compared to other sectors. However, this concept is mainly true and feasible in politically stable and developed countries. Stable situations may slow down conflicts arising from institutional reforms. It is obvious that the impacts of conflicts on international rivers primarily affect the communities at grassroots level. On the other hand, the institutional capacity at low level is limited and it has a weak network with the high-level, river basin, regional institution. In most cases and in low-income developing countries, agreements signed at a high level do not incorporate the views of the local water users and other cross-sectional governmental institutions.

2.5 Fundamentals of Conflict Management Frameworks

Conflict management is a quite complex process that requires a careful approach and needs its own suitable time to negotiate. Most of the negotiations held without a deep understanding of the problem could cause another problem or expand the problem area. Poor approaches and an untimely conflict management process may escalate the problem. Its process should be supported by negotiation and management strategies depending on the negotiator's experiences. The uses of third parties and tools for interaction, such as technologies, have a major impact on these strategies. Negotiation strategies are commonly divided into two types: integrative and distributive, whereas conflict management strategies are divided into five: compromising, collaborating, forcing, accommodating and avoiding (Whetten *et al.*, 1996).

A group with very little conflict may spend most of its conflict in highly-distributive interaction, whereas one with high levels of conflict may spend most of its time in integrative behaviour (Poole *et al.*, 1991). Whetten *et al. (*1996), further explained about the following six organizing frameworks, which are useful when adapting one of the integrative negotiation strategies, commonly considered as a general-purpose strategy: establish common goals; separate the people from the problem; focus on interests not positions; invent options for mutual gains; use objective criteria and define success in terms of gains not losses.

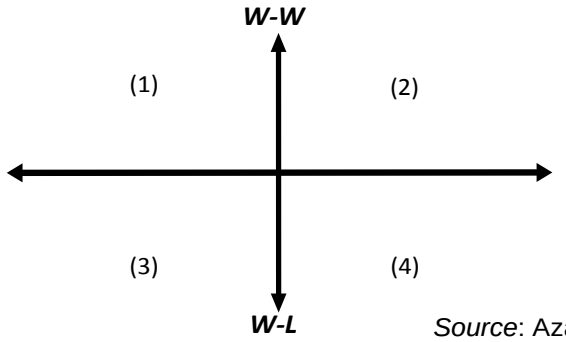
In practice, conflict management should start from designing a simple strategy, such as controlling of rumours at certain levels, which escalates conflicts. Some scholars in the water sector consider IWRM as a tool for water-conflict resolution. Concepts of conflict resolution help in developing a theory regarding the preparedness frameworks for water conflicts.

The next section reviews and compares different types of conflict management frameworks as a continuation of section 2.3.9. It includes, the frameworks on negotiation theory (Thyne, 2006), simple conflict continua quadrant (Azar and Burton, 1986), steps of conflict management (Grazier, 1997), a conceptual model of conflict management (Whetten *et al.*, 1996), a model of the impact of technology on conflict management (Poole *et al.*, 1991) and an integrated conflict management approach (Houk, 2003). All these have been reviewed and compared.

2.5.1 General Approaches to Conflict Management (Conflict Quadrant)

Some of the alternative procedures in international conflict management were further exemplified and discussed by Azar and Burton (1986) using the quadrant, below, based on two simple continua: from power (P) to cooperation (C) and from win-loss (W-L) or lose-lose to win-win (W-W). Burton further explains “winning is the aim of all parties engaged in a dispute. Games are typically win-loss. Party politics are win-loss. Court procedures are win-loss. When ‘winning’ is a goal in itself, it can be defeating for other, even more valued goals. Interests, values and needs require the winning of conflicts, yet winning is dangerous in its consequences. A win-solution, that is agreements that gave to all parties what they were seeking, was very useful.

Figure 2-16: Conflict quadrant



Source: Azar and Burton (1986)

Whereas,

Quadrant 4:	The most familiar in every days games, win-loss. This happens according to the rules of win-loss game, which make the outcome acceptable.
Quadrant 1:	This accommodates typical paternalistic decisions; the parties are thought to benefit as a result of decisions by some person or institution exercising power.
Quadrant 3:	This is the one with which we are familiar in conflict situations. There is power bargaining or even war, with winners and losers or, perhaps, all losers.
Quadrant 2:	This is the one in which would be placed conflicts with outcomes in which all parties are winners.

2.5.2 Specific Process of Conflict Management

This section presents some examples of specific modern options for the basic steps recommended by different authors in the process of conflict management activities. The findings of the study related to the identification of a conflict management location are also compared at the end of the review.

2.5.2.1 Example-1: Levine's Seven Steps Approach

Grazier (1997) shares the next seven steps of Levine's approach to conflict resolution as a new paradigm, which is different from the most common one:

- Develop an attitude of resolution,
- Tell your story,
- Listen for a preliminary vision of resolution,
- Get current and complete,
- See a vision for the future: agreement in principle,
- Craft the new agreement: make the vision a reality,
- Resolution: when your agreement becomes reality.

2.5.2.2 Example-2: Srinivas' Nine Steps Procedures

Srinivas, (2007) defined nine easy steps for conflict resolution procedures as indicated below:

- ***Define the* conflict*,***
- It is not you against me; it is you and me against the problem,
- List the relationship's many shared concerns and needs, as against one shared separation,
- When people have fought, do not ask what happened,
- Work on active listening, not passive hearing,
- Choose a place to resolve the conflict, ***not the battleground itself***,
- Start with what's doable,
- Develop forgiveness skills,
- Purify our hearts.

In the Afar region, traditional people select the conflict place as a key criterion for resolving the problem, which contradicts step six of Srinivas' modern ways of conflict management approach. In Levine's approach, selection of a conflict management area was not indicated.

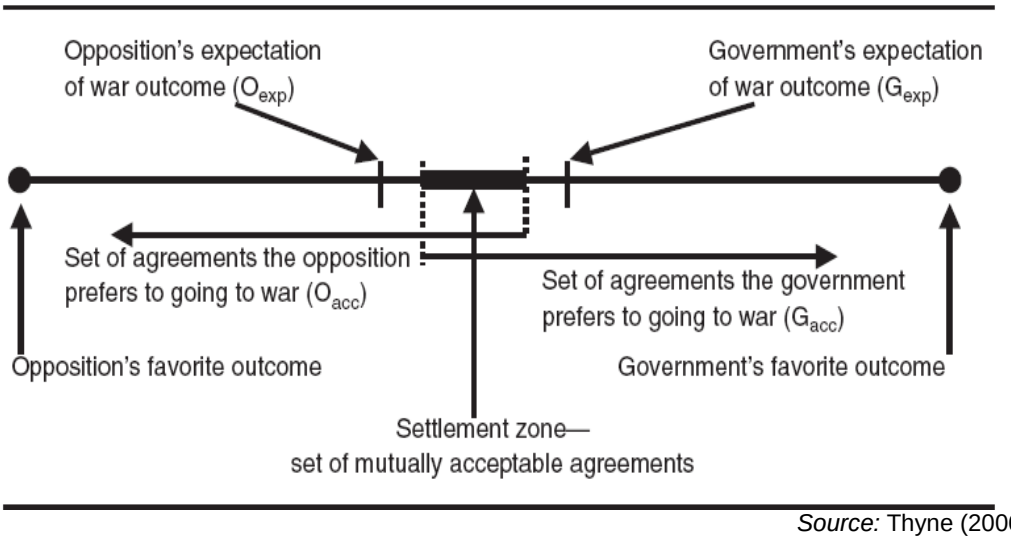
2.5.3 Framework Models of Conflict Management

Models are partial mirrors, reflecting how humans perceive the world around them (Dodge *et al.*, 2009). Depending on the type of conflict, professionals are defined in different ways including sketching out a general schematic map of a model of conflict management. In general, Hestenes (1996:8) explained, "a model is a representation of structure in a physical system and/or its properties. It describes (or specifies) four types of structure, each with

internal and external components: systemic structure, geometric structure, temporal structure, and interaction structure". Next, the researcher has presented five examples of conflict management framework models prepared by different authors.

2.5.3.1 Example One: Intrastate Negotiation Framework Model

A good example of the basic framework for resolving conflicts was the one designed by Thyne (2006), who indicated general negotiation theories (Figure 2-17 below) on managing the disputes between Intrastate conflicts without first looking at the causes of the major disagreements. The conceptual map shows that the gap to bring the two conflicting bodies towards the mutually acceptable zone is very small as compared to each party's expectation.

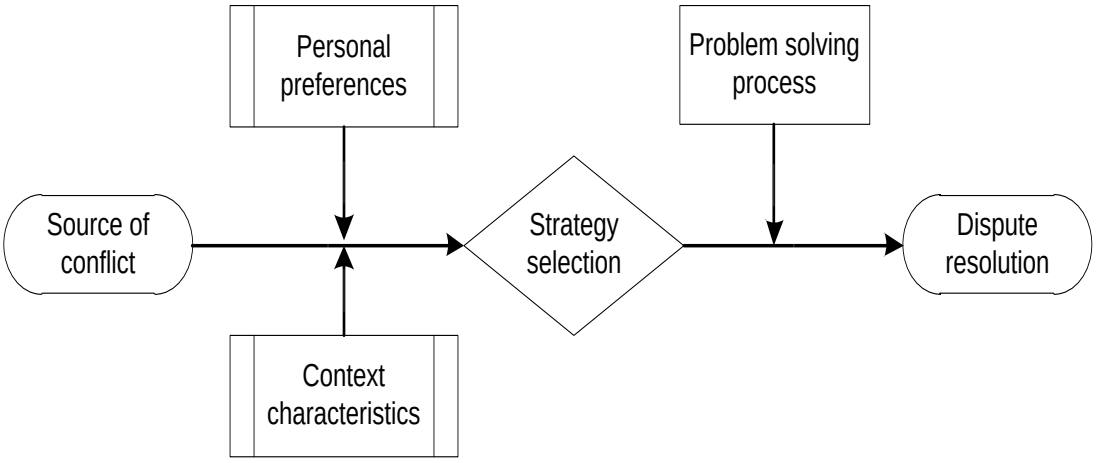


Source: Thyne (2006: 939)

Figure 2-17: Intrastate bargaining positions without considering interstate signals

2.5.3.2 Example Two: Basic Conceptual Framework Model

Whetten *et al.* (1996) continued their model for conflict management by dividing it into three phases. This includes (1) diagnosing the sources of conflict, (2) selecting the appropriate conflict management strategy and (3) using specific problem-solving techniques, to resolve interpersonal disputes.

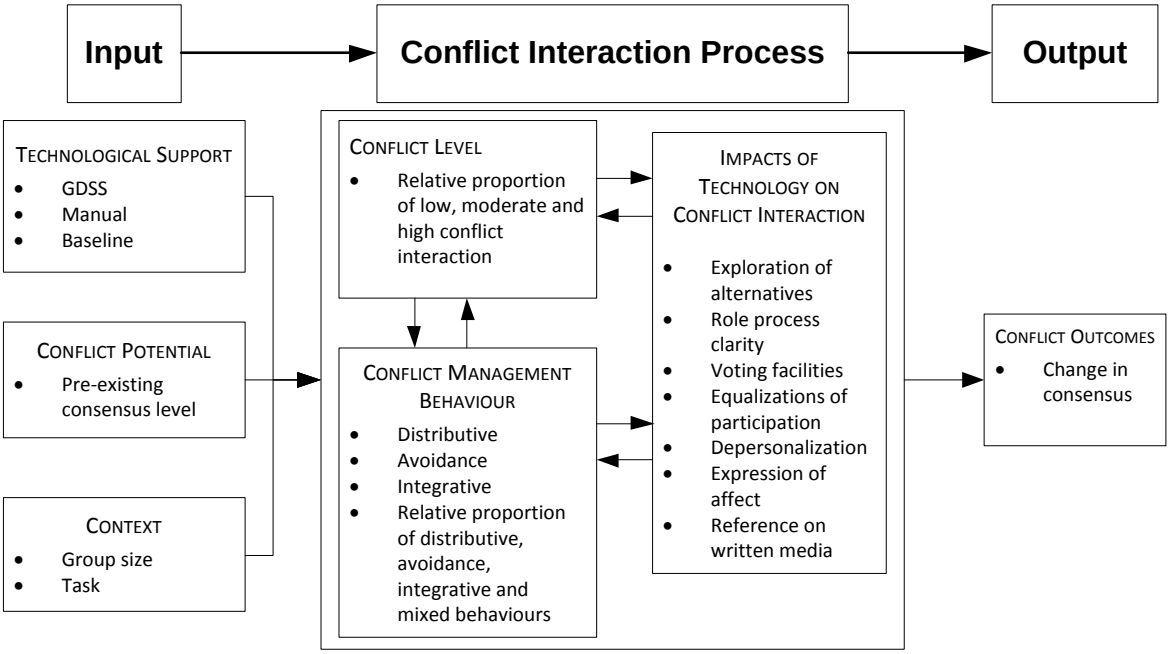


Sources for drawing: Whetten *et al*. (1996:52)

Figure 2-18: Summary model of conflict management

2.5.3.3 Example Three: Computer-Based Framework Model

Poole *et al.* (1991) proposed a structure for conflict management having three main structures (input, conflict interaction process and output) in a computer-supported meeting environment, as mentioned in Figure 2-19.

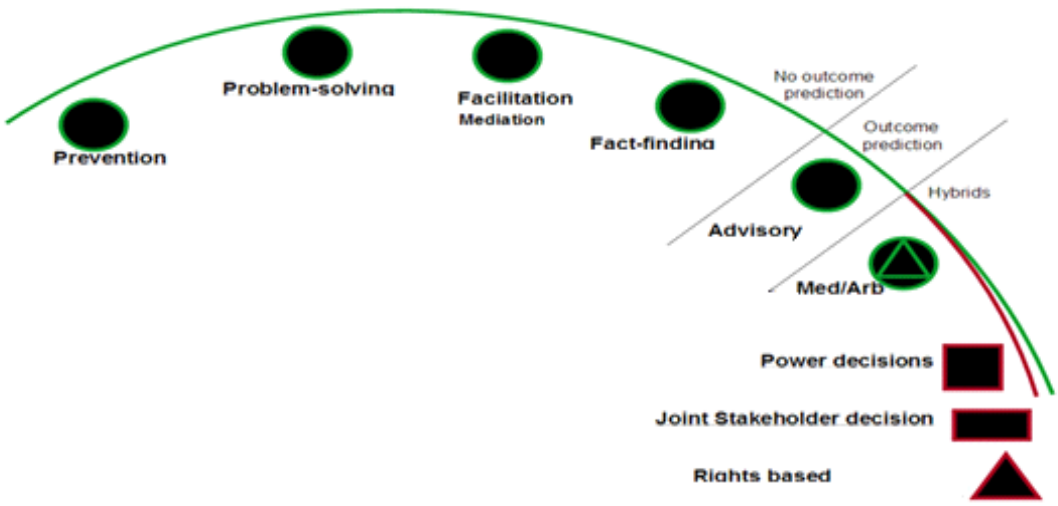


Sources: GDSS-Group Decision Support System (Poole et al., 1991)

Figure 2-19: A model of technology impact on conflict management

2.5.3.4 Example Four: Integrated Conflict Management Framework Model

Lynch (2004), Houk and Moidel (2003) defined integrated ways of conflict management systems concepts as indicated in Figure 2-20, below.



Source: Lynch[6].,2004

Figure 2-20: Integrated conflict management approaches

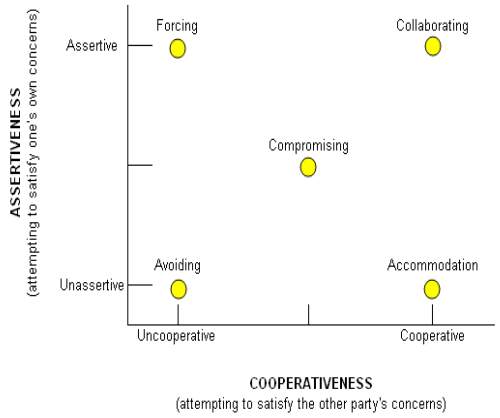
[6] Jennifer Lynch, Q.C., heads an international group of system designers and facilitators with extensive experience in government and private enterprise.

2.5.3.5 Example Five: Two-Dimensional Model of Conflict Behaviour

Filley (1975, 1978) and Robbins (1974) cited by Whetten *et al.* (1996) conducted a survey that identifies responses to conflict that fall into five categories (forcing, accommodating, avoiding, compromising and collaborating) where each of them are again organized along two dimensions as shown in Figure 2-21 below. These are:

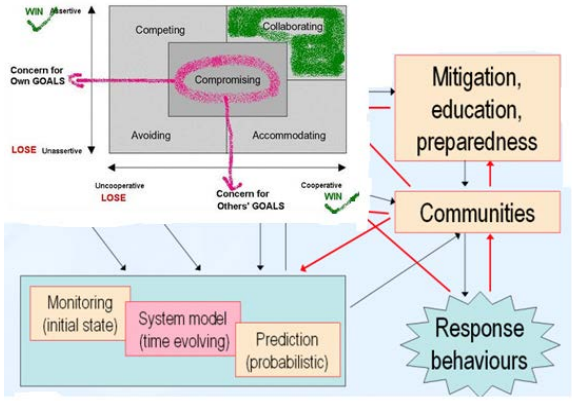
- The forcing response (assertive, uncooperative),
- The accommodating approach (cooperative, unassertive),
- The avoiding response (uncooperative, unassertive),
- The compromising response,
- Collaboration (cooperative, assertive).

Two-dimensional Model of Conflict Behaviour (a)



Source: Whetten *et al*.(1996:16)

Two-dimensional Model of Conflict Instrument (b)



Source: Whetten *et al*.(1996:16)

Figure 2-21: Two-dimensional model of conflict behaviour (a) and implementation (b)

Further elaboration of Table 2-21 (a), which is displayed in Figure 2-21 (b), was originally designed by Whetten *et al*. (1996) as an instrument for modelling a conflict, which is actually the explanation of the implementation of the first design.

2.5.4 The Use of Quotations in Traditional Conflict Resolutions

Traditionally, conflict resolutions are available in most societies. Questions and quotations are a powerful tool for a negotiation process. Traditional elders and 'skilled negotiators typically enter negotiations with a number of questions already prepared', Reardon (2005). Some of the conflict-resolution-related quotations are as follows:

Table 2-8: Sample quotations on conflict resolution

1.	*Starting negotiations directly or through a third party:*	"First they ignore you, then they laugh at you, then they fight you, then you win." *(Mahatma Gandhi)* "Wise to resolve, and patient to perform." *(Raiffa, 2000)*
2.	*Starting communication:*	"Always remember the old riddle: 'what do you call a mad terrorist with a gun?' 'Sir'." *(Whetten et. al., 1996)*
3.	*Balancing views during negotiations:*	It is useless for the sheep to pass resolutions in favour of vegetarianism while the wolf remains of a different opinion. *(Dean William Inge,1984)*

2.6 Early Warning Systems

Water conflicts hamper the sustainable utilization of water resources affecting our life. In order to mitigate this problem, a long-term care plan is necessary. A local water conflict early warning system is one such plan that enables people to be sufficiently aware of the problem in advance so that the public and government officials could respond effectively. An early warning system depends on time and the accuracy of the forecasting model. The current knowledge, practices, data and tools for predicting local water conflicts within low-income developing countries, are very limited and make the problem more complex. This research will make a significant contribution to the identification of proper models, guidelines and methods that help in the preparation of a local water conflict early warning system's identification and preparedness processes. Depending upon the type and complexity of the early warning structure, the system can be operated at different levels such as locally, nationally and internationally. In general, there is not enough data and theories on local water conflicts early warning services. This section deals with the conceptual understanding of an early warning system. It elaborates the risk assessment stage of early warning services and knowledge management in the context of local water conflict.

In Chapter 3 of The Framework of the Study Plan, the integration of the concept of an early warning system is clearly illustrated and described as a leverage in the process of pre-identification and preparedness of local water conflicts, which is displayed in Figures 3.1, 3.2, 3.4 and 3.5. In the next section, the review, purpose and anatomy of the early warning system in the context of local water conflicts will be highlighted.

2.6.1 What is an Early Warning System?

2.6.1.1 Background, Definition and Objectives

There is no standard definition of an early warning system that has universal acceptability. For instance, Glantz (2004) emphasized that an EWS has gained much attention in the prolonged drought and famines in the West African Sahel and in the Horn of Africa during the 1970s and 1980s. However, an early warning system (EWS) is a relatively long-term plan that depends on the timing of the warning. Glantz (2004:8) explains EWS as follows:

> “As a part of human nature, everyone in society would like to have a glimpse of the future. Early Warning Systems exist in every society: can be formal ones visible in the structure of national government bureaucracy or they could be informal ones that are local and cultural in nature. They could be operated by people with a special interest. They do this by looking at trends and by making projections, forecasts and scenarios as well as by mystical and astrological means”.

Advanced definition of an EWS is the one provided by the UN and stated as follows: “The provision of timely and effective information, through identifying institutions, that allow individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response” (Glantz, 2004:7). Alternatively, Adelman *et al.* (1995), in a report published by a committee of the Joint Evaluation of Emergency Assistance to Rwanda, defined early

warning as the collection, analysis and communication of the appropriate evidence and conclusions to policy-makers to enable them to make strategic choices.

Adelman *et al.*'s definition misses the inclusion of a timely warning. Both Adelman *et al.* (1995) and UN (Glantz, 2004) definitions did not incorporate the issue of transparency, which is a basic tool that helps effective decision-making in an early warning process.

Figure 2-22 provides short summaries of EW literature reviews and the anatomy of EWS. It includes the types, elements, efficiency, stages, prediction models, approaches and components of EWS. The main objective of an Early Warning System (EWS) is to avoid or reduce the risks associated with the sustainable development of human beings. In support of this concept, Glantz (2004) stated that if an early warning system does not contribute to sustainable development, it should not exist. Davies (2000) stated that the goal of an early warning system might be conceived as avoiding or minimizing violence, deprivation or humanitarian crises that threaten the sustainability of human development. In contrast, many early warnings knowingly and unknowingly activate other early warnings as the time gap between a warning and the onset of a hazardous event shortens (Glantz, 2004).

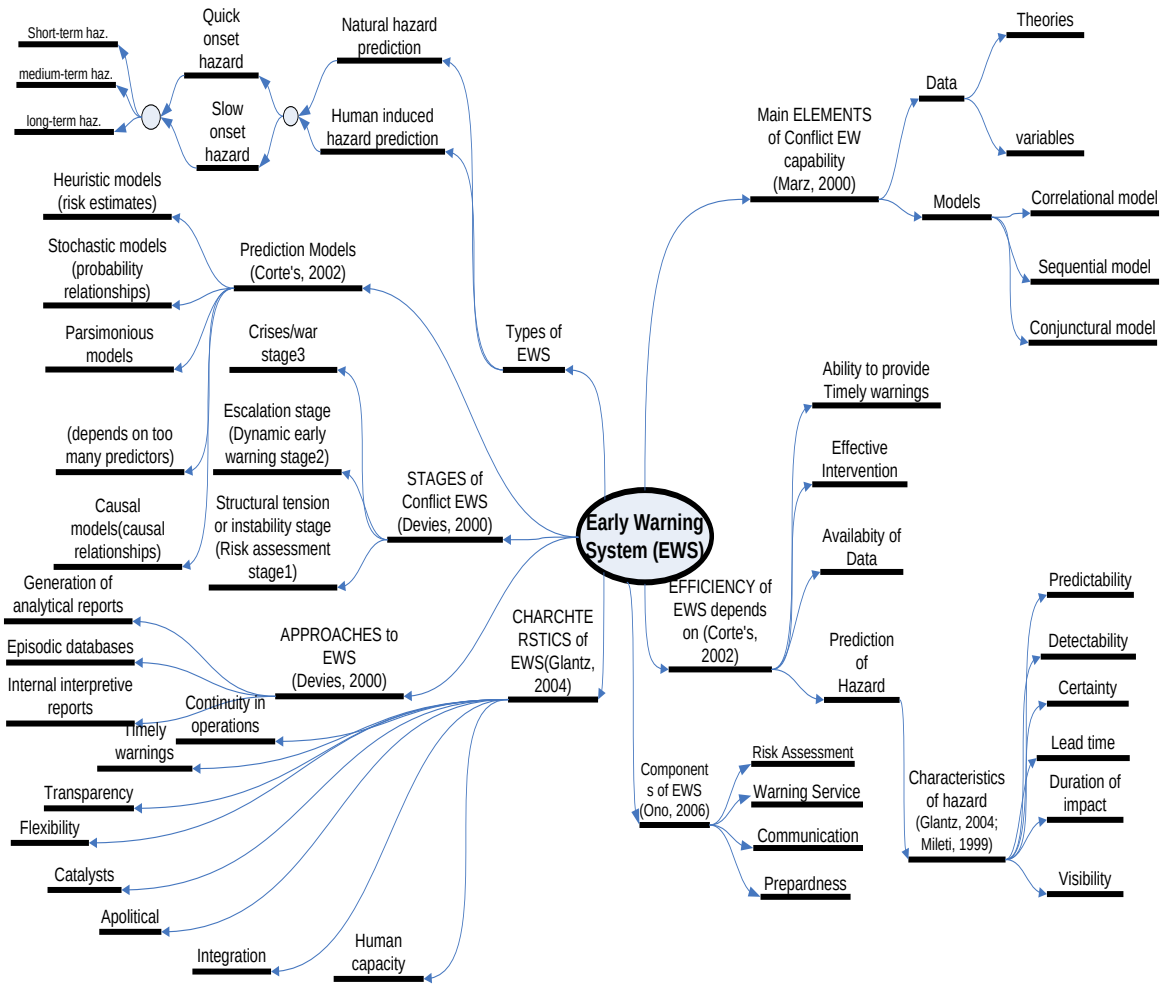


Figure 2-22: Anatomy of conflict early warning system

The bigger problems in an early warning process that most developers face are the lack of theory - supported by data - that can guide the design of a reliable risk assessment model (Brecke, 2000). Brecke further stated that there are actually two types of data that we must collect and use for appropriate risk assessment models: data to determine the theories that best explain the outbreak or escalation of violent conflict and data corresponding to variables that have been demonstrated to have predictive power. Another problem stated by Glantz (2004) was that one of the most challenging tasks to keep politics out of EWS, even though most early warnings arise out of a political or social need.

2.6.1.2 Risk Assessment Stage of Early Warning

Risk assessment is one of the four components of EWS as stated by Ono (2006). The other components are warning services, communication and preparedness as indicated in Figure 2-22 above. Primarily, a conflict early warning system mainly focuses on the first stage, which is the risk assessment stage in order to prepare effective planning that helps to prevent escalation of a conflict that might lead to a major calamity. The risk of conflict is the product of two elements: probability and expected damage (Engel, 2003). Moreover, he explains that reducing the damage resulting from conflict, which one might call the patterns of conflict, is often much easier than reducing the probability. Risks are broadly expressed as a function of hazard and vulnerability. The local communities in low-income developing countries are vulnerable to problems related to water. Africa and Asia are the ones mostly exposed to such risks. The researcher has formulated Equation 2-5 for the identification of the status of local risk exposure. Moreover, in Chapter 5, the data analysis, further explanation and the general formulation are presented for hazards and risks in comparison to local water conflicts in the Afar region. The relationship between risk, hazard and vulnerability is shown in Equation (2.5) below.

$$f\,\textbf{(Exposure to Risks)} = h\,\textbf{(types of hazard)} * S\,\textbf{(Intensity)} * v\,\textbf{(Vulnerability)} * p\,\textbf{(Probability)} \quad (2.5)$$

where, f, h, s, and p, stands for functions of risk, intensity, vulnerability and probability respectively.

Local water conflict risk assessment study depends on long-term risk factors in association with the type of conflict or crisis supported by interpretation of the information. An early warning system that indicates such risks should have a system to communicate the information to people at the operation and responsibility level. Similar to the general EWS problems, Marz (2000) stated, “the major problems that can guide the design of a reliable risk assessment model are lack of theory supported by data”.

2.6.1.3 Users of EWS (Glantz, 2004)

EWS could be included in a large socio-economic, cultural, and political system and the main user stakeholders of this system are indicated as follows:

- At-risk populations, regions or socio economic sectors,
- Government officials,
- The EW international donor community, and
- Risk-affected stakeholders.

2.6.1.4 EWS Models and their Efficiency

Many models and meta-models for EWS have been developed and used in different sectors. These models analyze the mathematical, conceptual, physical and visual parts of the risks associated with observable facts. However, the efficiency of the models depends on adequate data to give proper information and appropriate theories to enable an effective analysis of the problems. Appropriate models are one of the main tools to have feasible EWSs. Nevertheless, Cortés (2002), stated that the efficiency of an early warning system depends on hazard prediction, availability of data, effective intervention and ability to provide timely warning.

There are many models that are developed for different types of early warnings. The following are some of the selected early warning models in relation to conflicts, healthcare, Tsunami natural disaster and social identity behaviours. In addition, a sample model based on geosciences teaching prepared by Carleton College was presented for comparison purposes.

(1) A conflict early warning system (Brecke, 2000) described below and its applicability is compared with the research work on local water conflict early warning.

Table 2-9: Brecke's (2000) conflict model and its applicability in local water conflicts

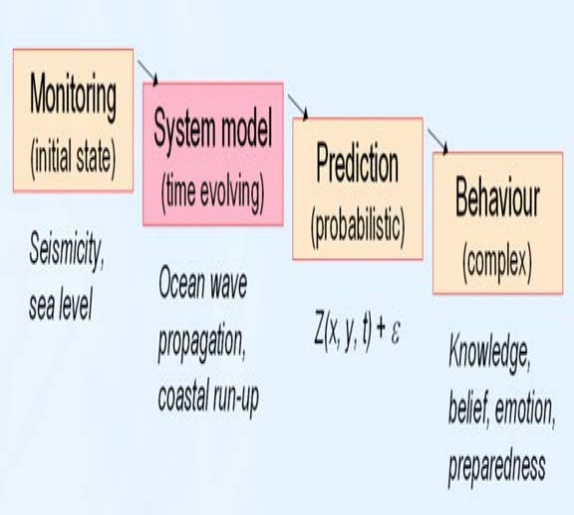
Brecke's (2000) Conflict models	Description	Keywords	Applicability in this water conflict research
1. Correlation models	To determine CAUSES of WAR , particularly intestate wars	indicators	not applicable
2. Sequential Models	METHODS for achieving conflict alerts	mechanism	applicable
3. Conjunctural Models	Focuses on combination of CONDITIONS AND EVENTS that lead to violent conflict	exploration	partially applicable

(2) A long-term medical care early warning system (Cortes, 2002):

- causal models (causal relationships);
- heuristic models (risk estimates);
- stochastic models (probability relationships);
- parsimonious models (depends on too many predictors)

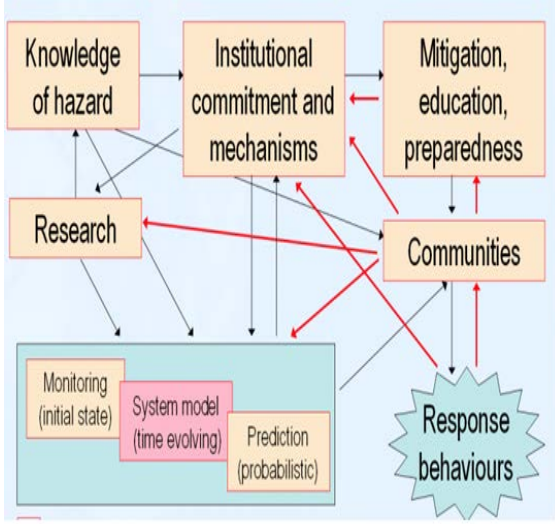
(3) A linear and integrated systems model of a Tsunami early warning system (Ono, 2006)

A linear systems model on Tsunami EWS (a)



Source: (Ono, 2006)

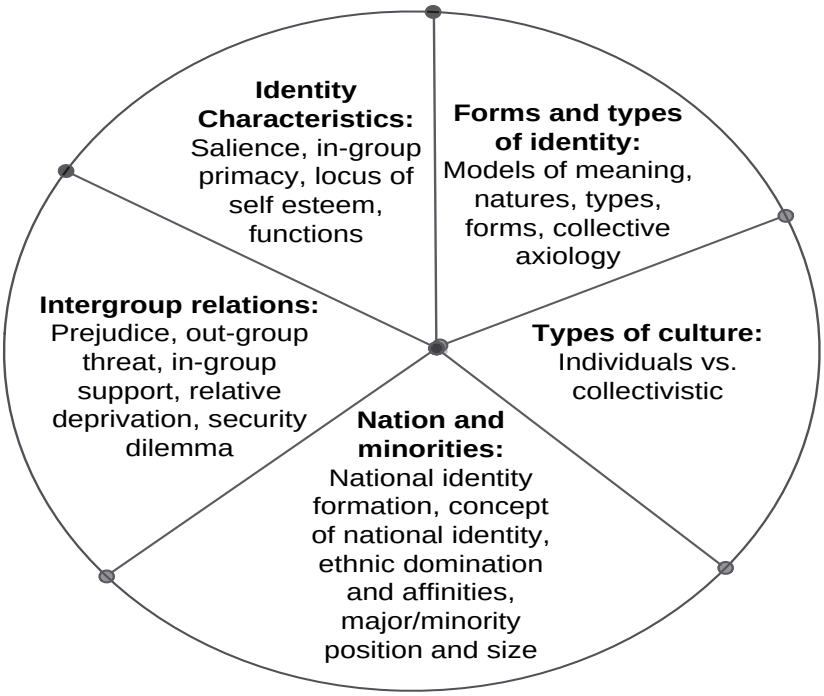
An integrated systems model for Tsunami EWS (b)



Source: (Ono, 2006)

Figure 2-23: Comparison of a linear (a) and an integrated (b) systems model on Tsunami EWS

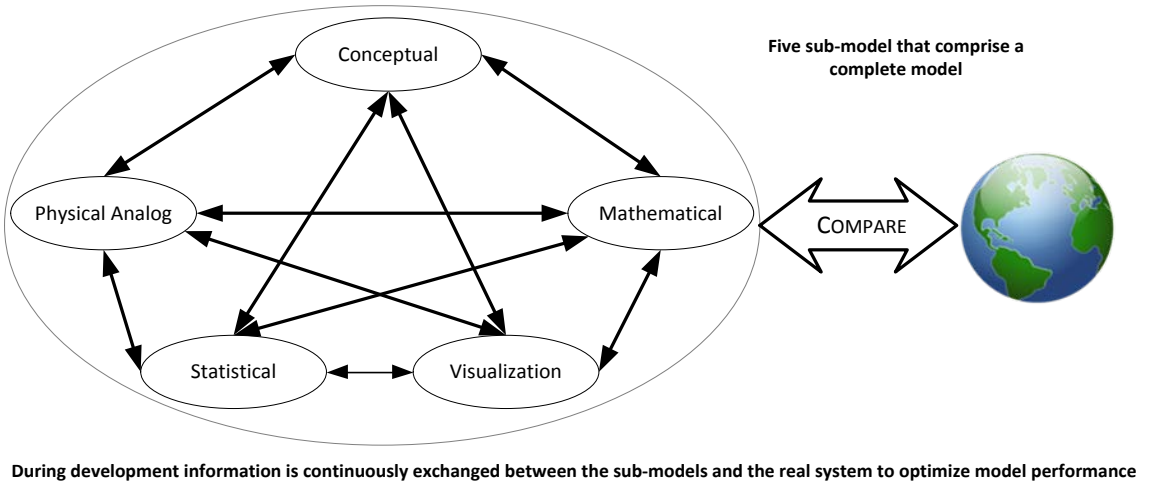
(4) Model of an identity-based early warning system - the system of social identities in Tajikistan: Early warning and conflict prevention (Korostelina, 2007).



Source: (Korostelina, 2007)

Figure 2-24: Model of an identity-based early warning system

(5) General classifications of a model design based on teaching Geosciences



Source: Science Education Resource Centre, Carleton College
Available at *http://serc.carleton.edu/introgeo/models/WhatIsAModel.html*

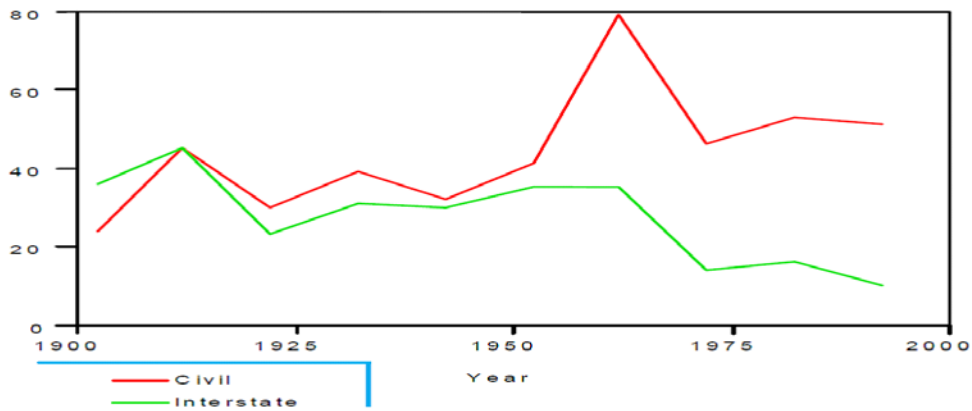
Figure 2-25: Sample models and meta-models of EWS

2.6.2 Early Warnings and Local Water Conflicts

In this research, the objective of the early warning system is to generate an analysis in order to identify key factors that cause local water conflicts and recommend proper scenarios. Davies (2000) identified three sequential stages of early warning systems in conflicts. These are:

- Structural tension or instability stage (Risk assessment stage);
- Escalation stage (Dynamic early warning stage); and
- Crises/war stage.

Brecke's (2000) study shown in Figure 2-31 below indicates that since the end of the 20th century, the analysis of conflict shows that civil and interstate conflicts are relatively and slightly reducing. On the contrary, while local water conflicts are increasing dynamically, international water conflicts are increasing at a very slow rate (see Figure 2-26 below and compare it with Figure 1-3 in Chapter 1). Could this mean that future local conflicts will probably be predominantly all about water-related issues?



Source: Brecke (2000:9)

Figure 2-26: Number of conflicts in 20th century – civil vs. interstate conflicts

Early warning events can be identified technically based on intensive data collection and effective use of information prepared through efficient EWS framework models. Such models are used as a tool for testing the validity of the early warning data. The following are some of the unstructured parts of water-conflict-related early warning titles posted as major headlines in selected newspapers.

Table 2-10: Headlines from newspapers as a source of water conflict EW information

Year	**Headlines and Sources**
2007	Warming Will Exacerbate Global Water Conflicts *By Doug Struck* Washington Post Staff Writer, Monday, August 20, 2007; Page A08, USA
2007	Great Lakes key front in water wars *Western, Southern states covet Midwest resource* *By Tim Jones* | Chicago Tribune national correspondent, *October 28, 2007, USA*
2007	Bali Conference: Diplomats warned that climate change is security issue, not a green dilemma "…from rising sea levels in the Indian Ocean to the increasing spread of desert in Africa's Sahel region and water shortages in the Middle East, global warming will cause new wars across the world and is being described by diplomats as a "threat multiplier" – adding new stress to areas of traditional geopolitical instability" *The Independent, By Daniel Howden, Deputy Foreign Editor ,Published: 06 December 2007* http://environment.independent.co.uk/climate_change/article3226421.ece
2007	Local governance: new research programme on water conflicts and cooperation in rural areas. The Danish Institute for International Studies (DIIS) is coordinating a new research programme on Conflict and Cooperation in Local Water Governance. It will focus on what the consequences are for the poor of increased water competition in the rural areas of developing countries. Danida's Research Unit for Development Research has approved funding of DKK 10 million (EUR 1.3 million) International Water and Sanitation Centre (IRC), 10 Nov 2007; The Netherlands
2007	Ethiopia: Complex Emergency Situation Report #1 (FY 2008) Cyclical droughts, exacerbated by a rapidly growing population, endemic poverty, and limited government capacity, have led to chronic food insecurity and water shortages in Ethiopia. Despite an overall improvement in food security in 2007, approximately 8 million people in Ethiopia continue to receive food assistance. U.S. *Agency* For International Development, Bureau For Democracy, Conflict, and Humanitarian Assistance (DCHA), Office Of U.S. Foreign Disaster Assistance (OFDA); USAID, 2nd December 2007
2003	Why the world needs to act fast *By Richard Jolly, BBC, Chair, Water Supply and Sanitation Collaborative Council, UK*
2003	Water wars: Ask the experts (*BBC*, UK)
2000	Water, water everywhere -- but will there be enough to drink? *CNN*, *January* 3, 2000; USA

2.7 Overview of Gaps in the Literature

In this section, further literature gaps identified in the previous reviews will be summarised. The gaps in the literature, together with the identified research problems, lead to developing the framework for the study presented in Chapter 3. The following are summaries of the main knowledge gaps in the areas of the study.

LIMITED LITERATURE AND KNOWLEDGE: The available literature on conflict is highly fragmented and provides confusing explanations. Conflict is defined in many controversial ways. Much literature is available on international water conflicts with some being available on local-water-conflict management practices in low-income developing countries. There are no clear and standard parameters for the identification of local water conflict problems. In addition, there is no specific theory for the analysis and study of local water conflicts. It was identified that there is a wide gap in integrating the existing conflict knowledge with the real practice at local levels. Similarly, the causes and indicators of conflicts are explained by different authors in different ways and a more clearly focused approach is lacking. Castro (2007:110) clearly indicated that "the existing fragmentation in the knowledge about water conflicts offers an excellent opportunity to develop genuine interdisciplinary approaches that bring together the expertise developed in the technical and the social sciences, and other epistemic fields", supports the findings in this research on the literature gap.

LIMITED DATA AND THEORY (INFORMATION ON LOCAL CONFLICTS): Literature regarding data and theory on local water conflict early warning systems is limited. The literature review shows that there is a gap in the comprehensive information related to local water conflicts. Further work has not been done at the local level. Similarly, the conflict negotiators in low-income developing countries have limited background information; and there is no positive information-exchange tradition between the conflicting parties.

LACK OF STRATEGY AND POLICY ON RESOLVING/HARMONIZING CONFLICTS: Most low-income developing countries lack a comprehensive strategic plan, policy and/or implementation guideline on the pre-identification and resolving of conflicts.

CONFLICT BOUNDARY LINE: Most researchers believe that positive conflict leads to innovation and growth. However, the question about how to identify the boundary line of positive and negative conflicts remains unanswered. Another question that remains unanswered is whether this line varies depending on the tolerance of conflicting parties. Similarly, there is insufficient information that justifies the time gap between conflict and the conflict management process, which can have a great impact on both phenomena. Questions about the type of water conflicts as well as the rate at which these conflicts occur, expand and die require a predictable answer.

LIMITED LOCAL/TRADITIONAL INSTITUTIONS: The review indicates that there is a limited number of institutions or organizations working on conflict in low-income developing countries.

Most of the conflict-management-related organizations are found in highly developed countries. In many low-income developing countries, in a place where there are many local water conflicts, there is no adequate formal institution or organization established to harmonise such conflicts associated with water resources. The importance of traditional institutions is getting weaker and weaker.

LIMITED PROFESSIONALS: The literature shows that there are very few professionals in the area of water conflict. The three well-known and internationally recognized water conflict experts are Dr. Peter Gleick, who is working on international water conflicts over water resources; Dr. Aaron Wolf, on transboundary water resources that lead to political conflict and cooperation; and Professor Falkenmark who deals with the problem of water scarcity in developing countries.

LACK OF ACCEPTABLE DEFINITIONS: There are no universally accepted definitions especially on two terminologies: 'conflict' and 'early warning system'.

2.8 Chapter Summary

In this chapter, the researcher studied the small amount of available literature on local water conflicts, and covered in-depth reviews and fundamental causes of conflicts with a special focus on local water conflicts. The risk and preparedness for the potential danger of a local water conflict and its relation to social, political and economic issues has been emphasized in general contexts. Moreover, conceptual understandings of conflict and water conflicts in particular have been discussed and existing conflict analysis and prediction theories on early warning systems have been investigated and summarized. The conceptual map of the link and the boundary line that differentiates conflict from simple disagreement, disputes and violence is presented in the study.

In the research, the existing controversial conflict definitions have been studied and reviewed and an alternative formulated. In addition, the primary dimension of local water conflicts was formulated. The researcher identified the existing knowledge gaps in the area of local water conflicts. The findings show that there is no feasible theory relating to a local water conflict EWS. The researcher has included sparkling effects of conflicts based on the gap found in the findings of Aumann's and Philip *et al.*'s theories of approaches to conflict study.

The author also compared the existing theories on the basic causes of water conflicts suggested by three well-recognized scholars, Gleick, Wolf and Falkenmark. Falkenmark compared the causes of water conflicts numerically to water stress factors. Gleick proposed four factors of vulnerabilities that lead to international water conflicts. Wolf describes problems related to cooperation and management structures as a cause for transboundary water conflicts.

Figure 2-27 below, indicates the road map and the links between major research question, "*How can we pre-identify and prepare for local water conflicts in low-income developing countries*?" and summaries of work undertaken in this literature review chapter.

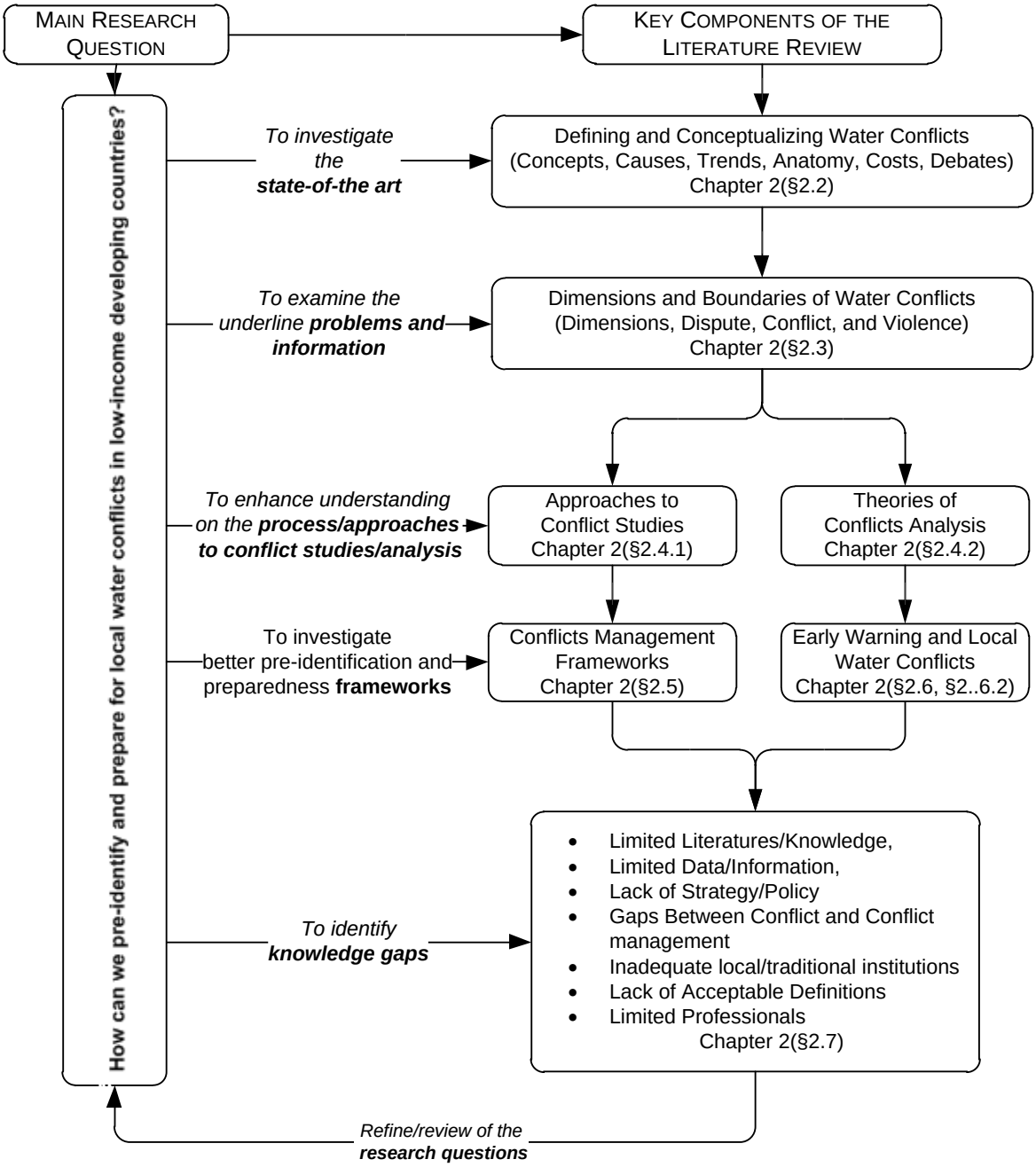


Figure 2-27: The road map of the links between research questions and the literature review

In addition to a review of the literature on research methodologies, this study investigated some concepts of conflict management practices and models that could mainly be used for further preparedness for addressing problems associated with local water conflicts. The review map of conflict anatomy was designed in detail in addition to the separate map of the anatomy of a conflict early warning system. Through this, the researcher has sought to demonstrate an understanding of the most current debates on water conflicts.

Chapter Three
THE FRAMEWORK OF THE STUDY

"To the lost man, to the pioneer penetrating a new country, to the naturalist who wishes to see the wild land at its wildest, the advice is always the same -- follow a river." (Edwin Way Teale, 2005)

This chapter mainly provides the three research frameworks that reflect the links among the central elements of the research process on a multi-dimensional approach to local water conflict studies. It includes (1) the primary framework that shows the links between the research questions, aims and objectives, (2) the framework for the whole design of the study, and (3) a conceptual model of the local water-conflict pre-identification, early warning and preparedness framework.

3.1 Introduction

The conceptual framework helps with the planning and analysis of the research to identify new findings and make recommendations for further research. The design of the conceptual frameworks can be illustrated using a relationship diagram such as spider diagram, cluster diagram, mind mapping and flow diagram (Finn, 2005). Finn further explained the purpose of a conceptual framework as being to:

- contribute to the research student's understanding,
- present general concepts, constructs and theories in a relevant and proper context,
- evaluate general concepts, constructs and theories,
- identify contradictions in concepts/evidence or identifies new links, and
- review the evidence.

The design of the relevant frameworks of the study will be further explained in § 3.2-3-5 and illustrated in Figures 3-1 to Figure 3-6, below.

3.2 The Link between the Research Question and the Knowledge Gaps

This framework indicated in Figure 3-1 helps to validate and integrate the key research problems, the knowledge gaps identified in the literature review, the research questions, the research hypothesis and the aims and objectives of the research *vis-à-vis* multidimensional approaches to local water conflict.

3.3 Constructing the Framework of the Research Study Plan

This framework shows how the design of the research work has been implemented, see Figure 3-2. The design of the study is also supported by the key words indicated in the mind-mapping diagram in Figure 3-3. The basis for preparing the framework relies on the concepts derived from section 3.2 of the Link Framework. Table 3-1 explains the background information used to develop the conceptual framework of the methodology. It also incorporates the key concepts indicated at Table 3-2 of the design of the research timetables.

Table 3-1: Key words for designing the conceptual methodology

Frameworks title	Key words	Remarks
Research understanding.	Having clear research questions, aims, objectives and theory.	Draw a design map
Presenting general concepts, constructs and theories in the relevant and proper context.	Conflict, water conflict, experiences in managing water conflicts and chronologies, institutions. Modelling, conflict histories, indicators, risks, costs of conflict. Some theories like Game Theory, theories on institutions, Newton's theory, etc.	Research design
Evaluating general concepts, constructs and theories.	Evaluation of each of the above keywords (by preparing variables and units of analysis).	Research design, survey design, literature search, report writing, presentation, workshop participation and publication. Establishing a line link and define the link.
Identifying contradictions in concepts/evidence or new links.	Draw any contradictions among the key words and propose a new link to fill the gap.	
Reviewing of evidence	Evidence, validity.	Discussion with supervisor.

This framework of the research plan illustrated at Figure 3-2 incorporates the concepts indicated in the design of the research timetables indicated at Table 3-2 below. The feasibility of a project will depend on a realistic effort to schedule the timing and duration of various tasks (Finn, 2005). All the activities and deliverables of the research followed the six stages of the timetable indicated below. During this this research, separate and detailed timetables of each stage were prepared using Microsoft Project Software which show the major milestone of each phase in accordance with the general guidelines below. Professional development training courses have been undertaken continuously in parallel with this schedule.

Table 3-2: The six stages implemented for designing the research timetable

Stages	Activities
Stage-1	*Research project management*: Research project scoping and definition, project planning, meeting and reporting, communications. *Preparatory activities*: Literature review, identification of key organizations, identification of key institutions, identification of key professionals, establishment of key contacts, fine-tuning of research questions and methodologies.
Stage-2	*Data collection (primary and secondary data):* Water conflict risk surveys, policy surveys, policy-documents, archival sources, etc. Field research: interviews with key firms and institutions and case studies on selected local water conflicts.
Stage-3	*Analysis and Discussion:* Preliminary analysis of interview material/data sources/policy dynamics. Identification of secondary questions. Discussion on conflict patterns, modelling and hypothesis.
Stage-4	*Developing framework models and refining (Results):* Follow-up of the interviews, further literature analysis and development of theoretical models based on findings.
Stage-5	*Writing the thesis:* Writing the first draft, revising and editing, incorporate feedback from supervisor, proofreading and printing the thesis.
Stage-6	*Wrap-up:* Revision and corrections, compilation of thesis.

3.4 The Conceptual Framework of LWC Early Warning System

This section deals mainly with local water conflict early warning system analysis and design. It presents two conceptual frameworks. The flow chart for local water conflict pre-identification in Ethiopia is indicated in Figure 3-4, which also reflects the need for the consideration of early warning studies in local water conflict research. Secondly, Figure 3-5 shows a multidimensional conceptual framework that leads to an operational guideline for a local water conflict early warning system mainly for further pre-identification and preparedness purposes.

3.4.1 Approaches to LWC Study in Ethiopia/Afar Region

Water conflicts primarily affect the local people. The water conflict occurrence process takes a long time to reach the critical stages. Once the problem is at the critical stage, violent conflict occurs abruptly. There are two phases to prevent problems arising because of local water conflicts. The first is developing an efficient local water conflict early warning service. The second is to prepare an implementation strategy for, and stakeholders' commitment to, making use of the recommendation. This section deals with the preparation of the early warning system. The flow chart in Figure 3-4 helps to justify and develop the local water conflict pre-identification, preparedness and early warning system variables based on the problem in Ethiopia and Afar region. In principle, system analysis and the design of the early warning framework for local water conflicts will be based on the general principles of the components of the studies that include: a feasibility study, a requirement analysis, the system design (physical and logical) and an implementation strategy that includes testing (unit test and general testing), which helps to avoid error. This process identifies the important need to study the early warning situations of local water conflicts.

3.4.2 Conceptual Framework for Local Water Conflict Pre-identification, Preparedness and Early Warning System

This section reviews, presents and justifies the process of the research frameworks and a conceptual model for local water conflict early warning systems. The input data, the process of data analysis and the output of the research are the core components of a local water conflict pre-identification and preparedness framework, also called a Framework Model, for a LWC Early Warning System. The design of the framework is displayed in Figure 3-5.

The conceptual understandings of the framework and its preventive actions are prepared based on the detailed analysis of the reviewed literature and knowledge gaps. The framework consists of three core parts:

- Data collection, variables definition, criteria and selection;
- The process of EWS that includes interpretation, analysis, evaluation, operating rules and regulations;

- The information parts that incorporate timely warning reports and prepare for taking preventive actions based on the warning.

3.5 Mapping the Key Research Variables

In this research, 10 core components of the parameters and over 116 research sub-variables were developed based on the concepts generated from the keywords of the research questions, objectives, knowledge gaps, the field visit of the study and the findings of the review. They were developed to incorporate the concepts of the framework of the research. The details of the flowchart are further explained in section 3.2 of the framework of the study.

The chart in Figure 3-6 indicates the hierarchical relationships among the variables, which are useful for developing the data collection questionnaires and analysis in order to have an integrated output for the study.

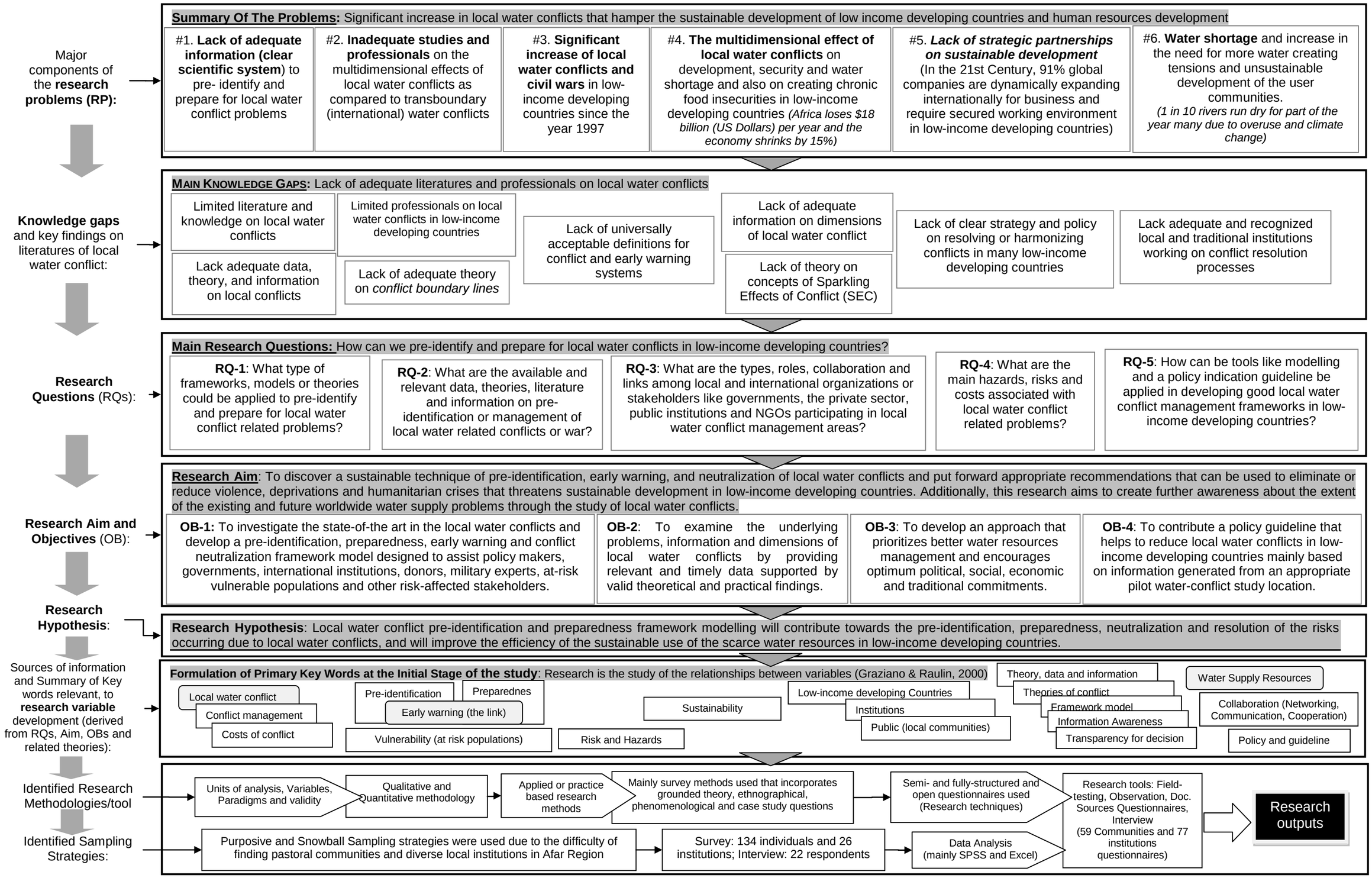


Figure 3-1: Framework of the study: The link between the research question and the knowledge gaps

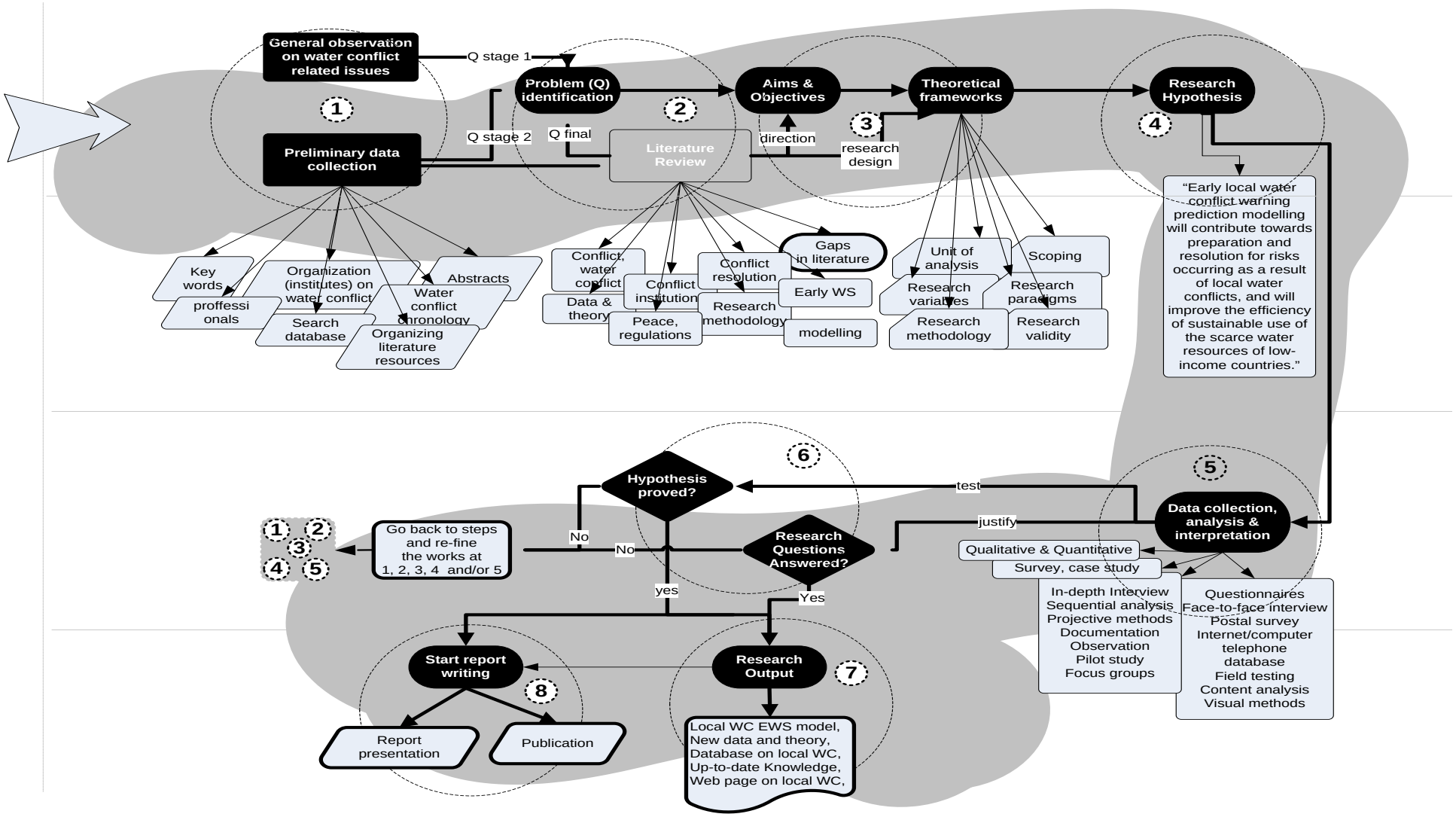


Figure 3-2: Conceptual framework of the implementation of the research design

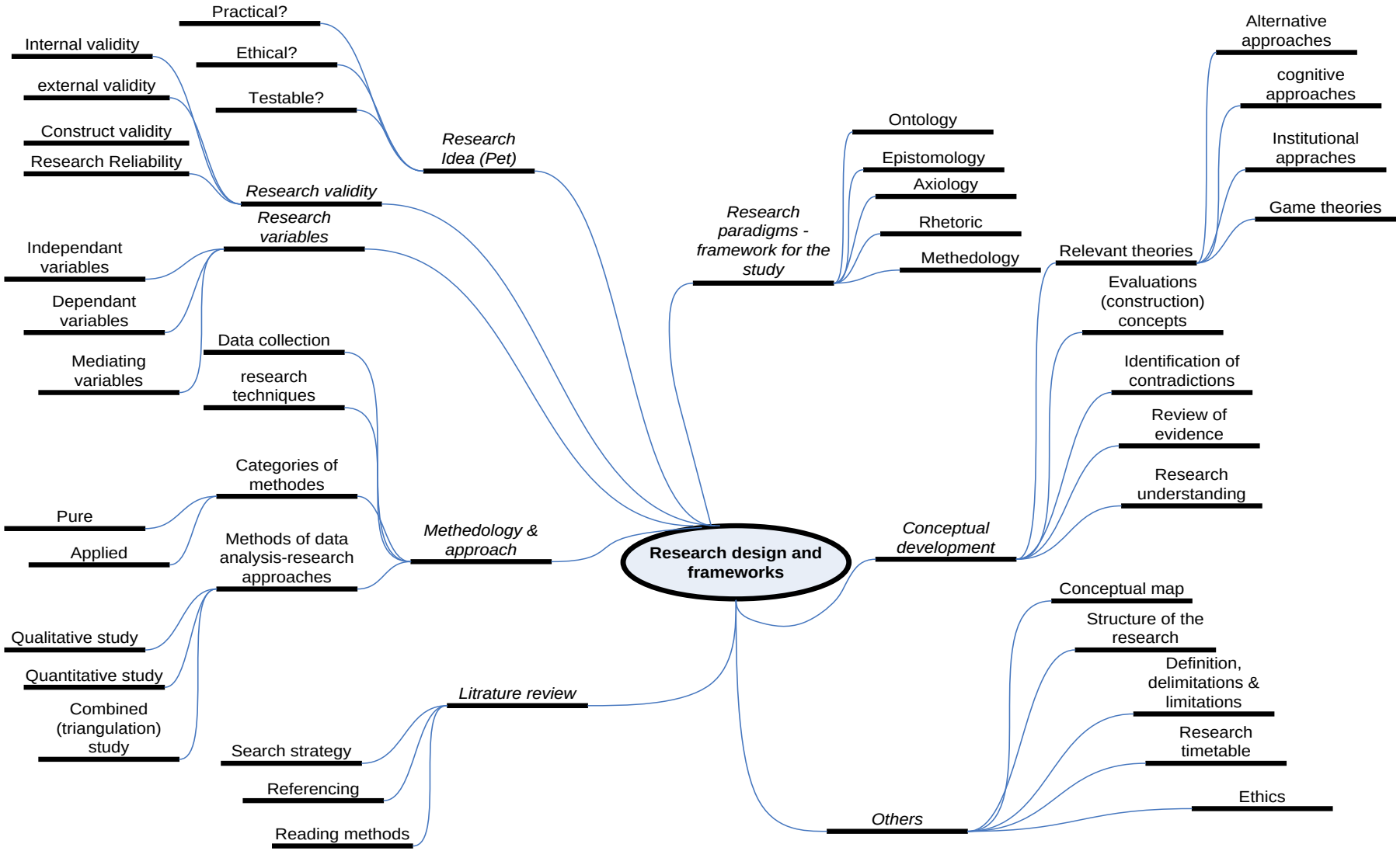


Figure 3-3: Key components of the research design and frameworks

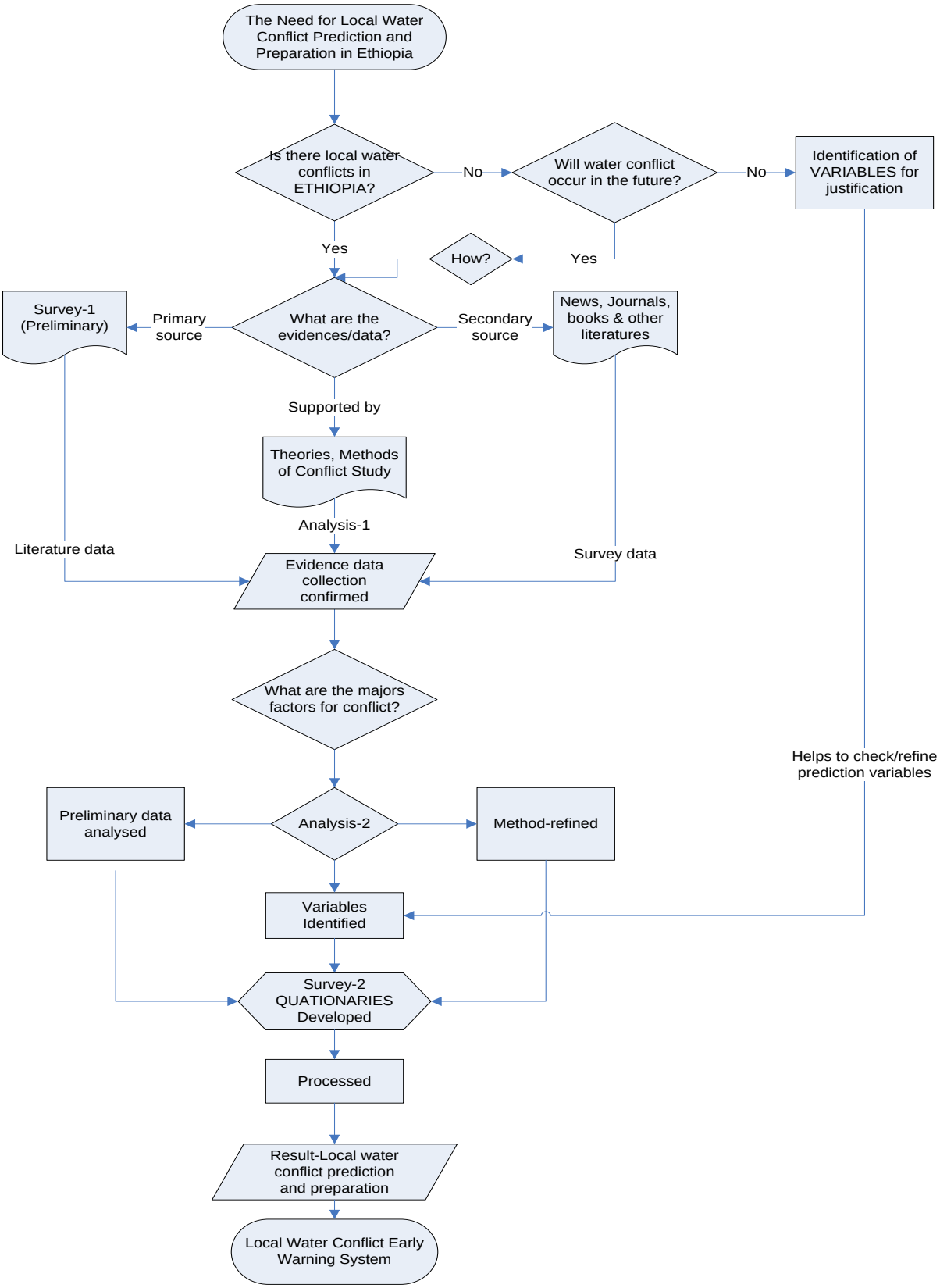


Figure 3-4: Pre- identification, preparedness and EWS for LWC problems in Ethiopia

Note: The flow chart additionally helps for searching availabilities of conflict situations (identification purposes)

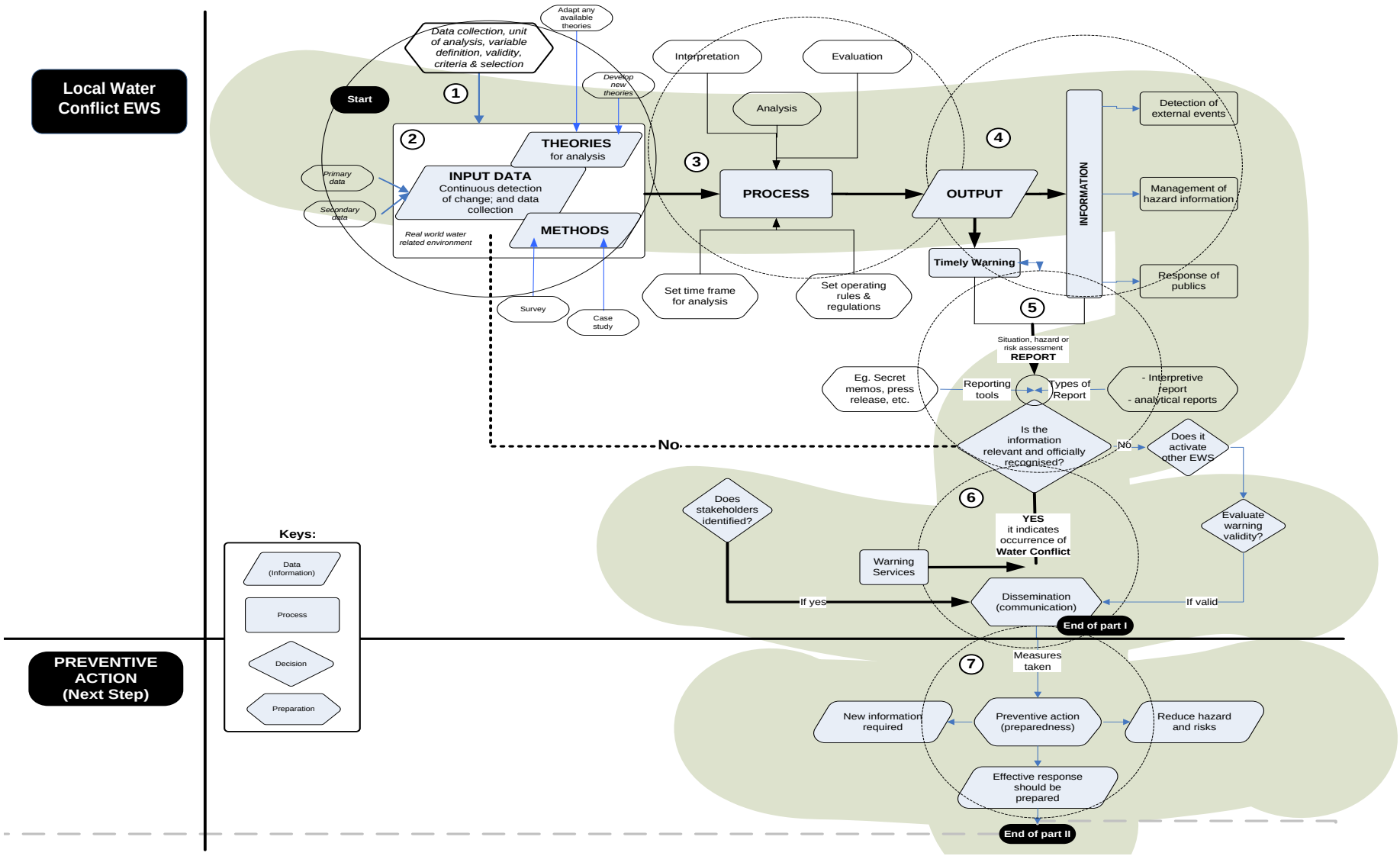


Figure 3-5: Local water conflict pre-identification, preparedness and early warning system conceptual framework (for operational purposes)

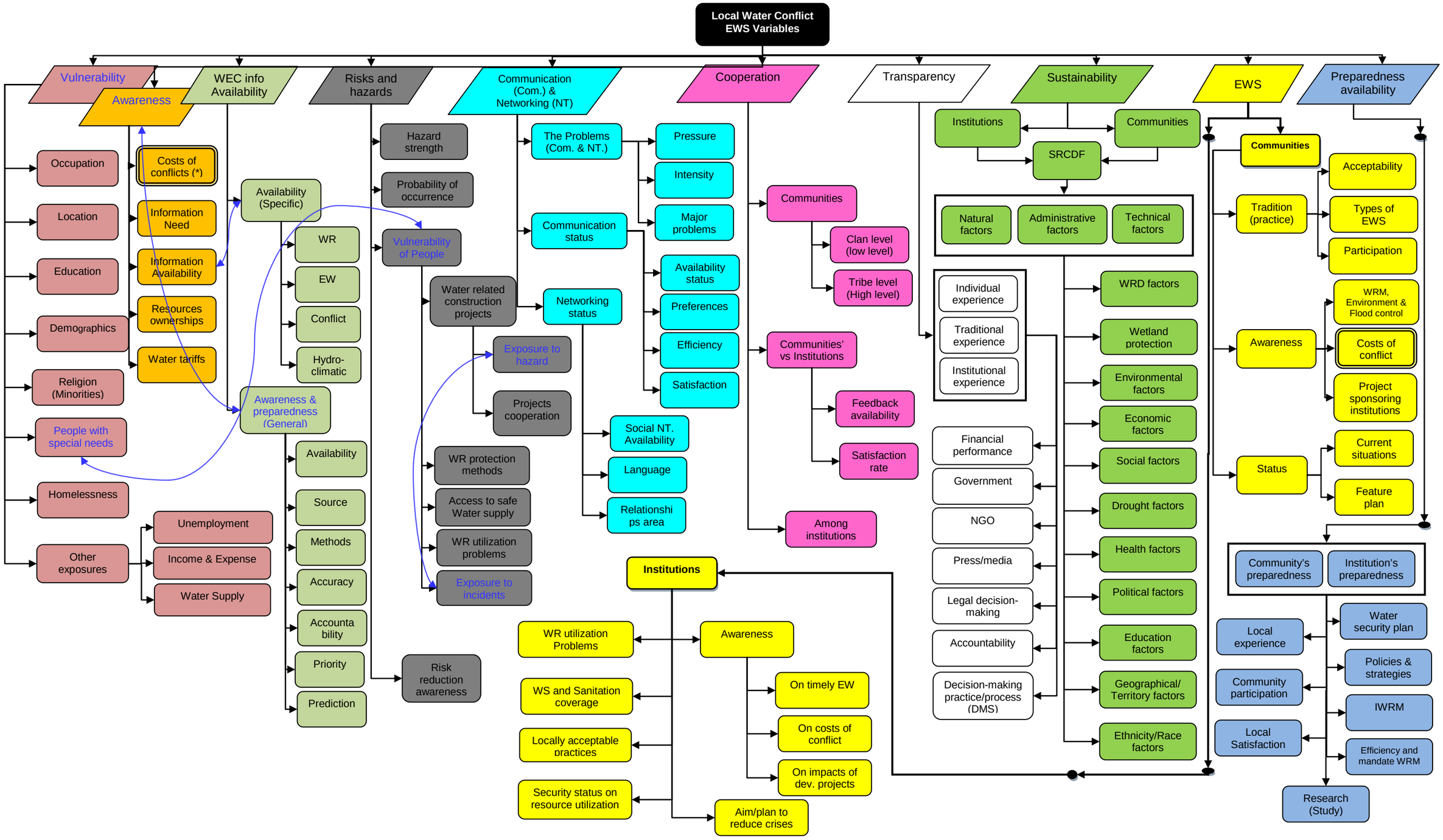


Figure 3-6: Mapping the local water conflict pre-identification, preparedness and EWS variables and flow charts

3.6 Chapter Summary

The central focus of the frameworks of the study and the conceptual frameworks indicated in this chapter are developed to answer the main research question, “How can we pre-identify and prepare for local water conflicts in low income developing countries?” It also provides an in-depth study aimed at understanding the complex areas of this research.

The frameworks include the link between the research questions and the knowledge gaps. It also shows the framework of the research study plan and the conceptual framework of a local water conflict early warning system. Finally, this chapter introduces the major flow chart and variables of the key elements of the WEC data collection and analysis.

Chapter Four
RESEARCH METHODOLOGY

"A land without a forest and a tribe without an elder have no protection"
(Afar's traditional proverb)

This chapter addresses two parts of the study: planning the research methodology and the process of data collection. Part one, provides and discusses the research methodology including the research paradigms, validity, variables, units of analysis, definitions and the limitations of the study. Part two, describes the process of data collection, preparation of the research questionnaires, data collection problems, a description of the population and sampling.

4.1 Introduction

Research design is a structured approach to data-collection that neatly and economically addresses the research question, answering the hypothesis or resolving the argument involved (Jankowicz, 2005). This chapter poses some key fundamental questions related to research design and frameworks and provides answers to such basic questions as, why do researchers need a research design, what are the conceptual understandings of research methods, can one undertake research on local water conflicts without designing the required method and which methods are useful for researching on the topic 'a multidimensional approach to local water conflicts'?

Basic understanding and the choice for appropriate research methods will adequately answer the above questions. Thus, Figure 4-1 shows some of the advantages of having suitable research methodologies.

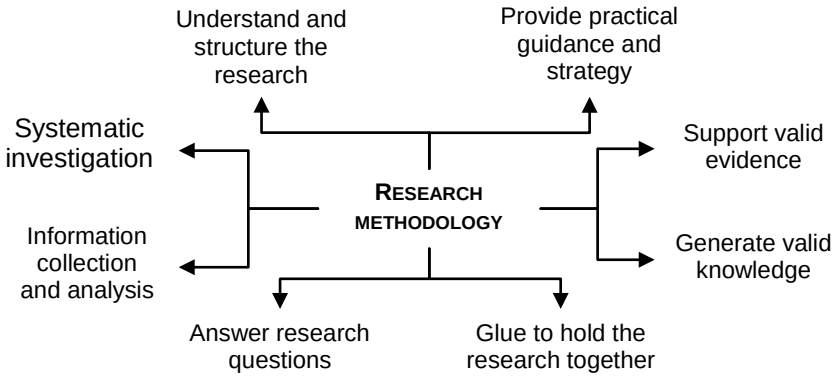


Figure 4-1: Purposes of research methodology

The research design of a study begins with the selection of a topic and a paradigm (Creswell, 1994). Moreover, Mitchell and Jolley (2007) stated that an awareness of research design helps us to understand psychology, read and evaluate research, be protected from quacks, be a better thinker, be "scientifically literate", increase marketability and finally to do one's own research.

Trochim (2006), a Professor in the Department of Policy Analysis and Management at Cornell University, states that research design provides the glue that holds the research project together. He continued his explanation, “research design is used to structure the research, to show how all of the major parts of the research project -- the samples or groups, measures, treatments or programmes and methods of assignment -- work together to try to address the central research questions”. Trochim further explains research design as follows:

> “Research design covers the entire research process including: formulating research questions; sampling (probability and non-probability); measurement (surveys, scaling, qualitative, unobtrusive); research design (experimental and quasi-experimental); data analysis; and writing the research paper. It also addresses the major theoretical and philosophical underpinnings of research, including the idea of validity in research; the reliability of measures and ethics”.

On designing a specific survey for local water conflict research, it is important to understand the concept put forward by Flower (1988) (cited by Creswell, 1994) who noted that a survey design provides a quantitative or numeric description of some fraction of the population - the sample - through the data collection process of asking questions of people.

In this chapter of the study, the core areas of the research design and framework are included and discussed. This covers the basic preliminary assumptions of the research, such as research validity, paradigms, variables and unit of analysis; the research methodology and research techniques and tools useful for the research on local water conflict pre-identification and preparedness. As a result, the researcher has prepared standard formats, checklists, procedures, detailed plans and data collection tools in order to perform effective surveys on local water conflict studies.

4.2 Research Design Initiators and Preliminary Tasks

This section introduces the preliminary basic elements of the primary components of the research design, namely: research validity, paradigms, units of analysis and variables used in the study, which are parts of the conceptual guideline of the research methodology in Figure 4-11.

4.2.1 Research Idea and Validity

4.2.1.1 Conceptual Understanding and Definition

In research terms, validity refers to the accuracy and truth of the data and findings that are produced; it refers to the concepts that are being investigated; the people or objects that are being studied; the methods by which data are collected and the findings that are produced (Morrison, 2000). Moreover, Wilkinson (2000) states that the validity of a research related to the extent that the measures achieved its aim. There are different types of indicators used for the measurement of research validity. In a separate section, the researcher has prepared a justification of the validity of this research. This is based on the explanation by Mitchell and Jolley (2004) that research ideas could be refined towards a practical, ethical and testable (PET) hypothesis. Furthermore, Mitchell and Jolley defined the following three concepts of

research validity: (1) Internal validity, (2) External validity, and (3) Construct validity. Yin (1994) defined 'Reliability' as a fourth validity test in case study research. The author of this report compares these four validity tests by using the 'egg diagram' shown in Figure 4-2 to show the integration of four validity variables of RICE (**R**eliability, **I**nternal validity, **C**onstruct validity and **E**xternal validity).

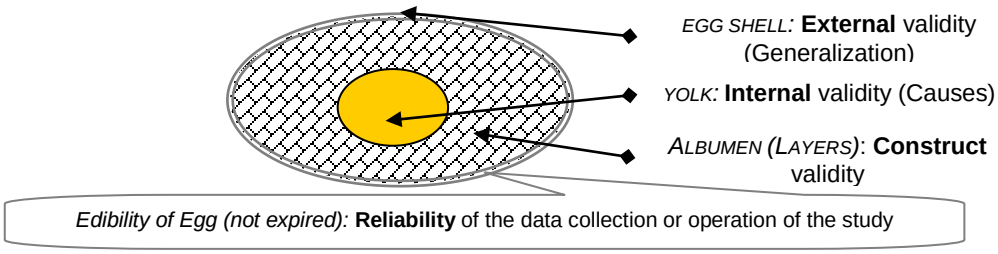


Figure 4-2: Concepts of research validity for LWC

A. Internal Validity

Internal validity deals with 'cause and effect' relationships. It refers to the extent to which changes in the dependent variable (the observed effects) can be attributed to the independent variable rather than to extraneous variables (Morrison, 2000). In this research, some of the processes of the validity test were based on variables used to identify the causes and effects of local water conflict on the population and environment such as the status of local water scarcity. In addition, the researcher has introduced local water conflict pre-identification and preparedness variables in order to measure the status of information that will bring positive changes of behaviour to the decision makers and the user community.

B. External validity

External validity deals with generalized results, which refer to people and places. It is an ability to generalize the results of this research to people and locations in others low-income developing countries. Morrison (2000) defines external validity as the degree to which the results of a study are generalisable beyond the immediate study sample and setting to other samples and settings.

C. Construct validity

Construct validity tends to focus on manipulations and measures; it is a psychological or a link dealing with the variables we think about; it refers to the degree to which a research instrument measures a theoretical concept (or construct) under investigation, Morrison (2000). The selection of a study area and the survey questionnaires were carefully prepared, analysed and integrated in such a way that they could bring the awareness, motivation, and skill development that play a significant role in bringing about behavioural changes in the local water conflict research field. The author has integrated the content and variables of the research to achieve maximum standards.

D. Reliability

The goal of reliability is to minimize the errors and biases in a study (Yin, 1994). Moreover, he further explains the need for documentation and development of the case study database so

that an auditor could repeat the procedures and arrive at the same results. Hence, all analysis and activities performed under this research will be documented sequentially and chronologically; a separate section of the report will be prepared for this task.

4.2.1.2 Approaches to the Validity of the Local Water Conflict Research

The validity of the research idea will be tested and refined using two methods. The first general approach was the PET approach developed by Mitchell and Jolley (2004). The second specific validity test (abbreviated as RICE) will also follow the approach of internal validity, external validity; construct validity and reliability, designed by both Mitchell and Jolley (2004) and Yin (1994). The compatibilities and variations of the two approaches in the context of this research are evaluated in Figures 4-3 and 4-4.

Figure 4-3: LWC research validity test using the PET hypothesis (General Option-1)

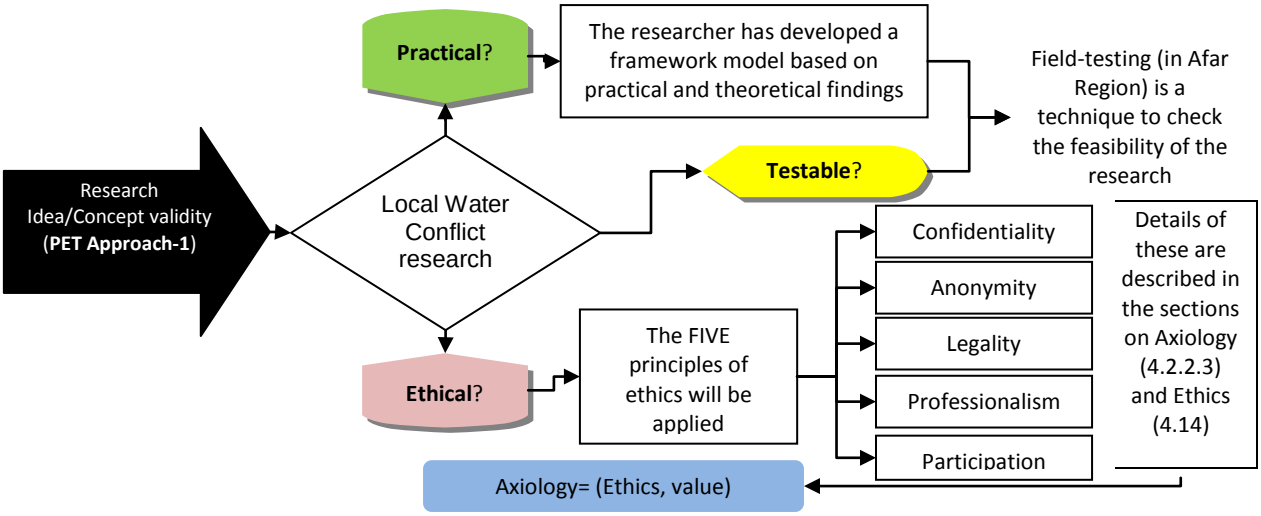
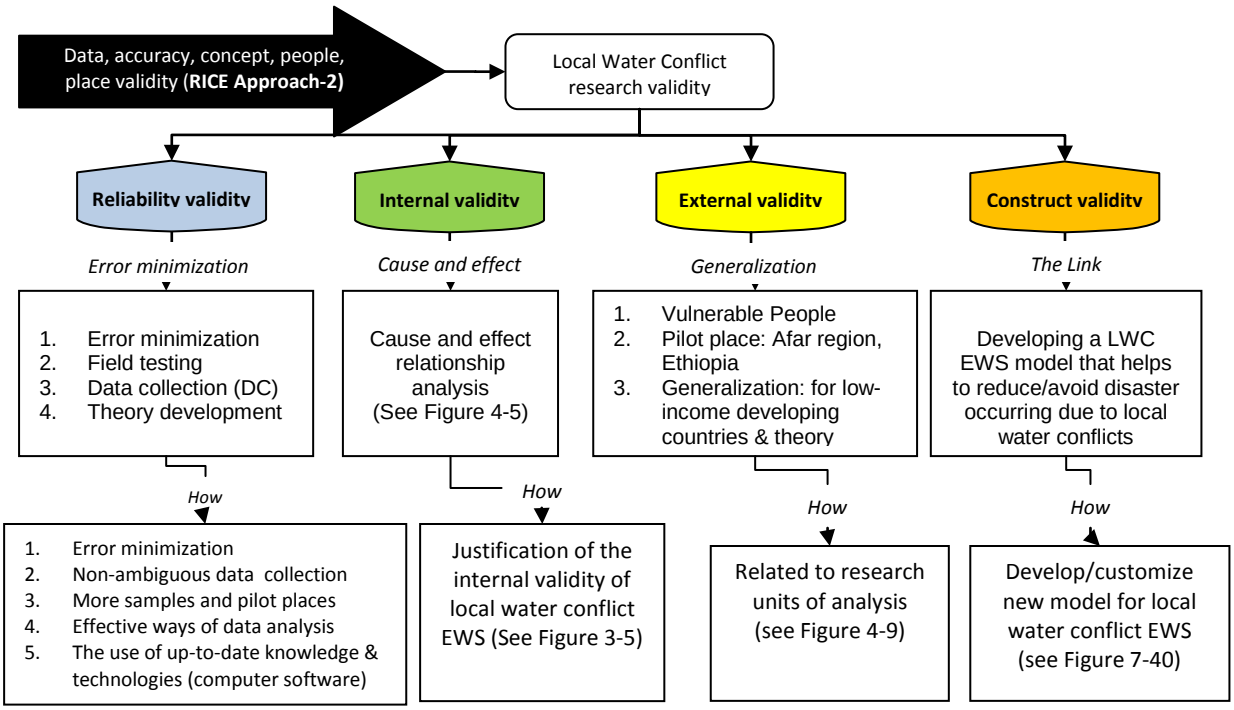


Figure 4-4: LWC research validity test based on the RICE approach (Specific Option- 2)



The above flow chart in Figure 4-4 indicates an option for the general approaches to a local water-conflict, EWS, research idea validity test based on the PET hypothesis. It is broader than the PET validity test as it incorporates overall data collection error minimization, accuracy, research idea, people and location validity tests. Figure 4-5 shows some of the techniques used for the justification of the internal validity of the study based on causes and effects of the core problem of local water conflicts in low-income developing countries. Some of the outputs of this analysis were used for the identification of the research variables.

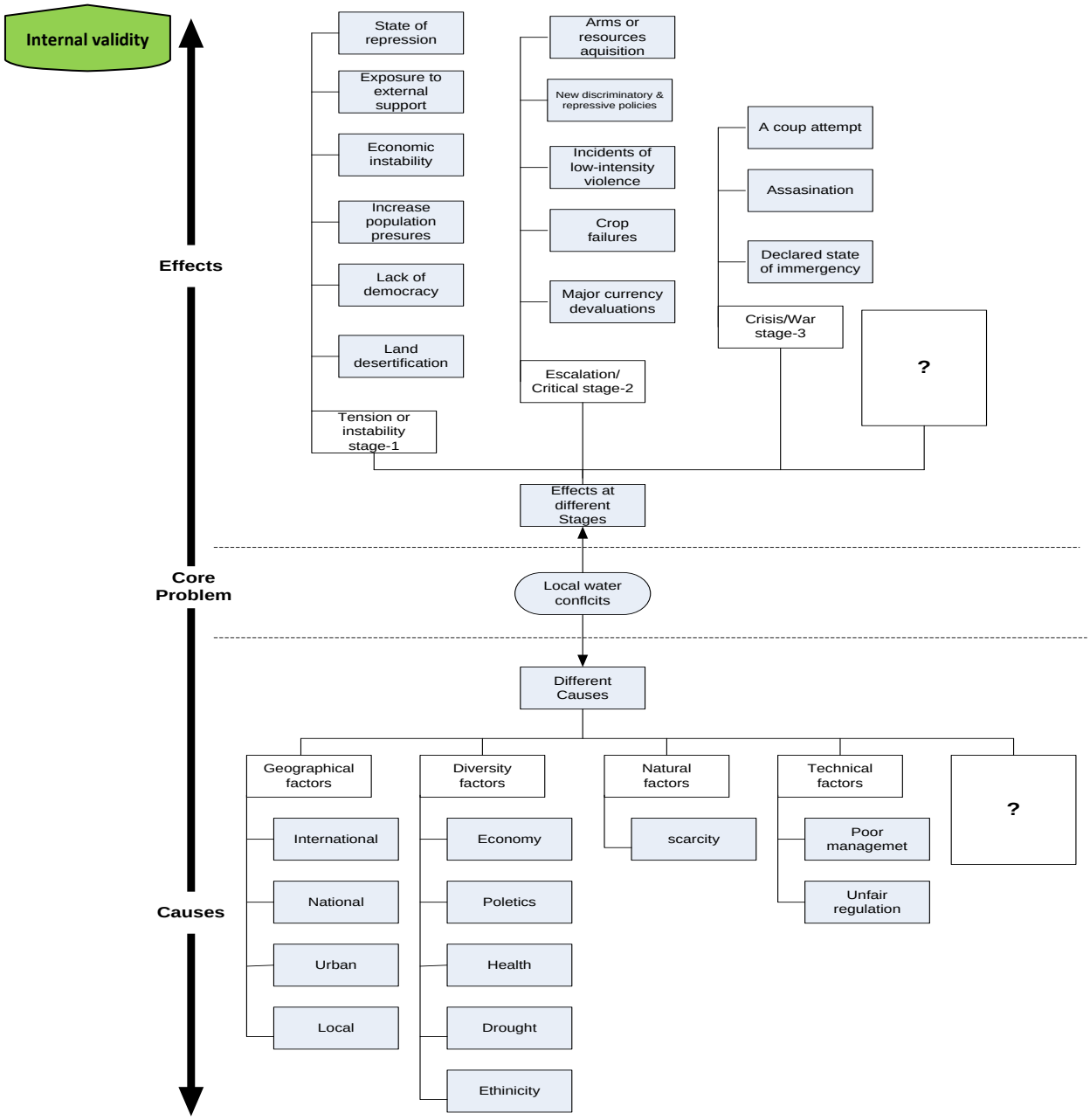


Figure 4-5: Internal justification of the research validity on local water conflicts

4.2.2 Research Paradigms

This section deals with the concepts of research paradigms, which is a key factor in strengthening the frameworks of the study of local water conflicts. Creswell (1994), in his study

of research design, illustrated that understanding the research paradigms will provide the direction for designing all phases of a research study. In addition, he displayed the five major qualitative and quantitative components of the research paradigms such as the ontological, epistemological, axiological, rhetorical and methodological approaches. This study has been conducted by including the indicated paradigms in the research methodology. Figure 4-6 shows a description of the research paradigms adapted from Creswell (1994).

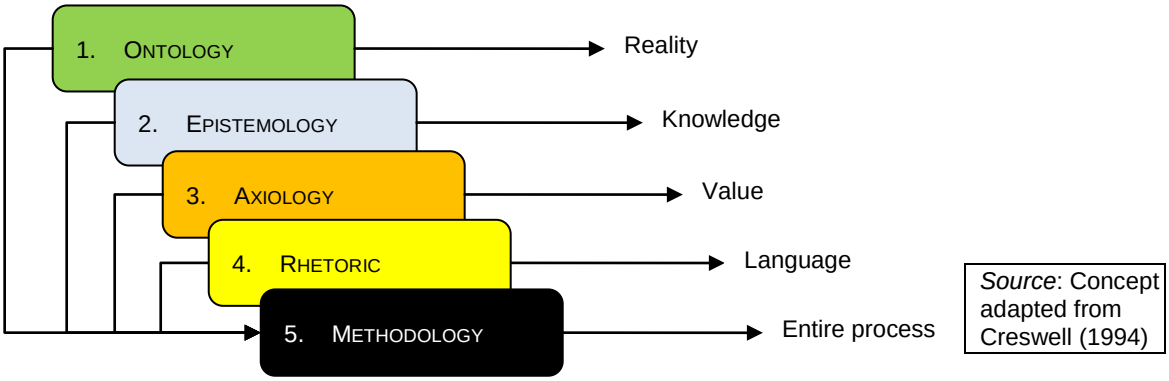


Figure 4-6: Description of research paradigms

4.2.2.1 Ontology Stage (Reality)

Ontology is the primary task in the research paradigms. Ontological issues deal with a reality independent of the researcher (Creswell, 1994). Ontology is an explicit specification of a conceptualisation (Gruber, 1993). Gruber further explained that the term is borrowed from philosophy, where ontology is a systematic account of Existence; for knowledge-based systems, what "exists" is exactly that which can be represented. In this regard, it justified the existence of water conflicts and the facts related to the problem. Moreover, parameters will be developed to validate the reality of the research. The next table validates the ontology stage of the research paradigms.

Table 4-1: Relating the ontology parts of the research paradigms

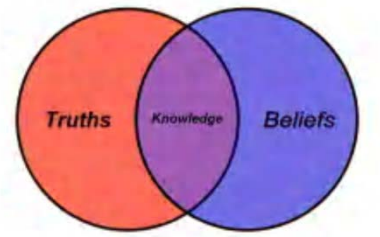
Ontological approaches	Work done and remarks on applicability
Existing facts or realities about the existence of local water conflicts (e.g. Facts/realities about conflict and its environment, how conflict occurs, water conflict chronology and analysis that have occurred up to now, facts about local and international water conflicts, how people react towards conflicts, etc.)	**Fact**: Availability of local water conflicts was proved during the lifetime of the research through: • Collecting and analysis of a list of water conflict chronologies from literature and through surveys at a local level. • Collecting list of organizations, professionals working on water conflict. • Collecting verbal information in the form of quotations related to water. • Collections of conference and news headlines on local water conflict. • Collection of a list of activities on-going in related areas of other institutions **Notes**: information made available within the background information (Chapter 1), literature review (Chapter-2) and data analysis (Chapter5)

4.2.2.2 Epistemology Stage (Knowledge)

A. Conceptual Understanding

Following the ontology, this is the second stage of any research paradigm. Epistemology or the theory of knowledge is the branch of philosophy that studies the nature and scope of

knowledge and belief, including its sources and validation (Kelley, 1996). Epistemology is the study of knowledge and how it is acquired (Druckman, 2005:5). Creswell pointed out that epistemological questions in the qualitative and quantitative approaches are not the same. According to Creswell, when adopting a qualitative stance the researcher should interact and collaborate with the study, whereas, in a quantitative epistemological approach the researcher should remain distant and independent of that being researched. According to Plato, "knowledge is a subset of that which is both true and believed". Hence, in order to search out the knowledge about a local water conflict early warning system an in-depth investigation was undertaken to find out the facts related to local water conflict problems. Throughout, this includes the study of local and traditional beliefs on water utilization of the communities in low-income developing countries.



(*Source*: Plato)

Figure 4-7: Relationship between knowledge, truth and beliefs

In general, Kelley states that epistemology is concerned with the basic relationship between man's mind and reality, together with the basic operations of human reason. Based on the epistemological stage of the research paradigms, the researcher has investigated the existing theories and models useful for studying local water conflict early warning research described in Table 4-2.

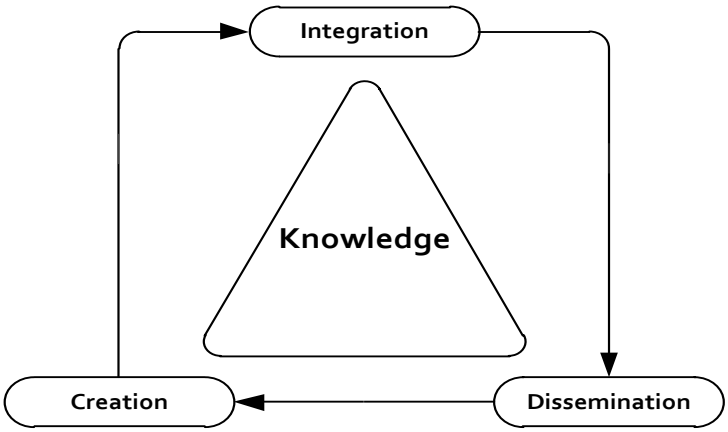
Table 4-2: Relating the epistemology parts of the research paradigms

Work done	Remarks on applicability
Epistemological Approaches: Theory of knowledge, beliefs, relationships and validity (e.g. knowledge about water conflicts, some of the conflict resolution systems and concepts, conflict theory and validity, etc.)	
1) **Available theories/knowledge for conflict analysis:**	
- Equilibrium theory: cyclical process.	- Not applicable.
- Utility theory: calculating actors who move through actions.	- Partially applicable to know the reactions of the actors in conflict through game theory techniques.
- Consistency theory: Emphasises on reducing tensions between competing cognitions.	- Partially applicable.
- Cultural theory.	- Partially applicable to sort out cultural factors that drive local water conflict.
- Psychological theory.	- Partially applicable.
2) Approaches to conflict studies:	
- Game theory.	- Applicable.
- Institutional theory.	- Applicable.
- Cognitive theory.	- Applicable.
3) Models for early warning systems:	
- Correlation models.	- Applicable for interstate conflicts. However, can be partially applicable to local conflicts too.

Work done	Remarks on applicability
- Sequential models.	- Applicable.
- Conjunctural models.	- Partially applicable.
- The approaches of meta-models (conceptual, mathematical, visualization, statistical and physical).	- Applicable to analyse conflicts from different point of view and to compare it with the existing reality.
4) Model of conflict management:	
- Whetten's (1996) conflict management model (see Figure 2-21 at page 57).	- It is not applicable for LWC EWS. It is useful for the next preventative stage.
- Pool *et al*.'s (1991) technology-based models having three structures (input, conflict interaction process and output).	- The general structures can be useful.
- Integrated conflict-management process.	- Applicable for conflict preventive stages only, not for local conflict EWS.
5) Lack of standard definitions (ambiguities):	
- Conflict.	- Requires new definition.
- Conflict early warning systems.	- Requires new definition in LWC context.
6) **Knowledge gaps on local water conflict EWS:**	
- There is no specific theory on local-level water conflict EWS.	- Requires new theories.
- Lack of local-water-conflict-related literature, theory, data and information in general.	- Requires survey and case studies for more information.
- Boundaries of conflict.	- Requires further analysis.
- Lack of institutions and professionals.	- Requires further survey and recommendations.
- Strategy and policy.	- Requires a guideline and further recommendations.

B. Knowledge Management

Knowledge management is part of epistemological research paradigms and it helps to analyse the reality, validity and relationship of the research topic with other facts or concepts. In low-income developing countries, knowledge of a local water management sector is a combination of natural or scientific facts and the traditional beliefs of the user community. Hence, any conflict arising because of a water resource should be resolved by incorporating such traditional experiences and modern concepts of water. Fischer and Ostwald (2001) stated that knowledge management is a cyclic process involving three related activities: creation, integration and dissemination, as seen in Figure 4-8 below.



Source: Fischer and Ostwald (2001)

Figure 4-8: Knowledge management as a cyclic process

All relevant theoretical and practical knowledge with respect to local water conflict pre-identification, early warning and preparedness is addressed and included in the study based on the following three factors:

- new concepts related to local water conflict,
- integration of this idea with the existing reality, and
- dissemination of new knowledge.

4.2.2.3 Axiology Stage (Value)

By considering the role of axiological issues in a study, the researcher should minimize the distance between him/her and those being researched, (Creswell, 1994). Creswell explained that the term 'axiology' comes from the Greek word '*axia'* meaning value, worth; it is the study of value or quality; it is often thought to include ethics and aesthetics. In addition, it was mentioned that the term was used in the 19th and early 20th centuries, but in recent decades, value theory has tended to replace it in discussions of the nature of 'value' or 'goodness' in general.

The axiological paradigms of this study include the value and ethical components of the local water conflict early warning system research. Moreover, they deal with the value of the research and its acceptability. The ethical components of Axiology will be explained further in section 4.14 of the ethical parts of the study. As parts of axiology, the researcher has investigated the preliminary advantages and disadvantages of the research with the axiological value comparisons being displayed in Table 4-3. In terms of cost, the value of the output of this research can be measured based on the disasters arising as a result of conflict in low-income developing countries. The concept of value theory can be explained in different ways. In this case, the good and bad values of this research are compared in the following table.

Table 4-3: Comparing the value components of the axiology in local water conflict EWS

Axiological Approaches and Stages	
Positive (Good)	**Negative (Risks)**
The axiological parts of the research paradigm were used to identify the aim and objectives of the research. Furthermore:	
• They were used for collection, analysis, communication and the provision of timely and effective transparent information about hazards and risks that affect people.	• Up-to-date data collection could be the most difficult and expensive parts of the work.
• They help to provide relevant evidence and conclusions to policy-makers to enable them to make strategic choices. • Similar to the behaviour of other warning systems, this warning system may indicate other unexpected types of warning systems. • The implementation of this research in conflict-prone areas will help to neutralize conflicts.	• Some people or politicians may use these warning systems for their own or other purposes that deviate from the main objectives of the research.

4.2.2.4 Rhetoric Stage (Language)

Rhetoric is generally understood to be the art or technique of persuasion through the use of spoken and written language; it is the language of research (Creswell, 1994). Moreover, Creswell further explains as follows:

> "When a quantitative researcher writes a study, the language should be not only impersonal and formal but also based on accepted words such as variables like *relationships, comparison*, and *within-group*. Concepts and variables are well defined from accepted definitions. This orientation marks a quantitative study. Different words mark a qualitative study. Such words as *understanding, discover,* and *meaning* formed the glossary of emerging qualitative terms. Moreover, the language of qualitative studies becomes personal, informal, and based on definitions that evolved during a study".

Table 4-4: Examples of the researcher's rhetoric stage

Rhetoric stage/approaches	
Work done	**Remarks on applicability**
Quality of language (e.g. Increase its readability and follow the quantitative and qualitative writing methods, improving English language)	The researcher has been taking professional development and English language courses to increase the quality of the research paper in addition to reading related books.

4.2.3 Unit of Analysis

4.2.3.1 Conceptual Understanding

The unit of analysis is an integral part of the research design and is dictated by research questions (Swekaran, 2003). Swekaran believes that 'unit of analysis' refers to the level of aggregation of the data collected during the subsequent data analysis stage. As a general guide, the definition of the unit of analysis is related to the way the initial research questions have been defined (Yin, 1994). The unit of analysis is the major entity that is being analysed in the study (Trochim, 2006) and it is used in direct reference to the 'what' or 'whom' that is being studied. Trochim (2006) and Swekaran (2003) forwarded some examples of units of analysis in research projects such as individuals, groups, artefacts (books, photos, newspapers), geographical units (town, census tract, state) and social interactions (dyadic relations, divorces, arrests). Nevertheless, Swekaran, believes that the data collection and sampling processes become more cumbersome at higher levels of units of analysis (industry, country) than at the lower levels (individuals and dyads). In conclusion, units of analysis indicates the level at which the study is being conducted.

Table 4-5: Examples of unit of analysis

	Description (based on related examples)	Unit of analysis	Remarks
1)	If, for instance, the problem statement focuses on how to raise the motivational levels of employees in general, then we are interested in individual employees in the organization and would have to find out what we can do to raise their motivation.	Individual	Low level
2)	If the researcher is interested in studying two-person interactions, then several two-person groups can serve as a unit of analysis. e.g. analysis of husband-wife interactions.	Dyads	Low level

	Description (based on related examples)	Unit of analysis	Remarks
3)	If the problem statement is related to group effectiveness, we may gather relevant individual data from different groups and aggregate into group data to see the difference.	Groups	Medium level
4)	For instance, to compare profits made by different business divisions across various geographical areas.	Divisions	Medium level
5)	If the researcher wants to see the proportion of a workforce employed by different industries such as healthcare, utilities, transportation, and so on.	Industry	High level
6)	If the researcher wants to compare profits made during the last 5 years by multinational corporation subsidiaries found in different countries.	Countries	High level

Source: Concept adapted from Swekaran (2003; p132)

Based on the above concepts and the research statements and research questions of this study, the researcher has discussed and identified the units of analysis for a local water conflict EW system, as explained in the next section.

4.2.3.2 Units of Analysis for Local Water Conflict Early Warning System

In a general context, the findings for the units of analysis for this research include objects, individuals, groups, organizations, social interactions and geographical locations together with artefacts that are useful for predicting and preparing for local water conflicts in low-income developing countries (see Tables 4-6 and 4-7 below). The research question “how can we pre-identify and prepare for local water conflicts in low income developing countries?” has been used as a basis for identifying these units of analysis. Another approach for the preparation of the units was based on the identification of the conceptual and physical entities of the research issues, such as, ‘what’ or ‘whom’ is being studied.

Table 4-6: Summary of local water conflict EWS unit of analysis

Research issues	Question types	Unit of analysis	Remark
1) What is studied?	What?	Local water conflict	Conceptual entity
2) Who is involved in the study?	Whom?	Objects (water supply resources), Geographical locations, Organizations/institutions, Groups (local communities), Individuals, Social interactions, Local and traditional Artefacts	Physical entity

Among the details of the units of analysis indicated in the table, the researcher has mainly focused on local water conflict (objects/concepts), vulnerable local communities (groups), local institutions, and the Afar region of the Awash River Basin. The researcher has studied and presented some of the other units of analysis partially or in combination with other major units of analysis due to the complex nature of this research area.

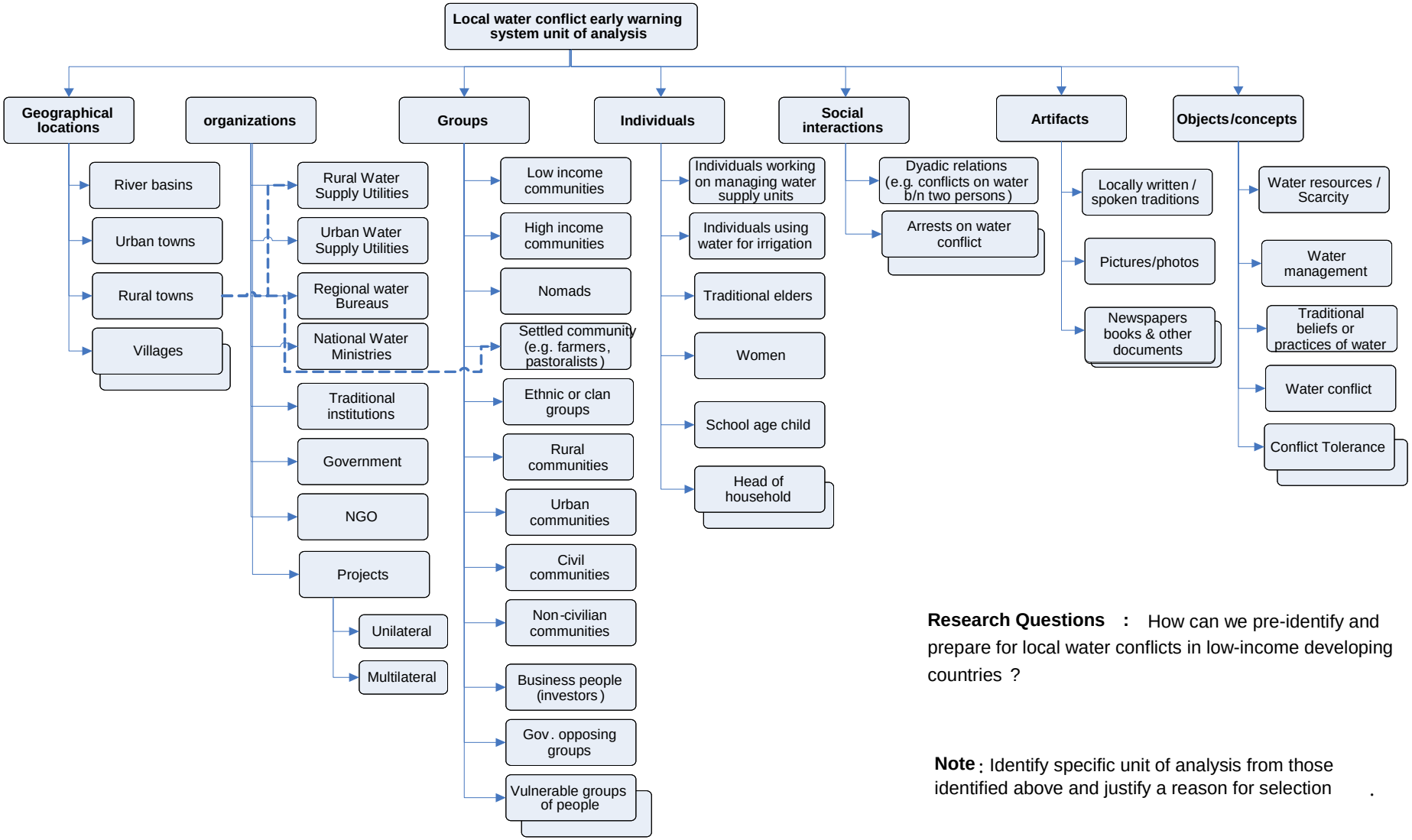


Figure 4-9: The process map for the identification of lists/anatomy of the units of analysis for a local water conflict EWS

Table 4-7: Categories of unit of data collection and analysis

Major Categories (Input) [Variable Category-A]	Sub Categories [Variable Sub-Category-B]
A. Water, conflict and EWS	
Water resources status (Awash Basin)	Quantity/Scarcity Quality/Pollution Accessibility Management
Conflict status (Awash Basin)	Socio-economic Diversity Factors (SEDF) Vulnerability Satisfaction rate/status Disagreement and dispute level Change in behaviour (social and individual) Tradition-Conflict
Early warning status (Awash Basin).	Local EW identification method Local EW practices and status
B. Stakeholders: Local communities and institutions	
Institutions status (working on water, conflict and other related activities in the Awash River Basin)	Traditional institutions Water Sector Institutions Pollution-control-related institutions EW and Disaster prevention institutions Construction institutions Conflict management institutions Impacts of institutions Policy, regulation, planning or strategy related activity Status of research works
Local communities	Pastoralists Farmers Students NGO and Government employees Private Other vulnerable people

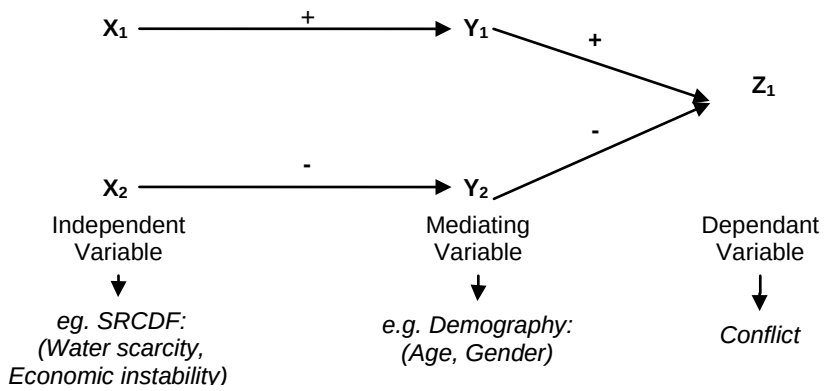
4.2.4 Research Variables

4.2.4.1 Concepts of research variables

At this stage, it is vital to identify the research variables for the study. Variables are highly related with indicators that can be applied in modelling effective management strategies. Research is the study of the relationship between variables and hence there must be at least two variables in a research study (Graziano and Raulin, 2000). A variable is defined as a discrete phenomenon that can be measured or observed in two or more categories (Kerlinger, 1997; Creswell, 1994).

Another definition is that a research variable is any characteristic that can take on more than one value such as speed, level of hostility, accuracy of feedback and reaction time (Graziano and Raulin, 2000). The study shows that a variable in research will be indicated by several scales of measurements such as nominal numbers, ordinal numbers, interval scales and ratio scales. Creswell (1994) describes and illustrates the three types of variables in social sciences with their relationships as mentioned below:

- Independent variables cause, influence or affect outcomes. They are also known as the predictor variables (Sekaran, 2003).
- Dependent variables are dependants on the independent variables; they are the outcomes or results of the influence of the independent variables. They are also known as the criterion variables (Sekaran, 2003).
- Intervening variables (also called moderator or nuisance or extraneous or mediating variables) intervene between the independent and dependant variables; these variables are statistically controlled in analysis; often these variables are demographic items, such as gender, age, income and class size (Sekaran, 2003).



Source: Concept adapted from Creswell (1994: 86)

Figure 4-10: Examples of independent, dependent and mediating variables

4.2.4.2 Research Variables for Local Water Conflict EWS

In the above, *§4.2.4,* the conceptual understanding of the need for research variables is discussed in detail. The main factor that should be considered during the process of the local water conflict pre-identification and preparedness framework modelling design study are the identification of valid variables and theories for analysis. Categories and variables listed under Appendix E were analysed, validated, prioritised and grouped for designing survey questionnaires and data analysis frameworks. The flowchart of local water conflict research variables is displayed in detail in Chapter 3, the framework of the study.

Research variables show the properties of those units of analysis that are going to be studied. This section defines and justifies the identified variables for local water conflict early warning systems. The existing relationships between dependent, independent and mediating variables of the research were also adapted. The researcher has identified the ten key variables useful to collect information that helps to develop the frameworks for local water conflicts studies. The research questionnaires were designed in a way that indicates the time when serious situations occurred: the past, the current and future situations. Moreover, the key categories of variables listed below were developed based on the basic concepts, definitions and main criteria of early warning systems discussed in Chapter 2 - the literature review - and Chapter 3 (§3.4) - the framework of the study. These are:

- Collection, analysis and communication of relevant and effective information,
- Identification of institutions that helps to take actions in reducing risks,
- Identification of individuals exposed to hazards,
- Identification of actions taken to provide or reduce risks,
- Identification of effective responses towards local water conflicts,
- Identification of conclusions to policy-makers to make strategic choices,
- Consideration of timely warning,
- The aim that helps to eliminate or reduce violence and human crises,
- Contribution to sustainable development, and
- The issue of transparency.

4.3 Research Methodology and Approach

Methodology is the entire process of a study (Creswell, 1994). Moreover, he further explained that in a quantitative methodology, concepts, variables and hypotheses are chosen before the study begins and remain fixed throughout the study, whilst in qualitative methodology, inductive logic prevails. Methodology is defined in Webster's dictionary as a particular procedure or set of procedures. It is "the analysis of the principles of methods, rules and postulates employed by a discipline" or "the development of methods, to be applied within a discipline". It was described that methodology includes the following concepts as they relate to a particular discipline or field of inquiry: a collection of theories, concepts or ideas; a comparative study of different approaches; and a critique of the individual methods.

In methodology, "the power of a method is inversely proportional to the generality of the method - i.e. the more specific the method, the more powerful - without method, we are left with chance; chance is the opposite of method and we would have a much disorganized world without methods and techniques", (Edmund, 2006). Research Methodology is not a grand substitute for a method, it is the analysis of, and rationale for, the particular method or methods used in a given study and in that type of study in general (Jankowicz, 2005). Creswell (1994) classified research methodology into two broad types: experimental and survey researches for the quantitative method; and ethnographies, grounded theory, case studies and phenomenological studies for the qualitative method.

The research has been primarily qualitative in nature, drawing on documentary and interview data and case study 'participant observation', both online and at specific sites and events (Plows, 2005). Due to the complex nature of local water conflicts, multiple research methods have been adopted in order to identify appropriate conflict data supported by relevant conflict theories. A separate local water conflict early warning system research protocol was prepared that includes operational definitions, type of study and general design, sample selection and size, and unit of analysis. Survey methods, root cause studies and grounded theory are the

main types of research method selected within the main qualitative and quantitative approaches of the research process.

4.3.1 Qualitative Approach

A qualitative study is defined as an enquiry process for understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants and conducted in a natural setting (Creswell, 1994). Similarly, views and some theories on water conflict can represent qualitative data. According to Wilkinson (2000), qualitative data is usually analysed by subjecting it to some form of coding process. Many literature support methods or approaches like a case study, politics and ethics, participatory inquiry, interviewing, participant observation, visual methods and interpretive analysis fall within the category of qualitative research methods (Denzin and Lincoln, 2005).

4.3.2 Quantitative Approach

A quantitative study is an inquiry into a social or human problem, based on testing a theory composed of variables, measures with numbers and analysed using statistical procedures, in order to determine whether the predictive generalizations of the theory hold true (Creswell, 1994). The number of water conflicts and their trends occurring at local and international levels are an example of quantitative data. The analysis of these data types involves manipulating them in some way and/or applying some form of statistical test (Wilkinson, 2000).

4.3.3 Combined Approaches

Triangulation refers to the use of more than one technique. Combined or triangulation approaches are a combination of both qualitative and quantitative methodologies in the study of the same phenomenon (Wilkinson, 2000). Triangulation has been generally considered a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation (Denzin and Lincoln, 2005); they pointed out that triangulation also helps to identify different realities.

In the next section, the flow chart and integration of major components of the methodology will be further introduced in Figure 4-11. This concept of an integrated map indicates the major hierarchical relationships of components of the research methodology. The type of components used or considered as important for this research are marked in the flow chart.

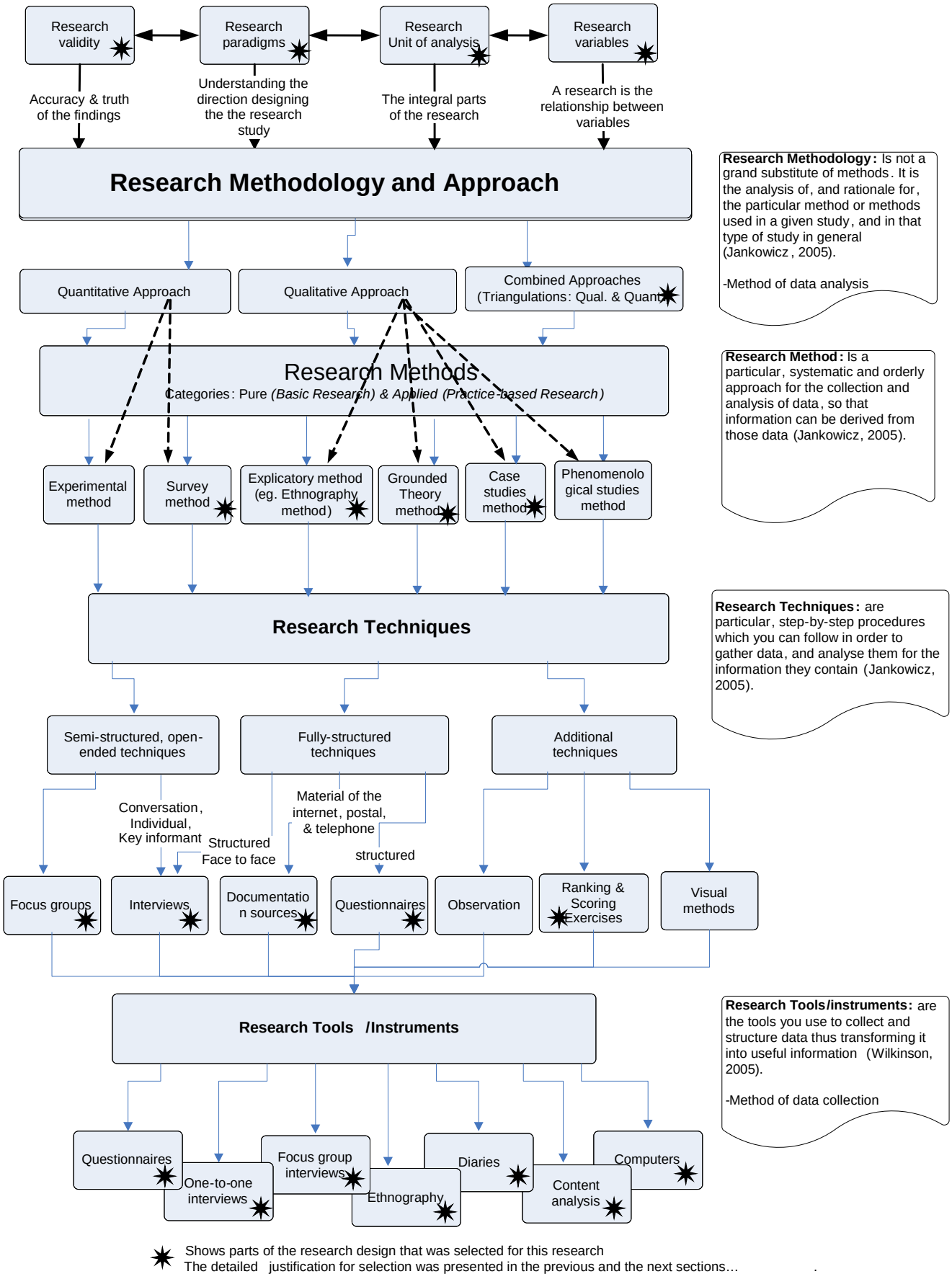


Figure 4-11: Conceptual guideline for designing research methodology

4.4 Categories of Research Methods

A research method is a particular, systematic and orderly approach for the collection and analysis of data, so that information can be derived from those data (Jankowicz, 2005). Research methods are ways of getting and analysing research data or meta-data. This section explains the categories and provides selected examples of research methods. Furlong and Oancea, (2005) explained the relationship of research and the real world in the following way:

> "Traditionally, it has been assumed that there is a clear distinction between the worlds of research and the worlds of policy and practice – that there are 'two communities'. On the one hand, there is the world of research, based on explicit, systematic work aimed at the growth of theoretical knowledge. Practice and policy on the other hand are seen as taking place in the 'real world', a world based on different forms of knowledge – for example on tacit knowledge and on practical wisdom. However, over the last 20 years there has been a growing recognition of the need for tighter links between research, practice and policy".

In general, there are many types of research. However, most scholars classify research methods as either basic or pure research or as applied or practice-based research. In some cases, the researchers apply both methods in the same research activities. In the next section, the researcher has given short definitions of both methods.

4.4.1 Pure Research (Basic or Fundamental Research)

Wagner, K.V. (2007) defines this as a study and research on pure science that is meant to increase our scientific knowledge base. Moreover, she further explains, this type of research is often purely theoretical with the intent of increasing our understanding of certain phenomena or behaviours but without seeking to solve or treat these problems.

4.4.2 Applied Research (Practice-based Research)

Applied or practice-based research is defined as an 'original investigation undertaken in order to acquire new knowledge, directed towards a specific practical aim or objective' (Furlong and Oancea, 2005). Such research is used to resolve practical problems in the real world. Most researchers believe that the goal of the applied scientist is to improve the human condition. There is a relationship between pure and applied researches. Pure research generates new ideas and applied research takes these ideas to create new inventions.

4.5 Further Reviews of Research Methods

Conflict contains complex causal links with our daily, real-life practices. Due to the complex nature of water conflicts, research shows that there is no standard or fully-fledged research method suitable for studying and predicting the root causes of local water conflicts.

The researcher has reviewed the approaches of root-cause studies: survey methods, grounded theory, forensic investigations, ethnographies and phenomenological studies in order to embed them in designing questionnaires for data collection and testing the local water conflict EWS framework. The importance of each method is reviewed as follows:

4.5.1 Root Cause Studies (root cause analysis - RCA)

In general, for case studies, five components of a research design are important (Yin, 1994). These are: a study question; its proposition, if any; its unit (s) of analysis; the logic linking the data to the propositions and the criteria. The detailed root problem identification requires appropriate tools for cause identification. The root-cause identification method plays a major role both in root-problem identification and in the production of problem-solving models. Root-cause analysis is a structured investigation that aims to identify the true cause of a problem, and the actions necessary to eliminate it (Doggett, 2004). Moreover, Doggett states that root-cause analysis is the process of identifying causal factors using a structured approach with techniques designed to provide a focus for identifying and resolving problems. Although, there are over 40 types of tools for root-cause-analysis, Doggett (2004) believes that there are three main types of these tools that assist groups and individuals in identifying the root causes of the problem with varying degrees of accuracy, efficiency and quality. These are:

Table 4-8: RCA tools

1.	Cause-and-Effect Diagram (**CED**): *Ishikawa (1982)*	To break down potential causes into more detailed categories. They can be organised and related into factors that help identify the root causes.
2.	Interrelationship Diagram (**ID**): *Muzuno (1979/1988)*	To quantify the relationships between factors and thereby classify potential causal issues or drivers.
3.	Current Reality Tree (**CRT**): *Goldratt (1994)*	To find logical, interdependent, chains of relationships between undesirable effects leading to the identification of the core cause.

Source: Compiled from Doggett (2004)

Doggett (2004) agrees that, although each of the three tools is as good as another, the lack of adequate and related information could be a major problem for comparing them to each other. Moreover, ID and CRT analysis tools require a minimum of two variables as they are dealing with relationships. Figure 4-12 shows a summary of the anatomy of RCA.

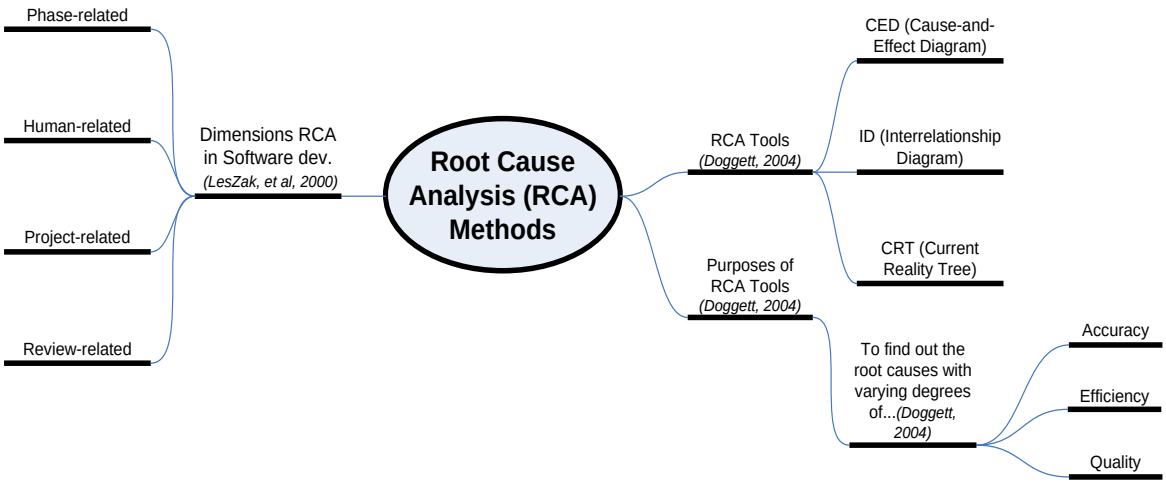


Figure 4-12: Anatomy of root-cause analysis

As compared to others, the application of CED could begin by breaking down of a causal factor into many details. It is easy to classify the root causes of a problem using the CED method. The author of this report found CED to be a more appropriate approach to study the root causes of local water conflict in low-income developing countries and to analyse how it is progressing in daily, real-life practice. In general, RCA could help in determining the root causes of one or more alerts in the process of water conflict early warning system development.

4.5.2 Survey Methods (SM)

Large amounts of data are a basic requirement when preparing for early warning situations. Research shows that there is no adequate data and theory for predicting and preparing early warning systems for tackling local water conflicts, especially in low-income developing countries. The bigger problems in an early warning process that most developers face concern the lack of theory - supported by data - that can guide the design of a reliable risk assessment model (Brecke, 2000). Hence, survey methods will help to minimize the data and theory gaps seen in local water conflict situations focused on basin information, community, traditional and modern institutions. This method helps in collecting lots of data from a relatively large group of local populations exposed to water conflicts.

4.5.3 Grounded Theory (GT)

There is no feasible theory on a local water conflict EWS. Furthermore, the terminologies 'conflict' and 'EWS' do not have universally accepted definitions. Grounded Theory Research, often referred to as the constant comparative method (Glaser and Strauss, 1967), is a qualitative tradition built on comparing concepts (Scott, 2004). Grounded theory is used to develop conceptual categories/theories about social processes inductively from real-world observations (data) from a selected group of people. The researcher may subsequently make further observations to test out the developed categories/theory. One of the major research questions in local water conflict EWS to be answered using the Grounded Theory (GT) method is “What type of modelling or theories can be applied to predict and manage local water-related conflicts?” GT in this research helps to further investigate and develop the modelling theory for a water conflict EWS. Although there is insufficient theory on local water conflict EWS, this research will attempt to develop such a feasible theory. Sequential relationships and game theory were adapted during the analysis stage of building the local water conflict GT (Elements and stages of GT are displayed at Appendix N2).

4.5.4 Ethnographies and Phenomenological Studies (EP)

These two methodologies are not the main parts of the study of a local water conflict EWS. However, the analysis based on the research question ‘What type of modelling or theories can be applied to predict and prepare for local water-related conflicts?’ leads the need for the further understanding of local traditions of water use and the impacts of climate change on

local water resources, which are directly related to ethnography and phenomenological issues, respectively. Phenomenology always represents the journey of experience (Druckman, 2005), which plays a significant role in studying the impacts of climate change on local water conflicts. Ethnography aims to describe the social experience of the groups being studied from their own point of view, presenting an account of what they notice as being meaningful in their own language and with their own emphasis and significance (Jankowicz, 2005). A traditional commitment that prioritises better water resources management reduces local conflicts. Hence, studying the tradition of local water use and the identification of the roles of concerned community members requires a systematic approach that should be partially supported by ethnographic methods. Open-ended interviews, biographical analysis, historic materials observation and reviews will be used as techniques when applying this method.

4.5.5 Forensic Investigation (FI)

Forensic investigation is an important tool for safeguarding peace. FI is a powerful method for case studies related to conflicts. One of the modern investigation techniques that help to reduce crimes arising among individuals or the public was the development of the Forensic Science Service (FSS). In July 2003, the then UK Home Secretary, the Rt. Hon. David Blunkett MP, announced the Government's intention to develop the FSS as a public-private partnership (HC, 2005). The report further stated that "at present, there is no one person or organization with responsibility for taking an overview of forensic science, from education and training through to research and development and its use in court". Gradillas *et al*. (2007), stated, "there has been rapid expansion of forensic psychiatric services in the United Kingdom over the last decade; and this has been associated with concern from communities about the risk to which they are subjected by the presence of secure units in their local area". The techniques of forensic investigation, forensic psychology, forensic speech investigation, and forensic science in general, help to identify and predict risks to local communities and surrounding areas associated with crimes occurring as a result of violent conflicts. Furthermore, the availability of such techniques and an awareness of the use of this method in low-income developing countries could have a major impact in predicting and being prepared for the occurrence of damage arising because of potential crimes in a society.

4.6 Research Techniques

Research Techniques are particular, step-by-step procedures that can be followed in order to gather a body of data and analyse it for the information it contains (Jankowicz, 2005). The most useful research techniques, which give guidance for the development of related projects, are based on interviews, focus groups, documentary sources, observation, questionnaires, ranking and scoring exercises and visual methods (Creswell, 1994). Moreover, Dr. Marion Joppe in his Tourism Research Webring web site explained the techniques for both methods as follows:

- The most common qualitative research techniques include in-depth interviews, focus groups, projective methods, case study and pilot study.
- The most common quantitative research techniques include observation, experimentation and survey techniques.

4.7 Summary Table for Identification of Research Tools

In the previous section, key components of the research methodologies was discussed based on the identification of useful approaches in answering the research question, “How can we pre-identify and prepare for local water conflicts in low-income developing countries?” Next, the validity of the tools will be explained, in Tables 4-9 and 4-10.

In identifying the required research approach and appropriate research methods, further analysis was required, as indicated in Tables 4-9 and 4-10 below. The result shows that both qualitative and quantitative approaches will be proportionally adapted. In general, survey methods, case studies and grounded theory research methods are applicable in this research. The analysis on choosing appropriate research methods indicates that survey methods (50%), case studies (22%), grounded theory (14%), ethnography (7%) and phenomenological (7%) methods will be in-parallel or sequentially-implemented depending upon the type of questions to be answered.

Table 4-9: Integrating research tools, techniques, methods and methodologies in LWC studies

Selected Research Methods	Techniques used for Local Water Conflict EWS		Tools/instruments	Methodology (approach)
	Type	Structure		
Survey methods	Direct observation, interviews, analysis of secondary data, ranking/scoring	Structured and semi-structured (e.g. analysis of formal output with informal)	Questionnaires, face-to-face interview, postal surveys, e-mail, telephone, internet survey, computers, recording tools.	Quantitative
Case Study	In-depth interview, focus group, projective methods, sequential analysis and pilot study	Fully structured and open-ended	Questionnaires, interview, field-testing, database, visual methods and recording tools.	Qualitative
Grounded theory	In-depth literature review, observation	Fully structured	Content analysis, computers	Qualitative
Ethnography	Historical review, Interview, Observation of materials	Open-ended	Questionnaires, visual materials, drawing conclusions, recording tools.	Qualitative
Phenomenological	Pilot study	Structured	Questionnaires	Qualitative

Table 4-10: Identification and validity of research methods and methodology

Research questions	Research methods applied	Research methodology/ approaches			Justification
		Qualitative	Quantitative	Combined (triangulation)	
MAIN RESEARCH QUESTION: How can we pre-identify and prepare for local water conflicts in low-income developing countries?	Survey methods (50%), Case Study (22%), Grounded theory (14%), Ethnography (7%), and Phenomenological (7%).	43% N=3)	43% (N=3)	14% (N=1)	= Percentage of [count of research methods applied or 'N' divided by 5, which is total number of research sub-questions]
RESEARCH SUB-QUESTIONS (N)					
1.1 What type of frameworks, models or theories could be applied to pre-identify and prepare for local water related conflicts?	Grounded theory	Fully applied			Search for the modelling theory on conflict and EWS requires further investigation. It was identified that there is not enough theory on local water conflict EWS. This research will develop a feasible theory on local water conflict EWS. The terminologies 'conflict and 'EWS' do not have universally accepted definitions. Sequential relationships and game theories can be adapted during the stage of analysis.
	Case studies	Fully applied			To study the root causes of conflict and to analyse how it has to be progressing. In addition, conflict contains complex causal links with daily, real-life practices.
	Ethnographies	Partially applied			To study the local tradition of water use
	Phenomenological studies	Partially applied			Climate change plays a significant role in water conflict.
1.2 What are the available and relevant data, theories, literature and information on the ore-identification or management of local water related conflicts or war?	Survey methods		Fully applied		There is not enough data on local water conflicts. Data is the basic component of EWS.
1.3 What are the types, roles, collaboration and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water conflict management areas?	Survey methods		Fully applied		Data collection and analysis
1.4 What are the main hazards, risks and costs associated with local water-conflict-related problems?	Survey methods		Fully applied		Data collection and analysis
1.5 How can be tools like modelling (quantitative) and a policy indication guideline (qualitative) be applied in developing good local water conflict management frameworks in developing countries?	Survey methods and Case studies			Partially applied	Data collection and analysis

Note: Experimentation as a research method is not applicable in this research study.

4.8 The Process of Literature Review

4.8.1 Definition

Bruce (1994) cited by Wilkinson (2000), defined that literature review as a list, a search, a survey, a knowledge enhancer, a supporting/directing tool and a report. Taylor (2006) pointed out that a literature review is an account of what has been published on a topic by accredited scholars and researchers. He further explained, besides enlarging your knowledge about the topic, writing a literature review lets you gain and demonstrate skills in the following two areas:

- Information seeking: the ability to scan the literature efficiently, using manual or computerized methods, to identify a set of useful articles and books.
- Critical appraisal: the ability to apply principles of analysis to identify unbiased and valid studies.

Hart (1998) cited by Blaxter *et al.* (2006), claimed that there are nine basic questions a literature review can answer:

- What are the key sources?
- What are the key theories, concepts and ideas?
- What are the major issues and debates about the topic?
- What are the epistemological and ontological grounds for the discipline?
- What are the political standpoints?
- What are the main questions and problems that have been addressed to date?
- What are the origins and definitions of the topic?
- How is knowledge on the topic structured and organised?
- How have approaches to these questions increased our understanding and knowledge?

This section introduces the conceptual background of literature reviews, the identification and searching of databases using keywords and the framework of searching as well as generally-recognised reading methods. All the useful papers and feedback questionnaires that were collected during the study are to be organized in folders, both electronically and as hard copy.

4.8.2 Literature Search Strategy and Referencing

4.8.2.1 Identification of Key Words

Initially the 24 keywords mentioned below have been used for searching and collecting appropriate research literature such as journal papers, magazine articles, theses, books, and others. Finally, the searching and the use of the refined keywords are limited to 10 keywords as indicated in the abstract of this paper.

Table 4-11: List of keywords initially selected

• Conflict	• Integrated WRM	• Traditional institutions
• Conflict evaluation system	• Local	• Water conflict
• Conflict management	• Modelling	• Water frameworks
• Conflict resolution	• Negotiations	• Water legislation
• Developing countries	• Prediction	• Water policy
• Early warning system	• Preparation	• Water safety plan
• Environment	• Risks	• Water security
• Institution and organization	• Sustainable development	• Water war

4.8.2.2 Identification of Search Databases

Loughborough University literature search engines such as MetaLib, RefWorks, and Loughborough OPAC, together with Google Scholar, were widely used to identify the relevant scholarly literature. By using search engines in combination with the identified keywords, the most relevant databases identified for this work are the following:

Table 4-12: List of OPAC databases used for literature searching

OPAC Database	URL Address
Wiley InterScience	http://www.intersceince.wiely.com
Web Science	http://portal.isiknowledge.com/portal.cgi
Science Direct	http://www.sciencedirect.com
Google Scholar,	http://scholar.google.co.uk
Geodatabse (OCLC)	http://www.engineeringvillage.com/controller/servlet/Controller?EISESSION=1_11db6bb115230af4313a9ases4&CID=quickSearch&database=8193
Emerald	http://www.emeraldinsight.com
CSA Illumna (Aqualine)	http://www-uk1.csa.com/ids70/quick_search.php?SID=e58ad713cfd114f16f5fbadaaa481ca9
CSA Illumina (Civil Engineering Abstracts, CSA Water Resources Abstract)	http://www.csa.com/csaillumina/login.php
Compendex (EV2	http://www.engineeringvillage2.org/controller/servlet/Controller?CID=quickSearch&database=8193

4.8.2.3 Frameworks for Searching

Wilkinson (2000) designed a framework for searching a literature in order to identify the concepts or components as well as their relationships to one other. His framework table consists of Boolean operators ‘OR’, ‘AND’ and ‘NOT’, which help to identify the relationships between words or groups of words in a search.

Table 4-13: Example of a framework for a literature searching

	← and →			
↑ or ↓	Concept 1	Concept 2	Concept 3	Concept 4… etc.

Source: Wilkinson (2000)

4.8.2.4 Referencing

The researcher has customized and used Harvard British Standard Style of RefWorks web based service for organizing and referencing the electronic and printed research materials.

4.8.3 Reading Methods

Reading and contacting the information source area are the main tools for controlling the environment around the research area. Different reading techniques were applied for researching all the required information as well as to control the research environment. The following are the three reading circles presented by Bundy *et al*. (2004):

4.8.3.1 Outer Circle

This is the process of skimming papers or reading the abstracts for an hour each week by visiting the library (physically or electronically) to skim the latest arrivals. An alternative to skimming is attending conferences to listen to both the short presentations and the longer tutorial addresses. It is also very valuable to make informal contact with people in the coffee room or corridor and engaging them in a short conversation about their latest ideas.

4.8.3.2 Middle Circle

Here, more time needs to be spent. The methods described for the outer circle are still applicable, but are insufficient - since some papers will need to be read completely along with some longer conversations. More specialized textbooks will need to be read and seminars attended etc. supported by keeping a record of the papers read and some comments about them, otherwise the benefits might be lost as memory fades. It helps to write the literature review in parallel with the rest of the research. These short notes help minimise re-reading a reference again when the writing-up stage is reached.

4.8.3.3 Inner Circle

For a deep understanding, reading a paper once is not sufficient. It should be read several times and any examples worked through. Setting some exercises and getting in touch with the author(s), either verbally or in writing, with a list of queries and/or criticisms is often valuable. One invaluable way to get a deep understanding of some work is to try to teach it to others in a seminar, either formal or informal. Legally acquire a personal copy of papers that are frequently used.

4.9 Data Types and Designing Survey Questionnaires

This section introduces the preparation of the local water conflict research survey questionnaire. The guidelines for answering the research questions should incorporate a definition of the objectives of the survey.

A survey is one of the research strategies and it involves systematic observation or systematic interviewing (Blaxter *et al.*, 2006). Surveys are systems for collecting information from or about people in order to describe, compare, or explain their knowledge, attitudes, and behaviour (Fink, 2003). Fink further explains that the best survey information systems have six features: (1) specific, measurable objectives, (2) sound research design, (3) sound choice of population or sample, (4) reliable and valid instruments, (5) appropriate analysis and (6) accurate reporting of results.

The questionnaires were prepared based on the pre-identified major unit of data analysis selected from Figure 4-9 and Tables 4-7 above, the anatomy of the unit of data collection and an analysis for a local water conflict early warning system. Local water conflict, communities and institutions are major factors identified as the central focal area of the unit of data

analysis. Social interactions and concepts related to local water and hydro-climatic information, local and international water conflicts and early warning situations are an additional unit of analysis identified for the study. Prior to the process of questionnaire development, the unit of analysis was integrated together with the identified variables.

4.9.1 Main Objectives of the Survey

- To explore past, present and future local water-related risks or the root causes of the problem that lead to conflicts.
- To identify relevant coverage of at-risk populations, other risk-affected stakeholders and the events and approaches related to local water.
- To discover local water-related issues that helps to reduce violence, deprivations or humanitarian crises that threaten the sustainability of human development in developing countries.
- To assess the level of awareness about a local water conflict early warning system.
- To identify local or traditional methods of better water management practices that help in reducing conflicts.
- To collect data on stakeholders who play a significant role in local water-related activities.
- To identify a specific local area for pilot water conflict management sites

4.9.2 Defining the Main Categories of Problems to be Examined

Table 4-14 shows the preliminary formulation and analysis of the categories of variables that are useful for data collection and analysis on local water-conflict as justified in Chapter 3 and §4.2.3.2 above. This support is a corner stone for setting operational rules for data collection and analysis as well as for preparing a framework for research variable development, as indicated in Appendix E. This section deals with the type of questions that should be examined in the study. It provides background, step-by-step, information on the process of identification of the unit of analysis as well as the identification of parameters for data collection and analysis.

Table 4-14: The process and procedure for integrating survey variables and population

Research Questions (RQ)	Main Survey Questions	Key words	Survey Population
MAIN RQ: How can we pre-identify and prepare for local water conflicts in low-income developing countries?			
RQ-1: What type of framework models or theories could be applied to pre-identify and prepare for local water-conflict-related problems?	• What are the traditional and local approaches that will be adapted to increase the level of awareness of local water conflicts by forecasting and preparing for local water conflict early warning and preparation?	• Forecasting • EWS • Traditional approaches • Timely warning	• At-risk population • Government • EW donor community • Risk affected stakeholders
	• What are the roots causes of	• Root causes	• Users

Research Questions (RQ)	Main Survey Questions	Key words	Survey Population
	local water-related problems that lead to conflicts, violence, deprivations or humanitarian crises that threaten the sustainability of human development in developing countries with special focus on the Awash (Ethiopia) basin? (Root Causes of conflict).	of conflict • Case and effect • Sustainability of the resources • Dimensions of conflict	• Legal offices • Police off • 'Kebele' • Basin Authority • Water Bureaux • MoWR • Federal office • Religious/traditional organizations
	• What are the available qualitative and quantities tools, frameworks, guidelines, models and policies applied for managing local water conflicts in low-income developing countries? (Conflict management tools).	• Rules and regulations • Strategies and planning • Policies • Management. tools	• Government representatives • NGO's • Communities • Professionals • Local elders • Local water schemes
RQ-2: What are the available and relevant data, theories, literature and information on pre-identification or management of local water-related conflicts?	• What are the available and relevant data, theories, literature and other information on local water resources and related conflicts or war? (Information).	• Local water resources data, theory • Traditional views • Unpublished literature , etc.	• Water users • Professionals • Traditional and formal institutions • Community leaders
	• What types of modern, local and traditional methods are practised to identify and manage local water-related views and conflicts? (Process)	• Traditional • Views • Methods • Management	• Local communities. • Organizations.
RQ-3: What are the types, roles, collaboration and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water conflict management areas?	• What are the types, roles, collaboration and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water-conflict-management areas? (Stakeholders)	• Stakeholders • Collaboration • Local water-conflict-management	• International organizations, • Governments, • Private-sector, • Public institutions, • NGOs participating in local water-conflict-management areas.
RQ4: What are the main hazards, risks and costs associated with local water conflict-related problems?	• What are the main hazards, risks and costs associated with local water conflict-related problems? (Events)	• Hazards • Risks • Conflict costs	• Events/situation. • Communities. • Individuals. • Medical centres.
	• What are the details of events and coverage of at-risk populations, other risk-affected stakeholders and approaches related to local water conflicts? (Events and risks)	• Types of conflicts • Risk events coverage • At-risk-populations	• Risk-affected or exposed populations.
RQ5: How can be tools like modelling and a policy indication guideline be applied in developing good local water-conflict-management frameworks in low-income developing countries?	• What makes the local area similar or different as compared to neighbouring locations in terms of water resources usage and management? (Site identification)	• Pilot site • Neighbourhood location (community)	• Geographical and socio-economic factors for conflicts

4.10 The Practice and Evaluation of Data Collection

This section describes the evaluation process for the validity of data collection by indicating the distribution and diversity of the target population in the Afar region of the Awash River Basin (see Tables 4-15, 4-16 and 4-17). This information helps to understand and validate the strength as well as the usefulness of the data collected. In Chapter 5 of the study, the researcher has also included water-conflict chronology information at the international level, which is useful for comparing and analysing the information collected.

Table 4-15: Weighting survey participants in the Afar region (diversity of survey respondents)

No.	The **BIG** numbers (how powerful?)	*Any friction?*	The **SMALL** numbers (How powerful?)	
1.	Communities representatives/member (134)	84%	Institutions representatives/member (26)	16%
2.	Respondents from main conflict area (Zone 1 and 3)	72%	Respondents from other or minor conflict areas - direct or indirect impact on conflict (other zones and regions)	28%
3.	Pastoralists	76%	Government employees	21%
4.	Illiterate	58%	Literate	43%
5.	Male respondents	78%	Female respondents	22%
6.	Islam	88%	Christian	22%
7.	Married/engaged	88%	Single/divorced	12%
8.	Name mentioned (transparent)	85%	Afraid to mention (not transparent)	15%
9.	Stayed for a long time in the region (above 5 years)	92%	Stayed for a short time in the region (below 5 years)	8%
	Average	80%		21%
	Range/Gap	59%		
10.	Diversity of institution	Small 40%,	Medium 35%,	Large 25%

Table 4-16: Introducing raw data evaluation checklist for analysis

Major check list	Yes	No	Description
Location: Was the selected geographical location representative for studying a local water-conflict EWS?	✓		- The Awash River basin is fully located in Ethiopia. The water resources in the basin are used for multiple purposes. Many stakeholders and a group of local people share the resources. There are frequent conflicts over the resources, mainly between the Afar and Issa tribes.
Unit of analysis: Representatives of the **population** selected...	✓		- Afar pastoral communities and local institutions are the main unit of analysis. Purposive and snowball non-probability sampling strategy was chosen due to the nature of the research.
Response rate above 90%	✓		- The difficulty of finding pastoral communities due to the nature of their way of life; and the difficulty of getting institutional respondents due to frequent and intensive meetings.
Institutional representatives	✓		- Most local institutions in the region belong to the government or government-affiliated bodies.
Availability of triangulation for **validity of data** (Data compatibility test)	✓		- Local community data and institutional data.
Availability of adequate **literature** on the areas of local water conflict		✓	- The study shows that less emphasis was given due to lack of favourable conditions for studying local water conflicts at the level of low-income countries. There is inadequate literature in the field of study.

Table 4-17: The primary process of preparing questionnaires required to be answered

Title	Description	Remarks
Main research question:	How can we pre-identify and prepare for local water conflicts in low-income developing countries?	Adequate variables were developed
Examples of key primary processes for preparing data collection questionnaires	Search for the modelling theory on conflict and EWS requires further investigation.	Desktop work
	It was identified that there is not enough theory on local water conflict EWS (search for local views, documents published and unpublished)	Survey
	This research will develop feasible theory on local water conflict EWS.	Survey + desktop
	The terminologies 'conflict'' and 'EWS' do not have universally accepted definitions.	Survey
	Sequential relationships and game theory can be adapted during the stage of analysis.	See variables
	To study the root causes of conflict and to analyze how it has to be progressing. In addition, conflict contains complex causal links with daily, real-life practices.	Survey-RCA
	To study the local tradition and other modern practices of water use	Survey
	To identify the role of local communities and stakeholders in water, conflict and EWS-related activities.	Survey + interview
	Climate change plays a significant role in water conflict.	Survey(technical)

4.11 Data Collection Process and SWOT Analysis

4.11.1 The Process of Data Collection

In this research, the process of data collection is presented in four sequential stages of the data collection strategy that incorporates the data type identification stage, the survey questionnaire development stage, the survey population and sample-setting stage and the process of data collection stage as shown in Figure 4-13, below. Each stage was carefully prepared in such a way that it is valid given the previous research design and theoretical findings of the study.

The first stage reflects the survey problems that should be examined, the units of analysis, the major parameters and variables. It also defines some socially and politically sensitive terminologies in order to ease the data collection process. The second part focuses on the data collection questionnaires used with local communities and institutions. It also includes the preliminary preparation of the survey objectives and guidelines. The third stage of the data collection process reflects the sampling method strategy, population size, weighting of the participants and the selection of the pilot survey area in the Afar region. The last step was about the data collection activities. These include primary survey data collection and secondary data collection on chronologies of local and international water conflicts. The survey data is focused on water, conflict and early-warning-related information at the local level where respondents were both from local communities and local institutions.

The Afar region was selected as a data collection and pilot study area (see Chapter 1). The region is exposed to a high level of manmade and natural problems related to local water conflicts. In addition, the region was scientifically well known as an origin of ancient hominids in Africa and very interesting location to study the aspects of conflict situations. The researcher has chosen purposive sampling and snowball sampling methods in collecting the survey data due to the difficulty of getting an adequate number of conflict zone pastoral communities and diverse local institutions as well as the intense political situations in the region. Though 90% of the population in the Afar region are mainly pastoralists that are living in a remote rural area, the research found it difficult to secure a proportional population size for the study and has chosen the indicated sampling strategy. The remaining 10% live in urban and semi-urban areas.

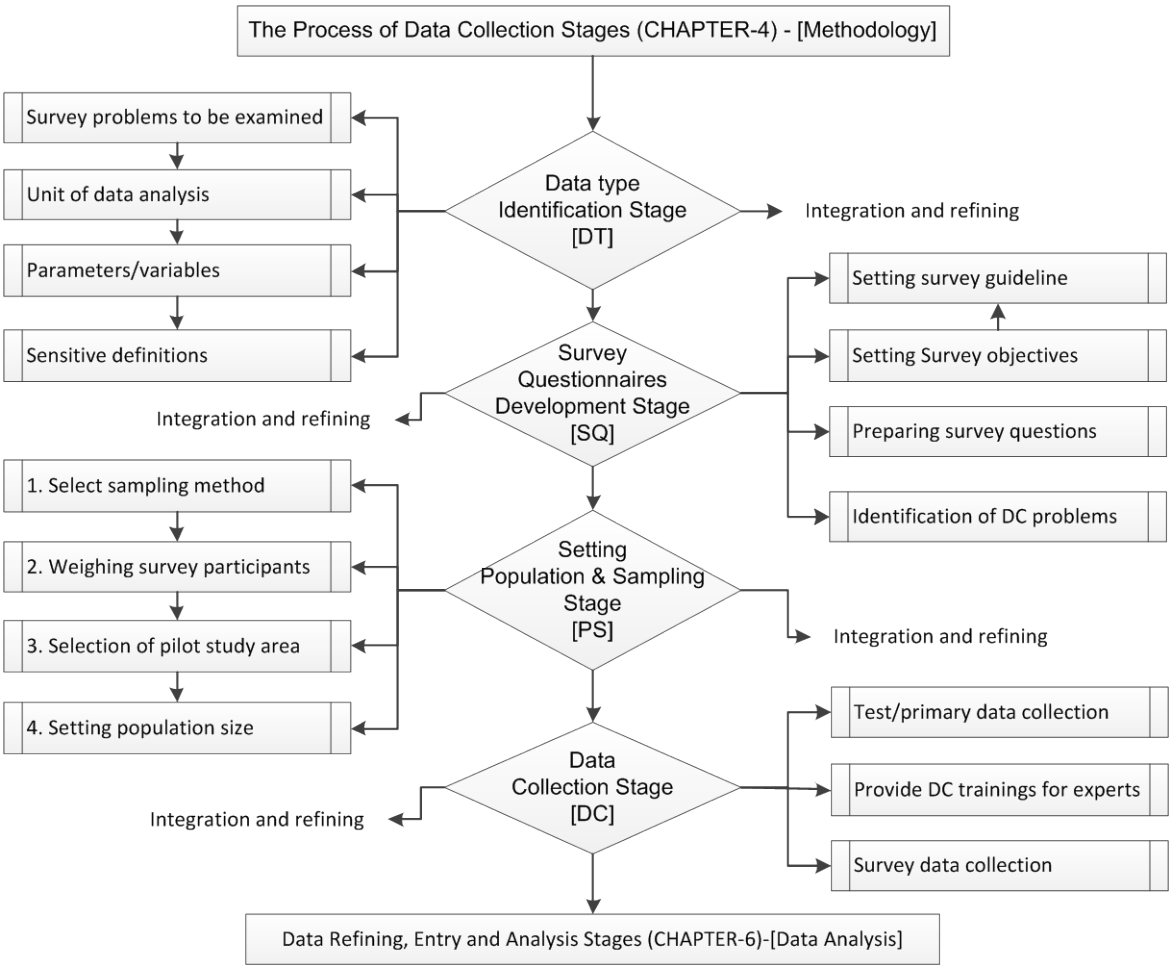


Figure 4-13: The process of local water conflict pre-identification and preparedness data collection

In the previous sections of this chapter, the researcher has explained the strategies and methods adopted for selecting a pilot location for data collection. Three experts who spoke local languages and knew the traditions of the people were recruited to conduct the survey data collection. Adequate training was delivered to all experts. The researcher also worked with them closely. Numbers of respondents were planned in advance depending on the geographical location and frequency of conflict occurrence in the region.

4.11.2 Problems Encountered while Collecting Data (SWOT Analysis)

In this section of Table 4-18, the researcher has described a detailed SWOT analysis based on the observed pros and cons of the data collection process in approaching survey respondent local people and institutions in the Afar region.

Table 4-18: SWOT analysis on data collection process in Afar region

	STRENGTH (INTERNAL)	WEAKNESS (INTERNAL)
OPPORTUNITIES (EXTERNAL)	**Strength/opportunities (obvious natural priorities)**	**Weakness/opportunities (potentially attractive options)**
	• Indigenous communities (pastoralists) are confident, cooperative and respond transparently. • Local/tribal/religious elders, NGO employees and private business people understand and have better awareness about local problems. • Local people (settlers from other regions) are educated, and better understand how government is working. • Non-politicians have a better understanding of the grassroots communities. • Government employees are aware of political situations in the region. • Professionals/experts are cooperative in responding to survey questions. • Female respondents are highly enthusiastic to speak privately irrespective of the external influences. • Youth groups understand and have better awareness about local problems • Male respondents prefer to influence the interviewer by requesting their own questions instead of responding to the survey questions. • The content of the questionnaire communicates within the Indigenous communities (pastoralists) immediately due to Dhaagu traditions. This helped for awareness creations in collecting survey data.	• Many politicians, government employees and officials are encouraged to participate in the survey. However, they are sensitive and preferred not to answer political questions. As a result, they are not answering all questions and reserved. • Local/tribal/religious elders are mainly concerned with power struggles as compared to local duties and responsibilities. • The type of questionnaire and information transfers within the community immediately due to traditional ways of information transfer called '*Dhaagu*'. This has created a negative impact on getting proper survey data.
THREATS (EXTERNAL)	**Strengths/threats (easy to defend and counter)**	**Weaknesses/threats (potentially high risk)**
	• Traditionally, most people, including the children, accompany the interviewee. Hence, the researcher found it very difficult to talk to the interviewee privately. • It is very difficult to contact people working in government institutions as per the agreed appointment schedule because of intensive internal and political meetings. • Non-politicians have strongly pessimistic views about politicians and government institutions (difficult to identify the role of political parties and governance). • Male respondents are reserved to speak as compared to women. • Professionals/experts have maximum level of dissatisfaction on job. • NGO employees are afraid, not transparent. • Private business people are afraid, not transparent.	• Local people (settlers from other regions) are not transparent, fearful of government and indigenous communities. • Non-indigenous people and those working in government institutions in the region were unwilling or fearful of answering some of the questions related to socio-economic and political activities in the region. • Local institutions are providing conflicting information due to the problem of poor documentation and information flow within departments in the same institutions and among different institutions. • Youth groups are highly exposed to harmful traditional and modern practices. • Female respondents afraid to talk privately due to cultural and religious influences. In most cases, it was not easy to find a woman who was prepared to talk to a man for interview purposes due to traditional barriers. • It was very difficult to find local people who participate in the survey process due to the high temperature of the region and the nomadic life of the pastoralists.

4.12 Description of Population and Sampling

The sampling strategies in this research focus on a group of local people sharing the same water resources in a basin. These people are living in various locations in a basin (e.g. upstream and downstream) with agrarian, pastoralist and nomadic lifestyles as well as working in different water and conflict-related institutions. Moreover, the groups of people are categorized according to the following:

- **People**: The groups of people surveyed include settled rural, semi-urban and pastoral communities sharing the same water resources. Within each group there can be more sub-groups classified according to key water conflict primary dimension factors that include the economic, people in drought-affected areas, political, ethnic and health situations. This also includes group of conflicting parties within the community.
- **Locations**: The water usage status of different geographical locations (upstream and downstream) in the same basin. This also includes those people living within different political boundaries but sharing the same resources.
- **Institutions**: Impacts and contributions of different institutions working on water- and conflict-related tasks with respect to the local area.

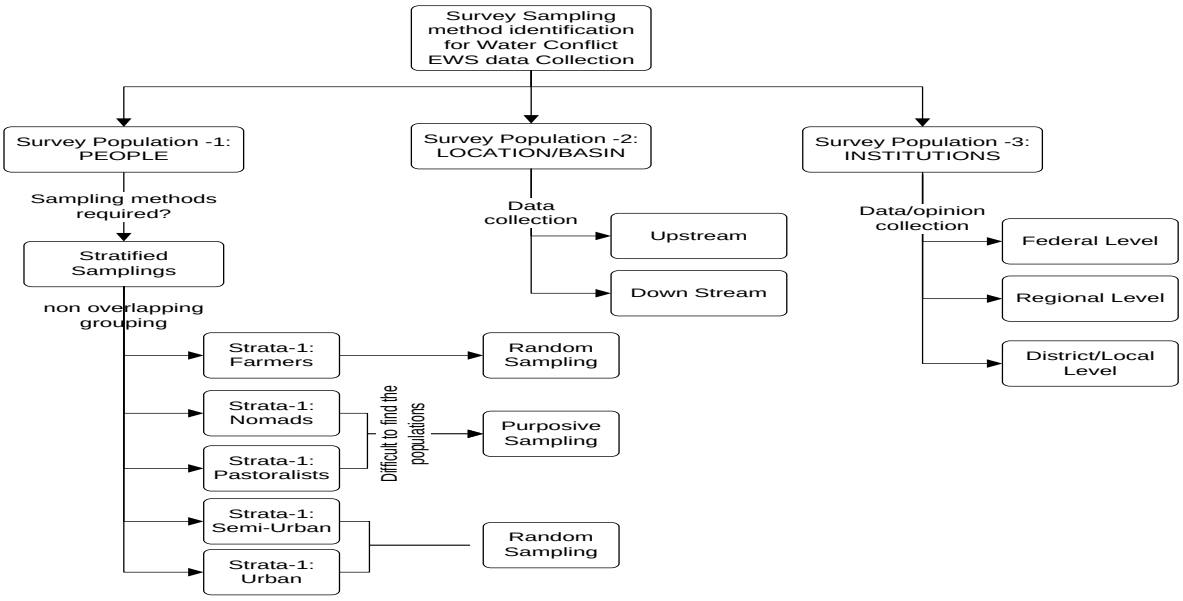


Figure 4-14: Selected sampling strategies and their justification

As the target populations are categorized into non-overlapping groups, stratified sampling should be taken as a major sampling technique. In each stratum, different sampling methods are applied as indicated in Figure 4-14 above.

The primary sampling method for this research would be a stratified probability-sampling strategy, which helps to divide the target population into different overlapping groups or strata. However, it is difficult to get the required data in a limited timeframe due to the complexity of the research location, environment and population. Therefore, non-probability, purposive and snowball sampling strategies were used as the second-best choice. The reason why the

researcher used purposive sampling was, (1) due to frequent conflicts occurring in the region among pastoralists from the Afar and Somali regions, (2) the pastoral communities comprise 90% of the population in the Afar region and (3) it is very difficult to find pastoralists for the survey interview since they are changing their locations frequently due to their way of life. The additional use of snowball sampling was due to the nature of this research and the need to identify clearly a vulnerable target population that has been affected by local water conflicts.

Table 4-19: Road map for selecting survey-sampling methods

Sampling Methods	Description of the methods	Remarks this research
	(A) Probability Sampling Strategies	
1. Random sampling (P)	Not grouped (simple) sampling. All population has equal chance to be selected.	Applicable (Secondary)
2. Systematic sampling (P)	Random sampling with a system: I=N/n where I is sampling interval, N is population size, and n is the required sample size	Applicable (Secondary)
3. Stratified sampling (P)	Group-based sampling: the sampling frame is divided into non-overlapping groups or strata, e.g. geographical areas, age-groups, gender.	***Applicable (Primary)***
4. Cluster sampling (P)	When the entire survey population is divided into groups or clusters (e.g. people living in the same street).	Applicable (Secondary)
(B) Non-probability Sampling Strategies		
5. Purposive sampling (NP)	"Purposive sampling targets a particular group of people. When the desired population for the study is rare or very difficult to locate and recruit for a study, purposive sampling may be the only option."	*Applicable (Primary)* In this research, the targeted populations are pastoral local communities and local institutions. Among local communities, the researcher targeted pastoral communities exposed to conflicts.
6. Snowball sampling (NP)	"It is incumbent on the researcher to clearly define the target population. There are no strict rules to follow, and the researcher must rely on logic and judgment. The population is defined in keeping with the objectives of the study."	***Applicable (primary)*** Due to the difficulty of finding pastoral communities and diverse local institutions.
7. Theoretical sampling (NP)	Sampling based on theoretical findings, especially for grounded study.	Applicable (Secondary)

(*Adapted from Source*: StatPac Survey Software (available at: http://www.statpac.com/surveys/sampling.htm; Valerie J. Easton and John H. McColl (Statistics Glossary, available at http://www.stats.gla.ac.uk/steps/glossary/sampling.html#srs)

4.13 Statistical Operation Tools Used for Data Analysis

SPSS is the program most widely used by university researchers; it is also widely used in private and government research organizations together with many large private companies and non-governmental organizations (Brace *et al.,* 2009). Another analysis tool is Microsoft Excel, a spreadsheet useful for easy data cleaning, analysing large tabular datasets, producing graphs and preparing reports. Descriptive statistics such as frequencies, cross tabulations, ratios, mean, percentiles, correlations, chi square tests scale, sorting, ranking, minimum, maximum and quantity, together with graphs and flowcharts were used to organize

and interpretations of the local water conflict data. Table 4-20 justifies the purpose of some of the statistical functions applied in the process of data analysis.

Table 4-20: Summary of the purpose of using statistical functions

Major category	What is it?	Why do you need?
Cross tabulation	Display the joint distribution of two or more variables. Cross tabulation returns a result set based on a two question selection	To count the frequency of the data
Chi square test and correlation	To compare observed frequencies based on some predictions and expectations.	To compare and validate the findings
Graphs and flowcharts	Used to compare, indicate and initiate discussion through mapping the relationships and the step-by-step process.	To indicate the relationships and sequences of the findings

4.14 Ethical Considerations

Ethical issues are, or should be, an important consideration in the design and conduct of research (Wilkinson, 2000). Consideration of ethical issues should be vital due to the natural interaction and dependence among societies in order to allow further development of the world. Finn (2005) states that the interaction and the dependence among cohorts of researchers were highlighted by Newton's famous quote, 'If I have seen further, it is by standing upon the shoulders of giants.'

In this study, other authors' works and findings should be respected and referenced; respect shall be given to people during data collection and discussion; privacy and confidentiality was respected; and due attention was given in respecting the environment. Blaxter *et al*. (2006) categorized and explained the most common ethical issues in five ways: confidentiality, anonymity, legality, professionalism and participation. The most common ethical issues categorized by Blaxter *et al.* (2006) were incorporated in the research in the following ways:

Confidentiality: The output and the process of the research will be kept confidential until it has obtained recognition. The respondents' list will also be kept confidential due to the sensitivity of the research.

In this research, the respondents' names in the Afar region are kept secret due to the political sensitivity of the research.

Anonymity: The research topic is very clear and there are no ambiguous concepts in it.

The research topic is very complex, multi-dimensional and connected to many factors. However, utmost efforts were made to reduce any ambiguous concepts in the process of the study.

Legality: All resources extracted from others were fully referenced; the topic considers many of the developing countries problems under the boundaries of formal legal activities and traditional practices.

The researcher recognized and referenced all works extracted from others. RefWorks was used for referencing. Prior to data collection, the University wrote a letter to whom it may concern as part of the process of research data collection; adequate cooperation was given

from local, regional and MoWR of Ethiopia

Professionalism: The research topic is unique in the world and no other work has been done in similar fields. Furthermore, all analysis was done in a proper professional manner.

An in-depth investigation of the problem, literature, knowledge gaps, brainstorms and field visits were held to be part of a unique and original research topic.

Participation: The work in the research was commented on and improved thanks to the participation of people directly or indirectly connected with the issues included in the paper.

In this research, the data collection process includes trained people from the region. The researcher carefully approached the 'pastoral communities', 'women' and 'politicians' in accordance with their cultural practices by respecting and requesting their willingness to participate. Some of the results of the study were informally discussed with recognized people from the region. The study was commented on by the supervisor of the research in addition to discussions with other researchers in the university.

4.15 Definitions, Delimitations and Limitations of the Research

Definitions: All the newly introduced and other relevant definitions were provided together with their appropriate sections so that any reader can understand the research easily. The researcher has included the definitions of '*Dhaagu'* and '*Fima'* together with other definitions in a separate Glossary/Definitions section.

Delimitations: These are used to address how the study will be narrowed in scope (Creswell, 1994). Furthermore, in contrast to "limitations", the delimitations deal with issues of external validity, or generalisability. The researcher has indicated the generalisability of the study by introducing theories of Sparkling Effects of Conflict together with DIPTI frameworks of local water conflicts.

Limitations: Limitations are provided to identify potential weaknesses of the study (Creswell, 1994). These research limitations relate to the internal validity of the study design. In Chapter 8.3 of the Conclusions, the researcher has presented the possible limitations of the research in terms of observed data (§8.3.1), missing data (§8.3.2) and possible bias (§8.3.3) of the study.

4.16 Chapter Summary

The researcher has adopted grounded theory and a survey method to seek further information and to make a critical appraisal in order to fill the existing knowledge gap in the area of local water conflict identification, early warning services and preparedness in low-income developing countries with a special focus on the Afar region in the Awash River Basin of Ethiopia. The researcher has used primary and secondary data collection systems supported

by techniques such as observation, questionnaires and interviews. Applied or practice-based research strategies were followed in order to recommend a proposal that could help to resolve the practical problems of water conflicts. In general, a combined (triangulation) approach was adopted to identify and analyse different realities of the problem by dealing with real people in real time. In addition, all accessible conflict variables such as dependant, independent, and mediating variables were identified and incorporated in the process of the study. Lastly, the following six main stages of approaches for this research work were sequentially followed to achieve the aim and objective and to answer the research questions effectively.

Stage-1:	A systematic and in-depth literature review (qualitative method); identification of parameters for validity of the research and units of analysis for data collection (primary and secondary systems). Following this, a framework design for questionnaire guidelines was developed.
Stage-2:	A survey design (quantitative method), supported by in-depth questionnaires. Survey methods will be adopted for identification of pilot locations for case studies and collecting and comparing feasible data/information for local water conflicts.
Stage-3 :	A few case studies (qualitative method) of local conflicts, supported by in-depth questionnaires. This method will be applied to explore and develop a theory based on the existing real local water conflicts in developing countries.
Stage-4:	A data analysis based on triangulation and mixed ways of evaluation, both qualitative and quantitative
Stage-5:	Field-testing the hypothesis; and database and webpage development to systematically organise, manage and validate the information that helps with the prediction of, and preparedness for, local water conflicts.
Alternatives:	Depending on the progress of the research, alternatives for local water conflict early warning research methods will also be developed.

This chapter also indicates the process of arriving at a unit of analysis, key parameters for data collection and the content of the questionnaires developed for local communities and local institutions. The researcher has also included the way secondary data on the chronology of water conflicts was collected and analysed. The importance of selecting purposive sampling and snowball sampling methods was also explained in the report.

The researcher has reflected the diversity and weight of the survey participants on the bases of their power, strength and distribution. The problems that the researcher has encountered in the process of data collection were indicated in this section. In addition, the researcher has defined some sensitive definitions that may simplify the interaction between the questioner and respondents of the survey. In addition, the data collection process flow chart has been illustrated in detail.

Chapter Five
PRESENTATION OF RESULTS

"The words of a man's mouth are deep water, but the fountain of wisdom is a bubbling brook" (Proverbs 18:4)

This chapter presents the positive and negative findings of the results of the research without any interpretation of the analysis. The researcher has presented the findings in a simple logical order based on the actual observational data and the data analysis. Mainly it includes the status of the survey respondents, the results of data analysis and a list of 180 local water-conflict-related main problems in the Awash River Basin of the Afar region. In addition, the chapter introduces water conflict information at local, international and institutional level.

5.1 Introduction

Glasman-Deal (2010), in her book 'Science Research Writing', noted that results do not speak for themselves; results cannot be achieved by just using tables, graphs or other images; they can be achieved only by using words. Hence, in Chapter 7 - *Discussion of the Findings* - the author will communicate the details of his own understanding and interpretation of the results presented in this chapter in the context of the research questions.

This chapter is about reporting a complete output of the data analysis of the research in terms of its logical order. It includes the most important results of the descriptive analysis. Here, the researcher has presented the results in tabular form, figures and graphs without indicating any positive and negative interpretation. However, each major section (§5.1 to §5.6) is introduced with a few useful informative words. Words have surprising power, and can encourage people to form strong impressions, (Glasman-Deal, 2010).

The presentation of the results of the survey on local water-conflict identification and preparedness focused mainly on the refined data analysis outputs of 10 WEC variables. These variables include vulnerability, awareness, WEC information, risks and hazards, communication and networking, cooperation, transparency, sustainability, early warning services and the preparedness of the local communities and stakeholder institutions functioning in the region.

5.2 Water Conflict Data at the International Level

In the beginning, a lack of adequate information on local water conflict was one of the major problems identified in the course of this research. Clearly, it is not possible to learn from experience without assessing the results of past actions; ***we interpret the term "history" broadly to mean any information from the past in particular***, we regard all forms of observational and experimental data as historical sources (UNESCO**,** 2001). The data presented in this section includes water conflict chronology, international organizations

on water conflict together with information on water conflict in Ethiopia. Preliminary data collection on water conflicts at the international level helps to understand why we need to study water conflicts at the local level and to compare them with conflicts over transboundary rivers.

5.2.1 Water Conflicts Chronology

The researcher has analysed Gleick's water conflict chronology data as of 2009 that indicates the existence of 203 water conflicts, classified by continent, specific types of water conflicts and local and international water conflicts. The detailed analysis of the data (See Table 5-1 below) shows that local water conflicts have increased dynamically since the year 2000.

Table 5-1: Comparing local and international water conflicts (2009)

Date Range	Local water conflict	International water conflict	Total	Percent
Before 0 BC	9	11	20	10%
0 - 1799	4	6	10	5%
1800 - 1899	10	2	12	6%
1900 - 1949	3	16	19	9%
1950 - 1974	6	19	25	12%
1975 - 1999	31	26	57	28%
2000 - 2009	41	19	60	30%
Total	104	99	203	100%
Percent	51%	49%	100%	

Sources: Data collected and analysed from Gleick's (2009) Water Conflict Chronology

Table 5-2: Categories of world water conflict chronology data comparison, 2009

Region	Conflict Category		Total
	Local	International	
North America	29	1	30
Latin America	5	4	9
Asia	25	21	46
Africa	**14**	**19**	**33**
Europe	10	21	31
Middle East	20	33	53
Australia	1	0	1
Total	104	99	203

Table 5-3: Frequency of water conflicts in Africa as of 2009

No.	Countries	Frequency of conflict occurrence
1	South Africa	9
2	Ethiopia	8
3	Angola	5
4	Egypt	4
5	Kenya	3
6	Sudan	3
7	16 other countries	26 (mean: 1.26/country)
	Total	58

Data Sources: D*ata collected and analysed from Gleick's (2009) Water Conflict Chronology*

5.2.2 International Organizations Related to Water Conflicts

This research showed that there are insufficient organizations working on resolving local water-conflict-related problems. The third research question states, ***"What are the types, roles, collaborations and links among local and international organizations or stakeholders like government, the private sector, public institutions and NGOs participating in local water conflict management areas?"*** The researcher has identified over 40 international institutions working on conflict and water conflicts, which helps to study their role and contribution at local level (Details are displayed at Appendix D). These institutions are located in 17 countries that are providing services for conflict-management-related activities, as mentioned below.

Table 5-4: Categories of international organizations working on conflict management

No.	Categories/departments of service provision within institutions	Number of institutions	%
1	Advisory and Advocacy	18	10%
2	Networking	18	10%
3	Policy, Law and Standard Setting	17	9%
4	Information and Publication	17	9%
5	Research (Res)	15	8%
6	Conflict Prevention and Management	12	7%
7	Peace and Development	11	6%
8	Training and Education	11	6%
9	Strategic Setting and Planning	10	5%
10	Technical Services	8	4%
11	Capacity Building and Funding	7	4%
12	Conference	6	3%
13	Negotiation	4	2%
14	Other Services	29	16%

5.2.3 List of Local Water Conflicts in Ethiopia as Compared to Africa

Data adapted and analysed from Gleick's (2009) water conflict chronology indicates that over 58 water conflicts were registered in 26 African countries that are directly or indirectly involved in water conflicts. In Africa, most conflicts related to water occur in East Africa (Ethiopia, Egypt, Kenya, Sudan, and Eritrea). Ethiopia, the so-called water tower of Africa, and South Africa have many local and international water conflicts. Since the year 2000, local water conflicts in Africa have been increasing rapidly as compared to international water conflicts.

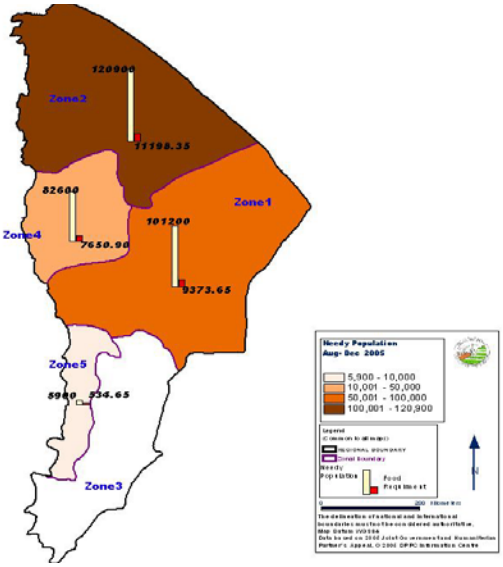
5.3 Survey Respondents' Information at Local Level

The survey method plays a significant role in minimizing the identified information and theory gaps in the areas of local water conflicts. In this research, the respondents to the survey include 134 local communities and 26 institutions in the Afar region. The questionnaires to

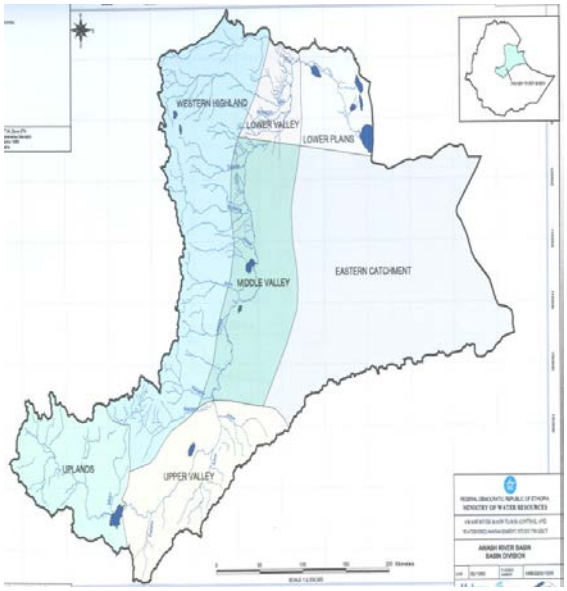
diverse representatives comprise 59 community questions and 77 institution questions. Details of respondents' information are presented in the sections 5.3.1 and 5.3.2 below.

5.3.1 Survey Location and Respondent Communities in Afar Region

A. Afar Region and Awash River Basin Map



(a) *Afar Region (Source: Afar Economic and Finance Bureau)*



(b) *Awash River Basin (source: MoWR)*

Figure 5-1: Survey location – the Afar region (a) and the Awash river basin (b)

In Appendix A, an additional map is presented showing the administrative regions and zones of Ethiopia.

B. Local Communities' Survey Respondents by Zone

Table 5-5: Local survey respondents' location/work area and gender

Work Area by Region and Zone			Gender		Total
			Male	Female	
Afar Region	Zone	Zone 1	38	8	46
		Zone 2	9	2	11
		Zone 3	38	12	50
		Zone 4	3	1	4
		Zone 5	12	6	18
		Total	100	29	129
Addis Ababa Region	Zone	Addis Ababa	4		4
		Total	4		4
Oromiya Region	Zone	Oromiya	1		1
		Total	1		1
		Grand Total	105	29	134

C. Respondent Communities' Socio-demographic Information

Table 5-6 and Figure 5-2 displayed below indicate details of the socio-demographic survey data that includes age, gender, education, religion, occupation and duration of stay in the Afar region. In the region, above 90% of the people are pastoralists. The survey respondents' comparison data shows 55% of pastoralists, 12% of jobless people and the other 33% of respondents are working in the public and private sector. Their way of life is directly or

indirectly related to pastoral communities in the region. The pastoral communities have been gaining education mainly through APDA using mobile schools, although this is not adequate.

Figure 5-2: Respondents' family members' distribution by age group in the Afar region

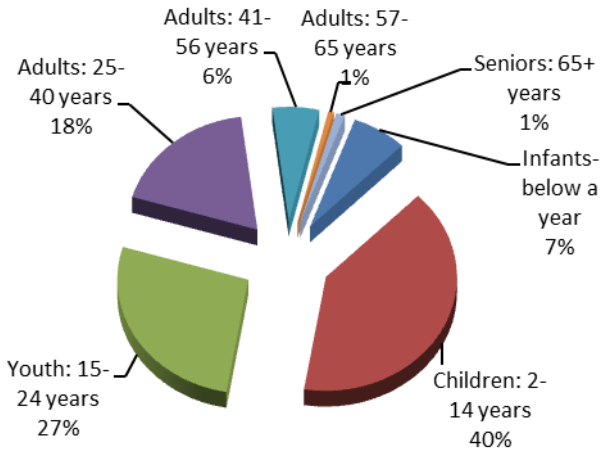


Table 5-6: Respondents socio-demographic information

Parameter	Scale of measurements	Gender			Percent (%)
		Male	Female	Total	
Occupation	Pastoralists	59	15	74	55
	Government Employees	16	5	21	16
	Having no Job (Jobless)	9	7	16	12
	Farmer	8	1	9	7
	NGO Employee	3	1	4	3
	Trader/Private	3	0	3	2
	Pastoral nomads	2	0	2	1
	Students	1	0	1	1
	Teachers	1	0	1	1
	Pastoralist and Government employee	1	0	1	1
	Nurse	1	0	1	1
	Daily labourer	1	0	1	1
Education	Illiterate	56	16	72	54
	Elementary	17	2	19	14
	High School	10	5	15	11
	College or University	22	2	24	18
	No comment	1	3	4	3
Religion	Islam	91	27	118	88
	Christian	12	1	13	10
	Indigenous/ traditional religions	1	0	1	1
	No comment	1	1	2	1
Duration of stay in the Afar Region	15 +	82	22	104	78
	11 - 15	6	2	8	6
	6 - 10	8	4	12	9
	1 - 5	9	1	10	7
Respondents' Age Group	15 - 24	6	3	9	7
	25 - 40	61	24	85	63
	41 - 56	35	1	36	27
	57 - 64	3	1	4	3

D. Mapping Local Respondents' Openness

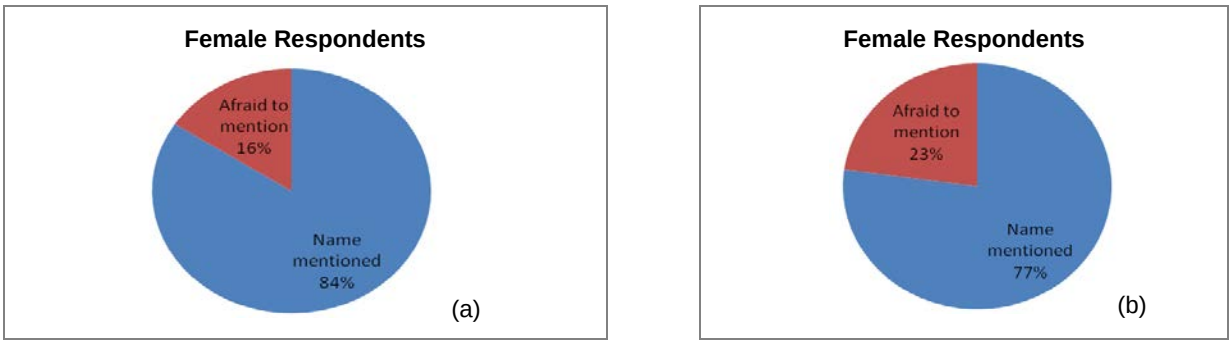


Figure 5-3: Respondents' openness on telling *name* by *gender*

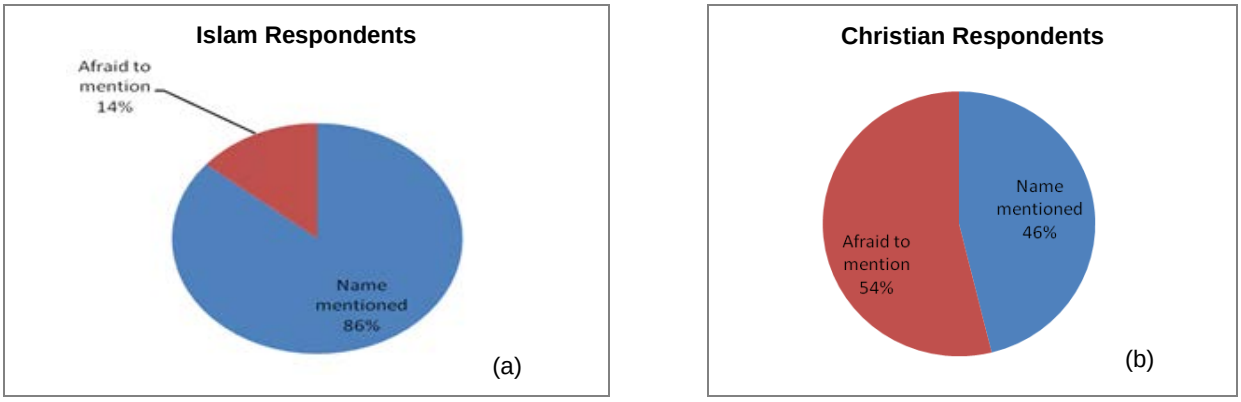


Figure 5-4: Respondents' openness as categorised by *religion*

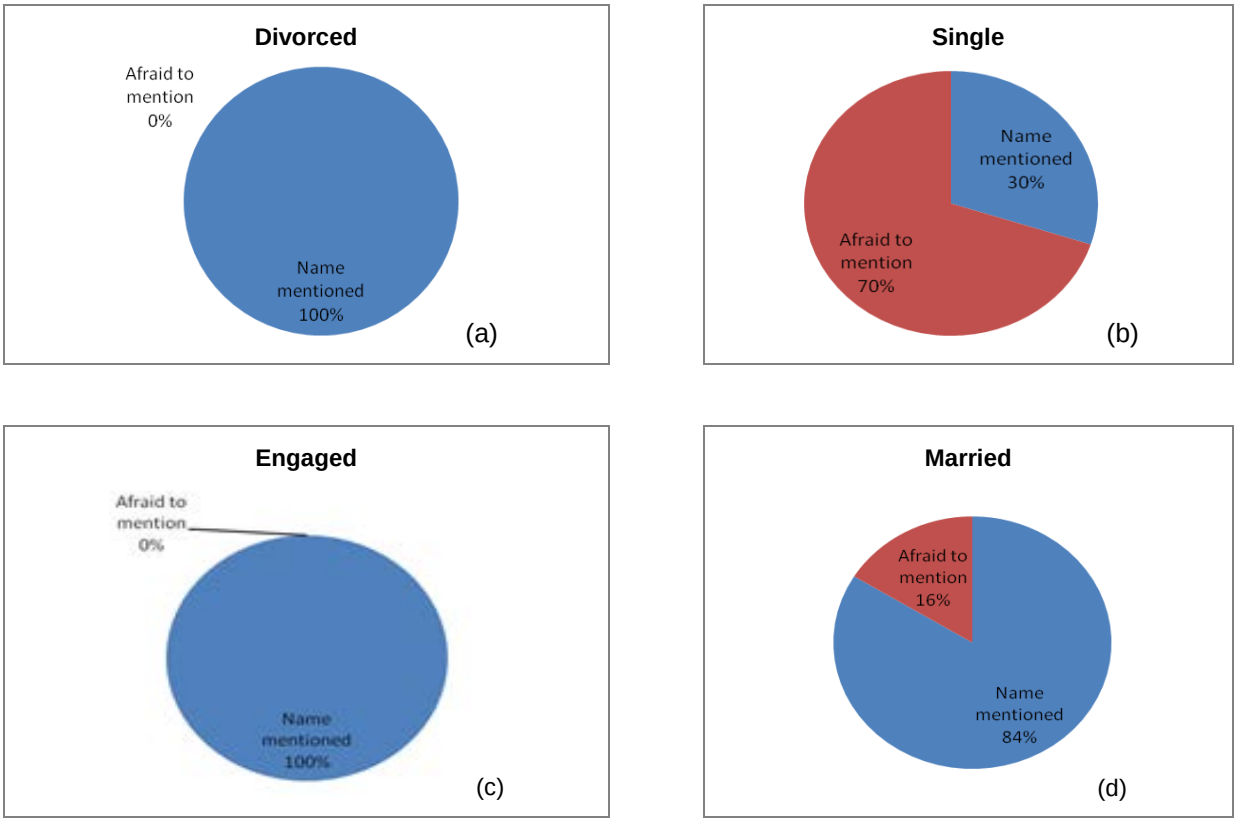


Figure 5-5: Respondents' openness grouped by *gender* and *marital status*

5.3.2 Local Institutions' Survey Questionnaire Respondents:

There are no specific formal organizations in the region working on water conflict management. The result of the survey includes a list of 26 potential organizations working on water, conflict and early warning and other related activities in the region.

A. Institution Survey Respondents: Coverage by Gender

Table 5-7: Institution respondents by gender

Institutions		Gender		Total
		Male	Female	
Coverage Area	Regional	20	1	21
	National	3	0	3
	Local	2	0	2
Total		25	1	26

B. Institution Survey Respondents by River Basin sub-divisions

Table 5-8: Institutions respondent by river basin

Organization coverage by river basin	Institution type			Total
	Gov.	NGO	Private	
Middle Awash Valley	3	0	0	3
Middle and Lower Awash Valley	19	1	1	21
The whole Awash Valley	2	0	0	2
Total	24	1	1	26

C. Occupation/Profession of Institution Survey Respondents

Table 5-9: Institution respondents by category of occupation/profession

No.	Respondents Category	Frequency	Percent
1	Planning	5	19.2
2	General manager	4	15.4
3	Program/Project Coordinator	4	15.4
4	Economist	2	7.7
5	Engineer	2	7.7
6	Operation and maintenance	2	7.7
7	Security and Justice	2	7.7
8	Health Surveillance	1	3.8
9	Hydro-geologist	1	3.8
10	Investment	1	3.8
11	Policy Advisor	1	3.8
12	Socio-economic expert	1	3.8
	Total	26	100.0

D. Categories of Institution Survey Respondents

Table 5-10: Local water conflict institutions data in the Afar region

No.	Organization Category	Organization Type			Total
		Gov.	NGO	Private	
1	Capacity building	1	0	0	1
2	Commerce	1	0	0	1
3	Early Warning and Preparedness	1	0	0	1
4	Economy	1	0	0	1
5	Education	1	0	0	1
6	Finance	1	0	0	1
7	Health	1	0	0	1
8	Justice and Security	1	0	0	1
9	Pastoral Development	2	1	0	3
10	Road Construction	1	0	0	1
11	Security	2	0	0	2
12	Urban development	1	0	0	1
13	Water	10	0	0	10
14	Water and Sanitation	0	0	1	1
	Total	24	1	1	26

E. Diversity of Institutions by Size

Table 5-11: Diversity of institutions by number of staff in respondent institution

Number of staff	Organization type				Total	Organization Diversity status
	Gov.	NGO	Private	*No response*		
No response				*6*	*6*	*?*
10	0	0	1		1	Small size 8 (40%)
21	1	0	0		1	
34	1	0	0		1	
39	1	0	0		1	
40	1	0	0		1	
50	3	0	0		3	
80	1	0	0		1	Medium size 7(35%)
114	1	0	0		1	
150	2	0	0		2	
180	1	0	0		1	
200	1	0	0		1	
232	1	0	0		1	
307	1	0	0		1	Large size 5 (25%)
320	1	0	0		1	
500	1	0	0		1	
750	0	1	0		1	
900	1	0	0		1	
Total	18	1	1	***6***	26	20 (100%)

5.4 Results of Data Analysis on WEC Variables

The results of data analysis revealed the status of 10 major outputs of the data collection in the Afar region. It is organized in accordance with The Framework of Study indicated in Chapter 3 (Figures 3.6, §3.4 and §3.5) and Chapter 4, the Methodology, (§4.5.2, §4.7, §4.9 and Table 4.10) that provides the key components of the DIPTI parameters for local water conflict pre-identification, early warning, preparedness and neutralization.

5.4.1 Vulnerability and Local People's Exposure Status

A. Vulnerability Status Summary in the Region

Table 5-12: Local people's vulnerability analysis summary

No	Vulnerability variables	Description	Status	Grading the positives
1	Occupation (types of work)- % within work category	Daily labourer, farmers, having no Job -jobless, pastoral nomads and pastoralists.	Vulnerable (75%)	D
2	Location- depending on duration (over 15 years) - % within stay - location - years	The data shows those who stayed long in the region are vulnerable.	Vulnerable (75%)	D
3	Education-respondents family status(Educated family members)	Educated family members.	Not vulnerable (58.5%)	C
4	Demographics- Age and gender status(Infants, women and seniors)	Infants, women and seniors.	Vulnurable (72%)	D
5	People- Vulnerable people with special needs and disabilities in a family	People with special need and disabilities.	Vulnerable (54%)	C
6	Homelessness	Rate of homeless people in the region.	Increasing (38-41%)	C
7	Exposure to Vulnerability	(Unemployment, income and expense and water supply).	Vulnerable- (64%)	D
	Mean		Vulnerable (62.6=63-mean)	D

B. Vulnerable and Non-Vulnerable Job Categories in the Region

Table 5-13: Categories of work exposed to vulnerability in the region

Non-vulnerable jobs	Vulnerable jobs
Teachers	Daily labourers
Nurses	Farmers
Gov. Employees	Jobless
NGO Employees	Pastoral nomads
Trader/Private	Pastoralists

C. Vulnerability and Homelessness Trends in the Region

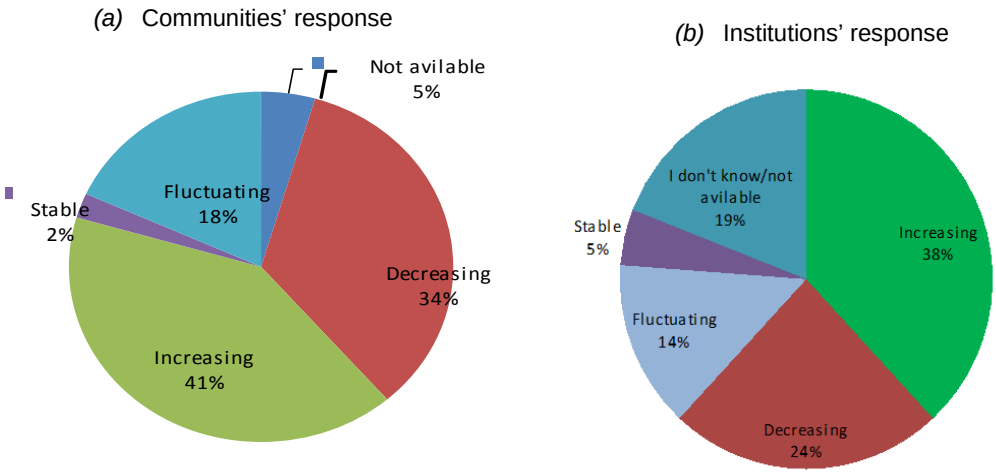


Figure 5-6: Visualizing local communities' (a) and institutions' (b) responses on trends of homelessness

- Traditionally local communities in the Afar region are pastoralists and houses are temporarily constructed from locally-made and available materials. Some respondents suggested that homelessness has not effectively recognized for pastoralists in the region because of the hot environment, low-income earnings and the nomadic nature of pastoral life in the region.
- Traditionally, a home is built only for containing items. However, there are increasing number of homeless highlanders coming from different regions as a pathway to illegally emigrate to Middle Eastern Arab countries.
- For any guest who speaks the Afar language and wants to join the local residents, he/she should be expected to say, "*Asala malikum*" meaning, "*peace be upon you*", before getting an invitation into a house. Once he was invited, the '*Dhaagu'* communication process starts between them for building trust and he can stay with them as long as he wants.
- A respondent working in the regional water bureau indicated that 95% of the homeless people in the region are male and the remaining 5% are women, which needs more research.

D. Vulnerability and Unemployment in the Region

Labouring job opportunities in the area are seasonally increasing due to the introduction of a new state sugarcane plantation project in the region. However, the rate of unemployment among professionals is also increasing. In addition, HIV/AIDS is the critical health problem in the region.

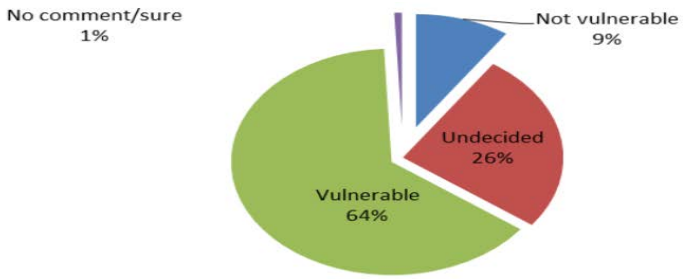


Figure 5-7: Vulnerability and unemployment status in the region

E. Vulnerability, Education, Work and Duration of Stay in the Afar Region

Table 5-14: Work- and education-related vulnerability in the Afar region ('a' and 'b')

Duration of stay in the region	**Work**-related vulnerability		Total
	Not Vulnerable	Vulnerable	
1 - 5	9	1	10
6 - 10	8	4	12
11 - 15	2	6	8
15 +	14	90	104
Total	33	101	134
Percent	25%	75%	100%

(a) Work-related vulnerability status

Duration of stay in the region	**Education**-related vulnerability		Total
	Not Vulnerable	Vulnerable	
1 - 5	10	0	10
6 - 10	9	2	11
11 - 15	6	2	8
15 +	33	68	101
Total	58	72	130
Percent	45%	55%	100%

(b) Education-related vulnerability status

5.4.2 Local Awareness Status Data Analysis Output

A. Main Results for the Data Analysis on Local Level Awareness:

Table 5-15: Local communities, institutions and other stakeholders' awareness summary

No.	Awareness variables	Description	Status	Grading the positives
1	Costs of conflict: awareness on service costs of the effects of conflicts.	Local communities', institutions' and other stakeholders' awareness of costs of conflict.	Partial awareness (44 - 50%).	**C**
2	Information need and flow: institution's information demand and supply awareness comparison.		Lack of adequate water quantity and quality information.	**D**
3	Information availability: awareness on the boundaries of information analysis.	The better approaches to data analysis mainly include the river basin as a base line and incorporates political and traditional administrative ways.	54 % primarily believe political boundaries are the way of analysis and 11% do not know the boundaries of analysis. In general 65% use unsustainable ways of analysis.	**D**
4	Resource ownership: awareness of resource ownership.		Disagreement on resource ownership status.	**D**
5	Water tariff: community participation on water tariff settings awareness.		Disagree (highly disagree) (57%).	**C**
	Mean		**Minimum level of awareness.**	D

B. Descriptive Results of Data Analysis on Local Level Awareness:

1) Demography-related awareness status

The data collected shows that women are equally concerned about health and the social relationships that they have within the local community. Men are primarily concerned about health/fitness and the issues related to social relationships in a community are seen as a secondary issue. Both women and men equally agree in ranking the time spent on local conflicts as a third problem.

2) Information awareness status

Information awareness gap: The findings show that the information awareness gap between a group of educated people (students and professionals) and institutional representatives (administrators and politicians) is very high. Local communities are pulled from two opposing directions. This explanation contradicts the people interviewed from the local community indicating that they knew more information regarding what is going on through their traditional communication system, not only in their region but in other parts of the world too. Does this create favourable or unfavourable conditions for the sustainable development of the region? Does this create conflicting information within the community? For example, a senior manager mentioned that the communities are ignorant about what is going on in their communities. In contrast to this, a respondent from a government organization claimed that the Afar *Dhaagu* tradition was recognised by the government.

Information need: Local professionals in the institutions have less awareness of having the necessary information for their work. Most institutions need water quantity and quality

information, mainly for planning purposes. Information requested mainly reflects the professions of the respondent, not the objective and activities of the organization.

***Information preparedness*:** the most astonishing point was that those institutions requesting the availability of more information mentioned above were fully or partially responsible for collecting the information themselves! That poses questions such as whether there is a lack of coordination among professionals and institutions within and outside the same institutions and, if so, why?

3) Resources ownership awareness status

Local communities and government institution representatives at both high and low levels have opposing views on resources. Government institutions believe communities are secondary when it comes to resource ownership and that government should take priority. This by itself creates another conflict between the government administrators and the local pastoral communities who believe that the primary owner of the local resources should be the local community. The researcher observed that the communities are highly dissatisfied with the government's control of the resources. In addition to these conflicting views, Table 5-16, indicates that, to some extent, the government believes in the joint ownership of natural resources whereas communities believe and have a tradition of private resource ownership.

Table 5-16: Ranking institutions' (a) and communities' (b) awareness of the ownership of natural resources

***Ranking institution's** awareness view (a)*

Local Natural Resources Ownership	Agreement rank in %
1st Government	46%
2nd Public/Community	23%
2nd Gov and Community (JOINT)	23%

***Ranking community's** awareness view (b)*

Local Natural Resources Ownership	Agreement rank in %
1st Community/Public	47%
2nd Municipal/Gov	26%
3rd Private	21%

5.4.3 WEC Information Data Analysis Output Summary

A. Main Results of Data Analysis on Local WEC Information Availability

Table 5-17: WEC Information availability and preparedness summary

No.	WEC Information Variables	Description	Status	Grading the positives
1	Institutions' awareness and preparedness on WR, EW and conflict-related information.	WEC information availability and preparedness,	Partial awareness	**C**
2	Water resources information availability.	Types of information and category of analysis,	Partially available	**C**
3	EW-related information availability (Includes max. risk information related to development projects).	Awareness and types of prediction practices,	Not available	**D**
4	Conflict-related information availability.	Information on conflict,	Not available	**D**
5	Hydro-climatic information availability.	Awareness and its effects on livestock and agricultural products,	Not available	**D**
	Conclusion	**Minimum level of awareness and preparedness (The location is EXPOSED to conflicts)**		**D**

Assessment on the distribution of WEC information indicated in Figure 5-8 shows that the level of WEC information awareness among people in the region is not evenly distributed.

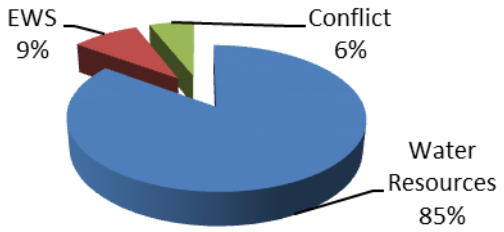


Figure 5-8: Percentage of WEC information awareness among communities

B. Descriptive Explanation on Some Information Collected During the Survey Process

1) Information Dissemination and Validity

Communities fully trust the information given by members of the local community. They partially believe the information coming from outsiders, who are not members of the local community. Any information provided by government representatives is considered as unreliable. Furthermore, some people in the urban and semi-urban areas are watching external media outlets such as Aljazeera TV via satellite dishes and listen to VOA and DW Amharic service programmes to get more information or to compare what they are getting locally.

2) *Dhaagu* Information Exchange

Dhaagu is the oldest and largest local information network system in the Afar tradition. It is a traditional information channel that is accepted as a reliable information system. The process takes a minimum of an hour especially between two people who already know each other. They start informing each other beginning from the day they met for the last time. The information to be communicated includes about rain, pasture, water, the livestock market, conflict, war and so on. At the end or during the conversation the information provider is requested to answer the following questions posed by residents: Did you see or participate in the information situation you are communicating? If no, where did you get the information, from a person who saw or heard?

3) Water Resources

In Afar tradition, water is shared and not denied to those who do not have any alternative sources. The necessary permission should be politely requested and justified if one wants to use other than his own water sources. Occasionally, people steal water when they think permission would not be allowed.

In explaining the decrease in flow rate of the Awash River, a survey respondent said that in the past, the Awash River could not be crossed by a camel due to its depth. Today, it can be crossed by children, just an indication of how the depth of the river has reduced over time and

been filled by sands and debris due to the decrease in the flow rate of the river and its tributaries.

4) Grazing Lands

Grazing lands for calves are highly protected and are the main causes of conflict in the region. Sometimes, local conflicts over water do not come directly. They occur in the form of political disagreements and by occupying a land, grazing land in particular.

5) Wild life and Natural Conservation

The types of wild lions in the region and in Ethiopia in general, are indiginous and very vulnerable species. They need big forests that might take 3-4hrs to reach from their residence area in the River Basin, which is very difficult and risky. However, leopards need a regular forest to live and it is normal to see them everywhere.

6) Land, Migration and Conflict

Afar and Issa tribes are the main conflicting tribes in the lower and middle Awash River Basin. The Afars believe that the Somali Issa tribes migrated to the river basin. Today, they have controlled many areas that include more than three villages on the main transportation route that connects the capital city with Djibouti seaport (see Figure 5-9 below).

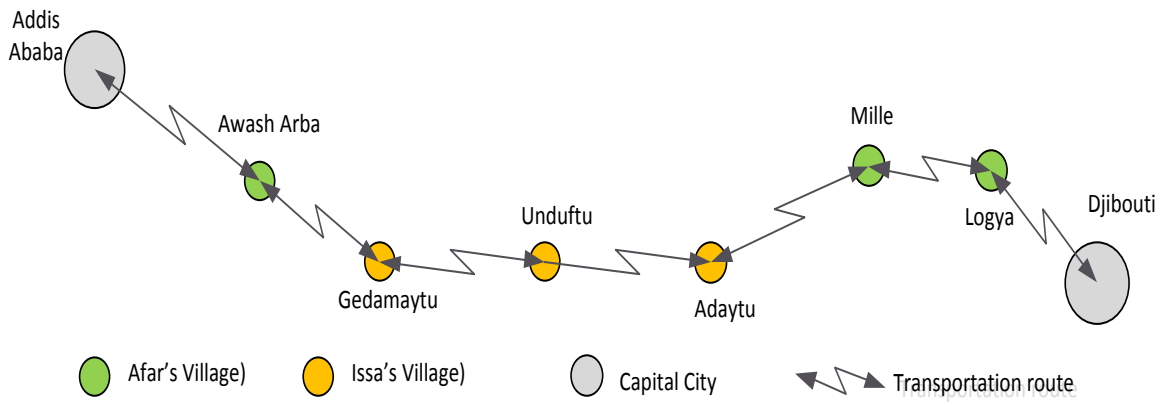


Figure 5-9: Afar and Issa tribes' settlement in the middle and lower Awash river basin on the main transportation route from Addis Ababa to Djibouti

7) Conflict and a tradition of controlling the intensity of conflicts

In the Afar community, there are strong traditional regulations to which local people are accustomed and which discourage insulting others or the use of 'bad mouthing'. There is a strong tradition of punishment for anyone who does not respect others. Conflicts rarely occur within the Afar community. Bad administration and the existence of long-term traditional hostility over land have aggravated conflicts in the Afar region. This traditional hostility already exists between the Afar and Issa (Somali), Afar and Raya-Kobo (Amhara) and Afar and Warra babbo (Oromo). As a consequence of conflicts between Afar and Issa, a minimum of one person dies every day. For example, the day the researcher was interviewing a person, some

Issa groups had killed a driver. Traditionally, when similar incidents of conflict occur in the region:

- Neutral tribes are involved when conflicts are occurring between members of other tribes.
- Local government has limited capacity in preventing disaster related to conflicts, drought, health epidemics and weather conditions.
- Women and children: Women are not allowed to carry a gun in the Afar tradition. Similarly, women and children under the age of 18 are not killed during wartime.

In pastoral communities, land, water and pasture for livestock are the key problems related to natural resources in addition to the diverse other conflict factors indicated in the previous chapters. These three interlinked factors commonly occur in integrated ways. Most frequently, conflict over land occurs as a primary/direct factor and conflict over water and grazing as secondary/indirect factors. There is a traditional conflict-forecasting plan among the local communities of the Afar region as described in Chapter 6 (Table 6-94).

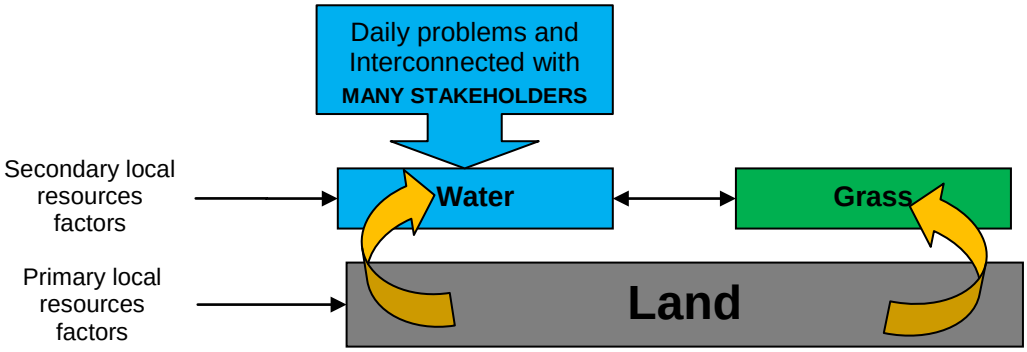


Figure 5-10: Comparing the views of pastoralists in the context of natural resources

C. Comparing the Modern and the Afar Traditional Conflict Resolution Practices

Table 5-18 prepared from the survey and interview data together with the literature review provides general comparisons between modern and traditional conflict negotiation practices in the Afar region.

Table 5-18: Comparing traditional and modern conflict negotiation practices in the local context

Description	Afar local tradition (*Source*: Survey and interview data from Afar region)	Modern practices (*Source*: Literature reviews)
1. Responsibility	Traditional leaders/tribes/religions whose member was participating in conflict. If life is lost during conflicts, the killer asks asylum with other tribes. Members of tribes and traditional leaders take responsibility.	Directly conflicting parties [Direct responsibility].
2. Conflicting parties representation	Tribal leaders who do not have any close family relationships with the one injured or affected by conflicts. [Indirect responsibility-representative] (good to avoid anger and have a tolerance to negotiate)	Direct representation [Difficult for negotiation].
3. Conflict resolution participants	Tribal representatives, traditional leaders, other neutral tribal leaders [mainly traditional leaders] participate.	Conflicting parties, gov, NGOs, professionals and other related stakeholders. Mostly based on

Description	Afar local tradition (*Source*: Survey and interview data from Afar region)	Modern practices (*Source*: Literature reviews)
		knowledge of conflict resolution and experiences but not focused on the real practice on the ground [Mainly professionals participate].
4. Location for conflict resolution	Not in a neutral area (At the place of the one who injured the other) and central for all parties, food availability [conflict zone].	[Neutral area]
5. The process	Conflict resolution process includes the participation of the place/land/environment/tradition/belief where the problem occurred [full process].	The discussion process mainly focuses on the issues and the people only [the process is not full].
6. Cost of conflict resolution	Cost covered by tribal leaders of the one who injured the other one [people feel the burden of conflict].	NGO or other donors [people do not feel the burden in terms of negotiation costs].
7. Timing	Compromise will be held immediately after witnesses heard, the amount of compensation was decided by the two parties and will be stayed for 40 days. After 40 days, the final decision is approved, and the final swearing/oath will be held at the same location. [Fixed/closed].	There is no defined process in this aspect. [Open/flexible].

5.4.4 Risks and Hazards Data Analysis Output

The study focused on identification of risks and hazards that causes local conflicts. Summaries of output data from Chapter 6 (§6.8) are presented and illustrated here (§A to §D). They deal with the local exposure to risks and hazardous situations in the region, which is a major factor in answering the fourth research question. The finding indicates that the overall situation in the region is fragile, at least grade ‘D’.

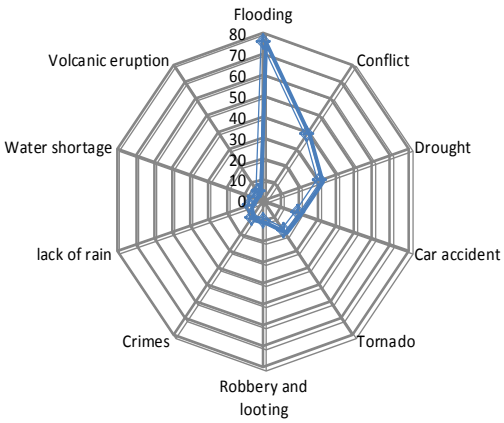
A. Main Results of Data Analysis on Local Risks and Hazards

Table 5-19: Local risks and hazards identification, exposure and awareness analysis

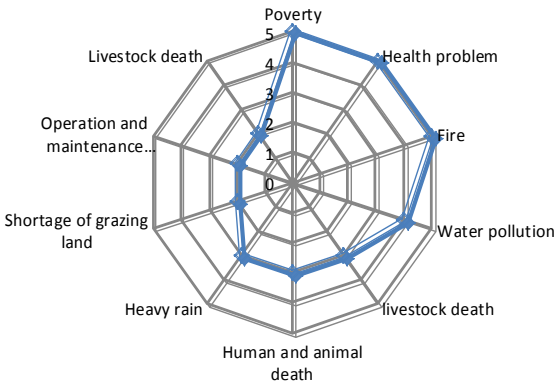
Risk identification variables summary	Description on the findings	Status: maximum % of respondents agreement	Grading the positives
A. Exposure to risks			
1. Exposure to hazard (hazard strength)	Critical	42%	D
2. Probability of hazard occurrence	Occasionally	73%	C
3. Vulnerability of the people and water resources in the region		Still communities are vulnerable by 19% (52-33)	D
3.1. Due to water-related dev. projects (dam, irrigation projects)	Vulnerable (exposed to hazards)	52%	C
3.2. Satisfaction rate on project's cooperation with local people	Satisfied	33%	D
3.3. Water resources protection methods and capacity of operation and maintenance (OM-partially available)	Not exposed (available)	42%	C
3.4. Access to safe water supply	Highly vulnerable	77%	D
3.5. Water resources utilization problems	Management problems	44%	D
3.6. Local people’s exposure to incidents	Sometimes only	39%	C
B. Risk reduction awareness			
4. Awareness on risk reduction methods	Less risks	67%	C
Exposure to risks -Conclusion		High level of exposed to risks	D

B. Grouping and Comapring the most Frequently-Occurring Problems in the Region

(a) Group -1 (Flooding, conflict, drought, etc.): Comparing the **FIRST 10** most frequently occurring problems



(b) Group -2 (Poverty, health problems, forest fire, etc.): Comparing the **SECOND 10** most frequently occurring problems



(c) Group -3 (Shortage of grazing land, dislocation, food price increase, etc.) Comparing the **THIRD 12** less-frequently-occurring problems

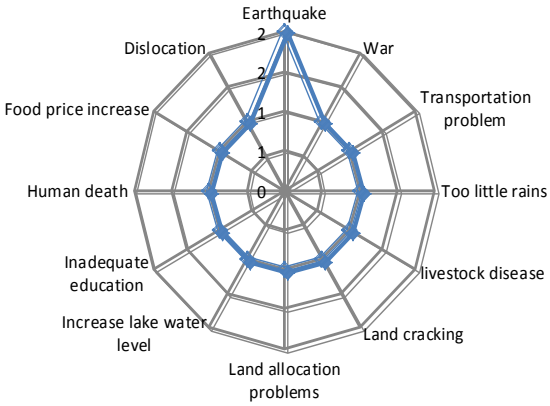
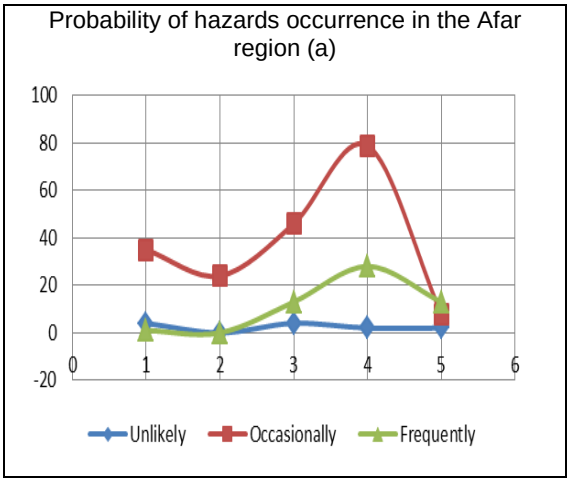


Figure 5-11: The most frequently-occurring problems in the region ('a', 'b' and 'c')

C. Severity and Probability of Hazard Occurrences in the Region



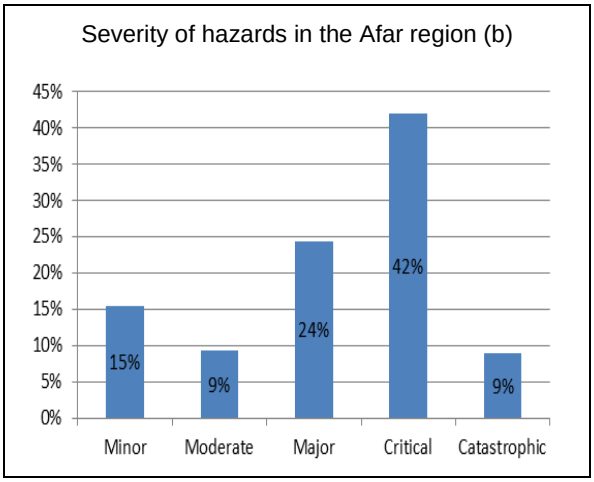


Figure 5-12: Comparing severity and probability of the occurrence of hazard in the region ('a' and 'b')

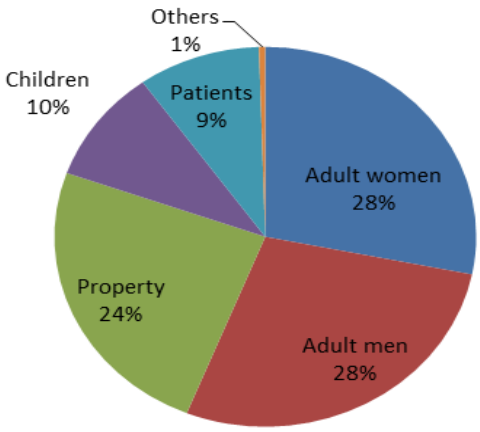


Figure 5-13: Victims and patients exposed to incidents related to conflicts

D. Summary of the Findings on Local Level Risks and Hazard Exposure

- The region has been exposed to critical hazards in the past 5 years. The data from respondents shows that there are over 32 categories of natural and man-made hazards in the Afar region. Among these, 68% of the hazards are related to flood, conflict, drought, car accidents and tornadoes (see group 1 of Figure 5-11). They also agreed that 54% of hazards occur as a result of natural phenomena, 36% are man-made incidents and the remaining 10% have both natural and man-made characteristics. Moreover, 42% of the hazards have critical effects on the local community.
- In the past 5 years (2004-9), 73% of the respondents believe that natural and man-made hazards occur in the region occasionally and cause critical problems for the water bodies and the communities residing in the region.
- Among the respondents in the region, about 52% of people believed that the region was vulnerable to hazards due to problems with the expansion of big government projects (construction of a dam, canal, road and irrigation projects). Local communities' dislocation, conflict, over-flooding, shortage of grazing lands, loss of farmlands, damage to private farms and deforestation are the major problems occurring in the region as a result of these projects. In contrast, 48% of the respondents do not have any awareness about on-going development projects in the region and related problems.
- Among respondents concerned with the status of the project's cooperation with local people, 33% agreed that they are satisfied. The communities are satisfied by the functions of some of the multilateral and bilateral projects in the region. However, they are neither satisfied nor dissatisfied by the works performed by unilateral projects in the region. Most of the unilateral projects are undertaken by the federal government.
- Water has top priority in the Afar pastoral community and 64% to 83% of the respondents agree on the availability of water resources protection activities practised by local communities, private individuals, government institutions, non-governmental organizations and other stakeholders. The majority (37%) of the local respondents agreed on the availabilities of both traditional and modern water resources protection practices. In

particular, 50% of them believe that a local capacity for water resources operation and maintenance services are partially available.

- On access to a safe water supply, 77% of the respondents agreed that they are highly exposed to unsafe water supply sources. People commonly use water supply from rivers, hand-dug wells, ponds and other multiple sources. The remaining 23% believe that they are getting safe water supplies (tap water, hand pump, public stand posts and rain water).
- Regarding water resources utilization problems, 44% of the respondents of institutions prioritised water resources management problems and 33% of them indicated chronic water scarcity as a major problem in the region.
- Regarding the status of local people's exposure to incidents, 67% believe that they are sometimes exposed to risks. The survey result showed that 24% of the property damage occurred occasionally due to the local conflict problems related to exposure to risks. Moreover, 28% of adult women, 28% of adult men, 10% of children, 9% of patients and 1% of others have sometimes been affected or exposed to risks related to conflicts over local water resources and any other natural resources during the last five years. In most cases, adult women are the victims of an adult men and that is why the figures are very close to each other. Women are highly exposed to incidents that occurred as a result of conflicts over local water supply or any natural resources. In most cases, women are those who fetch water for the household whereas adult men are watering and grazing livestock. Verbal aggression, physical aggression and sexual abuse are the three major incidents that occur in the region.
- It is assumed that respondents must know at least three methods of risk reduction, one from each category: water, conflict and early warning. In this case, the mean awareness shows 2 out of 3 or 67% of the local people have an awareness of local risk reduction methods.
- In the Afar region, areas such as Gewane, Amibara and Buremudaytu are mainly exposed to health problems related to diarrhoea due to a lack of adequate water supply and sanitation facilities. Moreover, many itinerant labourers are coming to the region as a result of some of the investment activities available there. Traditionally, the majority of people are pastoralists and helping each other and hence vulnerability and unemployment is not a major problem. In this research survey and the interview data indicated in section 5.5 of Table 5-32 (Category VII- human health-related problems), HIV is the critical problem near to the main road (see Figure 5-9) areas of the region; and the number of people with mental or psychological illnesses are increasing in the region.

5.4.5 Local NCC Data Analysis Output

A. Main Results of Data Analysis on Local NCC

Table 5-20: NCC status among stakeholders in the region and river basin

NCC Variables	Description on the findings	Status: maximum % of respondents agreement	Grading the positives
1. PROBLEM IDENTIFICATION RELATED TO LOCAL NETWORKING, COMMUNICATION AND COOPERATION			**D**
1.1. Pressure on communities on sharing local water supply resources	Measuring the internal and external pressure	Communities in lower and middle Awash Valley face a HIGH pressure over resource utilization. High pressure – external (76%).	D
1.2. Intensity of pressure	To identify external and internal pressure	External pressure (64%).	D
1.3. Problems related to communication and cooperation	Types and frequency of problems	Conflict as a problem (50%).	C
2. COMMUNICATION STATUS			**C**
2.1. Communication availability	Availability of communication types and status	Traditional ways mainly available 61% (Has an impact on significant development)	B
2.2. Communication preference	Transfer and information use priority	Majority preferred traditional ways -66% (Has an impact on fast development????)	B
2.3. Communication efficiency/style		Assertive, 17% only, (Majority style was passive 45%) (Has an impact on resolving conflicts that require much critical thinking).	C
2.4. Communication satisfaction	General communication satisfaction (among institutions and communities)	80% of the existing communication POSITIVE	D
2.4.1. Among institutions	Communication satisfaction among different institutions	Dissatisfied or highly dissatisfied, 46% (Communication based on Water, conflict and EW-related activities).	D
2.4.2. Among a group of communities (different tribes in the river basin)	Availability of communication tools/ networking	NEGATIVE? (There is no means of communication among different tribes in the river basin. Negative).	D
2.4.3. Between different institutions and local communities working in the region	Between institutions and local communities	Used both traditional and modern ways 76% (Positive).	C
3. NETWORKING STATUS			**D**
3.1. Social network availability			**C**
3.1.1. Within the same tribe (Afar)		Traditional ways available - *Dhaagu*.	A
3.1.2. With other neighbouring tribes in the region		Not available	D
3.2. Understanding/speaking neighbouring people's language		Below average, (37%) only.	**D**
3.3. Key areas of relationships or networks		NEGATIVE relationships (48%)	**D**
4. COOPERATION STATUS			C
4.1. Communities cooperation within themselves (clan level)		Positive	B
4.2. Communities cooperation with other communities (tribes level)		Negative	D
4.3. Communities cooperation with Institutions		Positive	C
4.3.1. Feedback/Response evaluation	Majorities response feedback	Medium 52%	C
4.3.2. Satisfaction rate or agreement	Majority satisfaction agreement.	Good (41%)	C
4.4. Institutions cooperating with other institutions		Negative	D
Summary of (Problem and NCC)		**Mean (D, D, D, C)**	**D**

B. Mapping the Links between NCC Variables

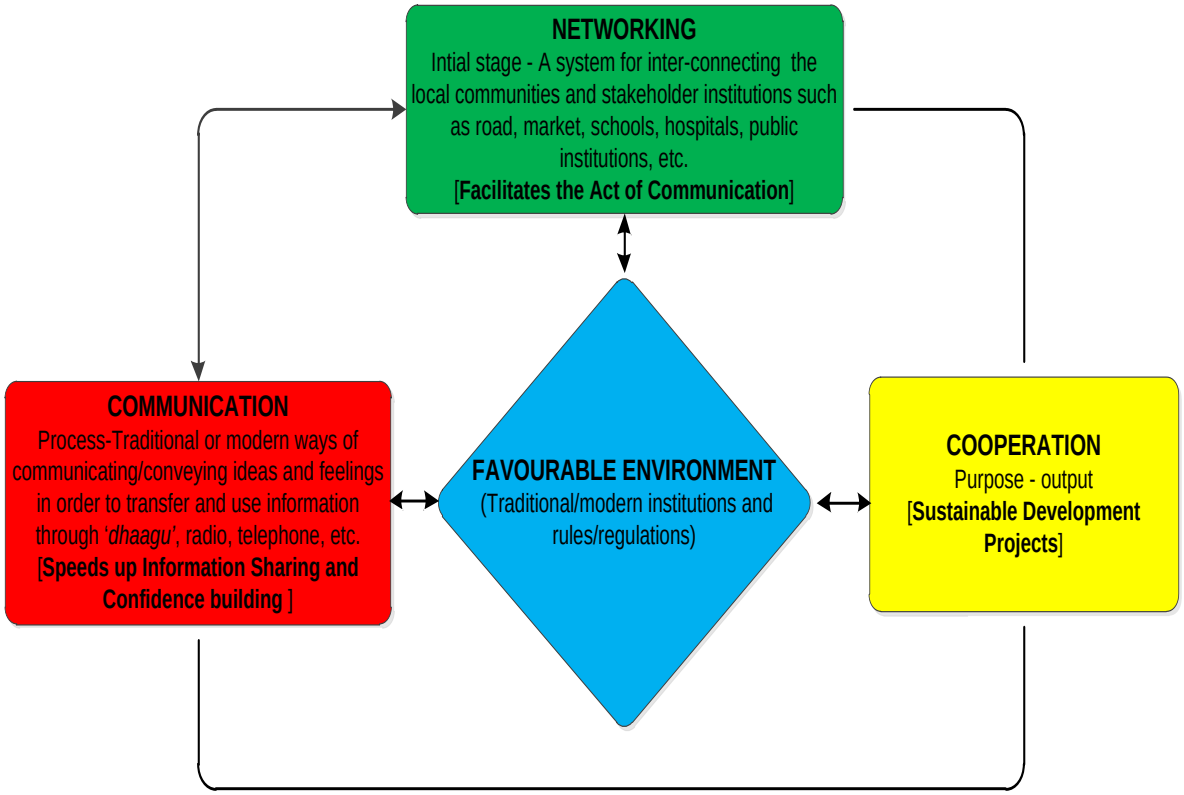


Figure 5-14: Triangular approach 1: Designing the links within NCC and focal point

C. Communities' and Institutions' Views on the Level of Local Interaction

Some institutions interact and communicate with a group of communities sharing the same water resources through government agencies, NGOs and tribal elders at local level. They also use opportunities of traditional festivities, celebrations and occasions for further communication.

Some of the problems in these area are related to the inaccessibility of those communities' members living in remote areas due to lack of communication systems such as road, telephone, internet, etc. The rarely-available transportation and community facilities are inefficient and inadequate. Security problems that include health and safety-related issues are also parts of the problem that hinders the local communication system.

The process of maximizing community involvement in locally-based projects is on-going in order to bring sustainable development to the region. The government is providing incentives and compensation for local people in order to increase the participation of communities. However, it is difficult to fulfil the high demands of the community. Most projects are directly or indirectly owned by the ruling party (government) members and the local community are not happy to cooperate with them. The expansion of large projects in the local area causes a great fear among the community that they might, one day, lose their land. A feasible scenario for cooperation between the communities, government and projects is illustrated in Figure 5-15.

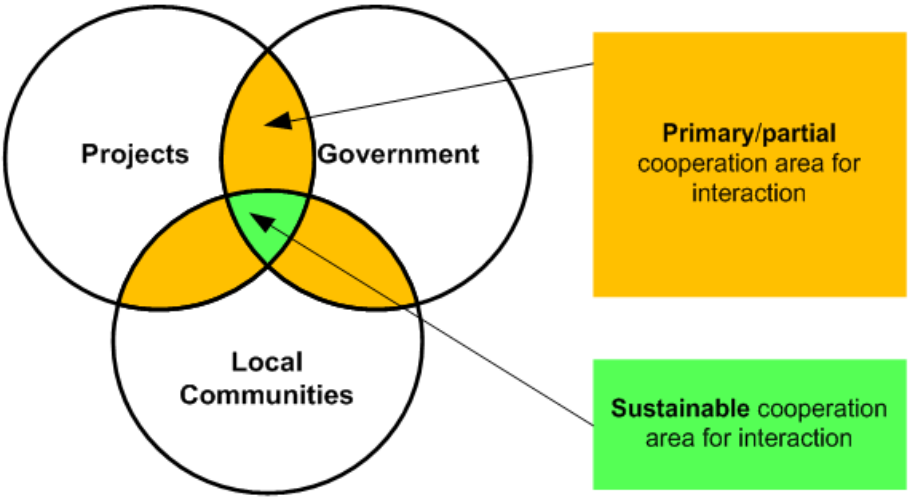


Figure 5-15: Possible scenarios on community- project-government based interactions

D. Communities' Opinions on the Effectiveness of Style of Communication

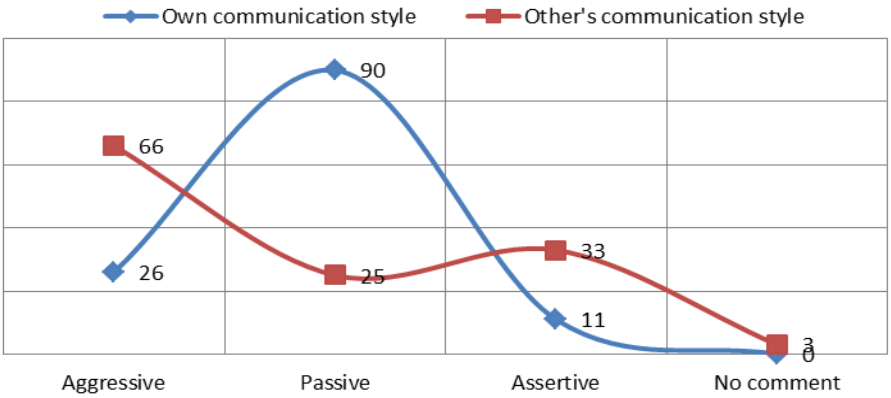


Figure 5-16: Illustrating the comparison of local people's own communication style

E. Key Areas of Communication among People in the River Basin

Table 5-21: Main areas of relationships among local people

No.	Types of Relationships for communications	Level of Communication				Total
		Negative	Normal	Positive	No comment	
1	Territory/border related	113	9	3	2	127
2	Natural resources-water/grass	109	12	4	2	127
3	Political	101	14	6	6	127
4	Economy	77	32	13	6	128
5	Ethnicity/Race	23	53	50	2	128
6	Language	3	44	77	4	128
7	Religion	2	44	80	2	128
	Total	428	208	233	24	893
	Percent	**48%**	**23%**	**26%**	**3%**	**100%**

F. Numerical Links between Communication and Cooperation at Local Level

The next diagram shows feedback on the local Afar communities' communication and cooperation with other tribes of people sharing the same water resources. They agreed that

communication and cooperation at the tribal level both start at a low (poor) level. In order to have good cooperation, there should be more communication. Once good communication has been established with the other group of people, the level of cooperation exceeds communication. In general, a majority (42%) of the respondents agreed that they have good relationships with other communities of the Afar tribe.

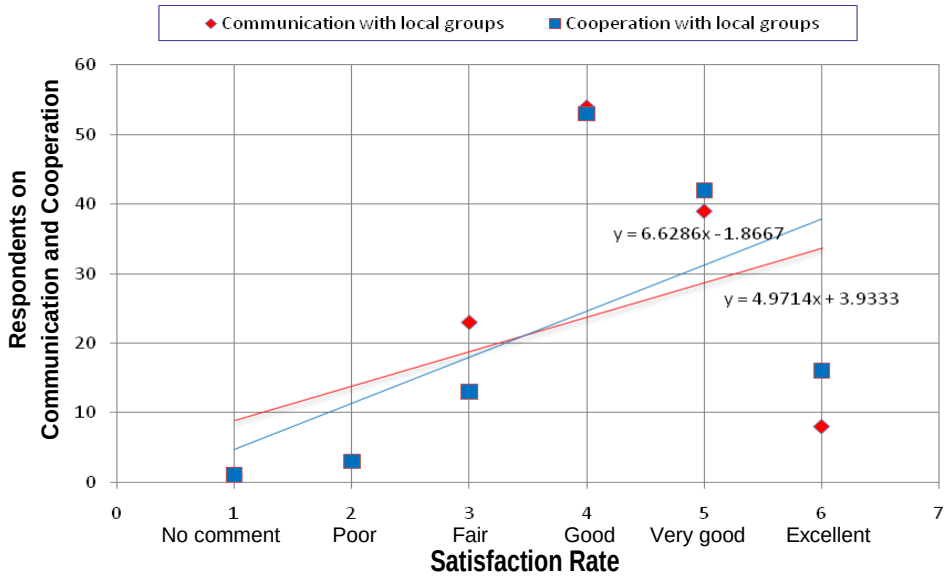


Figure 5-17: Comparing communication and cooperation among local people

5.4.6 Transparency Data Analysis Output

A. General View of the Level of Transparency in Afar Region

In this section, Figure 5-18 and Table 5-22 indicate the data from the Afar region on the local transparency status surrounding effective decision-making within the process for pre-identification, preparedness and early warning of local water conflicts.

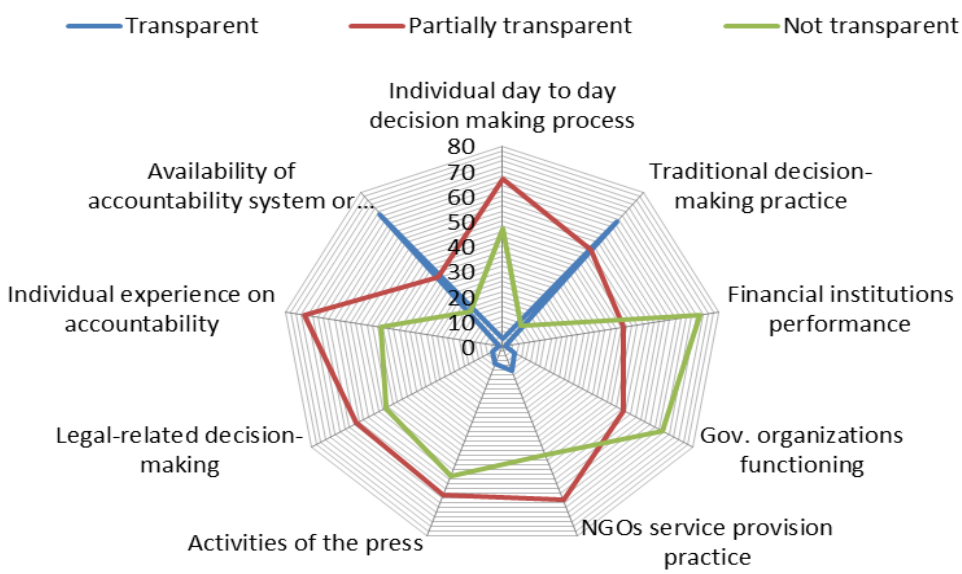


Figure 5-18: Level of transparency in the Afar region of the Awash river basin, Ethiopia

The result of data analysis (Chapter 6 of §6.10) shows that the level of openness in the region is partially transparent (see Table 5-22).

Table 5-22: Local level transparency status analysis variables summary

No.	Transparency Variables	What to analyse?	Findings	Description (Grading the positives)
1	Financial institutions' performance	Finance	Not transparent	D
2	Individual day-to-day decision-making process	Decision	Partially transparent	C
3	How Government organizations are functioning.	Government	Partially transparent	C
4	NGOs' service provision - see notes on local and international NGO comments.	NGO	Partially transparent	C
5	Activities of the press/media.	Media/press	Partially transparent	C
6	Legal-related decision-making	Justice	Partially transparent	C
7	Individual experience of accountability.	Individuals	Partially transparent	C
8	Traditional decision-making practice.	Tradition	Transparent	A
9	Availability of accountability system or tradition.	Accountability	Transparent	A
	Summary		**Partially transparent**	**C**

The result shows that most respondents agreed that local NGO's are not transparently working as compared to international NGOs. The Afar's tradition is more democratic and transparent by nature. Most of the time, this positive tradition contradicts the process of government administration, which is not equally transparent. As a result of this, the communities are dissatisfied with the current administration.

B. Comparing Local Interactivity, Openness and Information Transfer

In Chapter 6 (§6.10.3.3., Table 6-78), the data shows that 54% of respondents agreed that the level of interactivity is decreasing due to strongly-decreasing and low levels of information flow among the stakeholders occurring as a result of conflicts. Figure 5-19 shows the level of openness in the Afar Region.

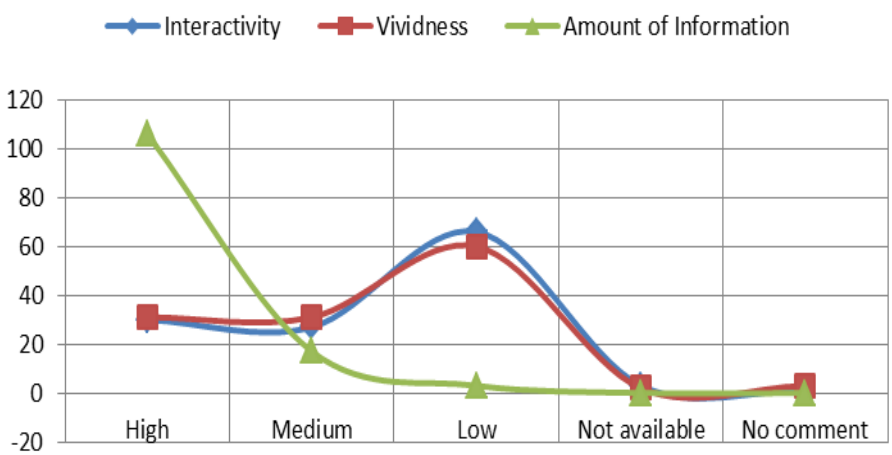


Figure 5-19: Interactivity, vividness and the amount of information

C. Comparing the Status of Interactions among Members of the Communities

Proceeding from the ideas to be introduced in Chapter 6 (§6.3.2) and those set out in Chapter 2, the literature review, transparency and conflicts have an inverse relationship. Figure 5-19, above, Figure 5-20, following, show that local communities interact suddenly and take actions based on their traditional beliefs. A majority of the people in the region do not prefer frequent interaction based on emotion and plans. When it is required, they prefer to take sudden actions.

Figure 5-20: Comparing frequent ways of interaction among communities

5.4.7 Contribution to Sustainable Development Data Analysis Output

A. Main Results on Sustainability Data Analysis Output

Table 5-23: Local level sustainability status of SRCDF variables summary

No.	Sustainability Variables	What to analyse?	Findings	Grading the positives
1	**Communities' view**			
	Sustainability of Conflict Diversity Factors (SRCDF) for Communities	Communities view, contribution, participation and satisfaction on sustainable development of water resources (SRCDF)	Neither satisfied nor dissatisfied (54%)	**C**
2	**Institutions' view**			
	Sustainability of resources and conflict diversity factors for institutions (SRCDF)	Institutions view, contribution, participation and satisfaction on sustainable development of water resources (SRCDF) [Extent of problems]	Large number of problems (44%)	**D**
	Summary view		Not sustainable	D

B. Institutions View on SRCDF

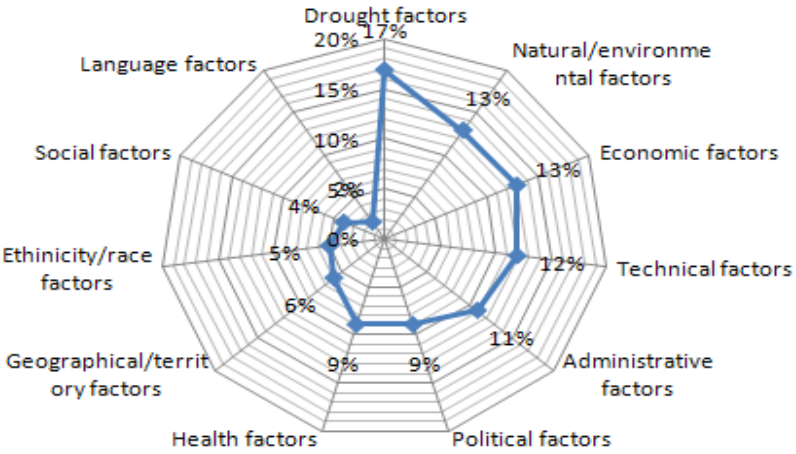


Figure 5-21: Percentage of high extents of the problem-related SRCDF

C. Community View on Activity, Participation and Satisfaction towards Contribution to Sustainable Development

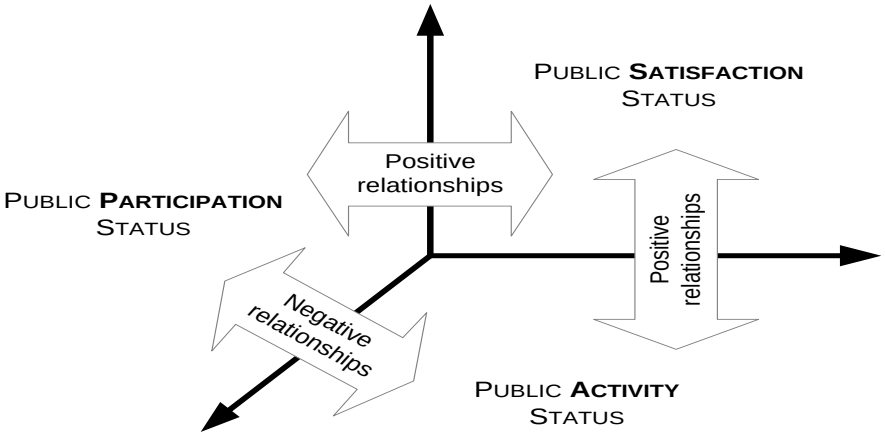


Figure 5-22: Communities activity, participation and satisfaction towards SRCDF

Figure 5-22 shows that the correlation between communities' activity on sustainable development and the rate of participation is negative. The communities did not fully engage in the development activities, which widens the gap between the two variables. However, Chapter 6 (§6.11.3.1, Table 6-85) shows information on local people's contributions. For instance, there was a relatively high level of environmental protection activities as a result of a national campaign on planting tree seedlings. This positive participation in environmental protection provides great confidence among the communities in sustainable development. Sustainability, which is a key part of the aim of this research, has a positive impact in reducing local water conflicts.

D. Descriptive Notes on Trends of Major Problems that Affects the Sustainable Development of the Region

The local administration and government policy in general was closely related to the political accommodation of different ethnic groups. However, most respondents were dissatisfied with the way political representatives and administrators were handling the situation. As a result, most members of the Afar tribe prefer their old traditional governance system as compared to modern ways [Socio-economic diversity factors].

Table 5-24: Trends of major problems that affect sustainable development in the region

Types of major problems		Trends of occurrence of the problems
1	Shortage and lack of drinking water supply	Always
2	Exposure to drought	Every year
3	Severe famine occurs	Every year
4	Social and political conflicts	Every one or two years
5	Disease outbreak	Every two years
6	Damage to animal species	Some every year

5.4.8 Early Warning Activities and Prediction Services Data Analysis

A. Main Results on Local Early Warning Services Data Analysis Output

Table 5-25: Early warning services analysis variables summary

Early Warning Services Variables	What to analyse? [Maximum/the most frequently occurring]	Description (findings)	Description (Grading the positives)
1. Communities:		**Medium**	**C**
1.1. Local Prediction Acceptability.	Status of traditional practice on early warning.	High [74%]	B
1.2. Types of local early warning practices.	The most frequent types of local EWP practice.	Conflict, war, arbitration and reconciliation and weather [50%]	C
1.3. Who participates in local early warning prediction practices?	Who participates in local early-warning prediction practices?	Local/tribal elders [82%]	B
1.4. Awareness of COSTS of CONFLICTS for early warning prediction activities.	Awareness of costs of conflicts.	Partially [44%]	C
1.5. Awareness on WRM, environmental protection and flood control activities.	Level of community participation.	No comment (Not available [54%]	D
1.6. Awareness on sponsor institutions in the region.	Local communities' awareness on sponsoring stakeholders.	No comment/ Not available [55%]	D
1.7. Local communities' participation area.	Local community participation status.	Yes [65%]	B
1.8. List of local plan, intention and threats forwarded by communities.	Water supply, irrigation dams, flood control, wetland protection and pastoral development.	Moderate [49%]	C
2. Institutions:		**Medium**	**C**
2.1. Water resources utilization and identified problems:			D
2.1.1. Water Supply Status,	Water supply status.	<500 m^3/person [43%]	D
2.1.2. Water Supply problems.	Water supply problems.	General management problems [44%]	D
2.2. Water and sanitation coverage:			B
2.2.1. Water supply coverage,	Water supply coverage.	Increasing [96%]	A
2.2.2. Sanitation coverage.	Sanitation coverage.	Increasing [46%]	C
2.3. Awareness and consideration of timely warning [EWS-LT].	% of institutions expressed their practice on EWS.	Below average [46%]	In between 'C' and 'D'
2.4. Status and acceptability of traditional knowledge and practices on EWS.	Status and acceptability of traditional knowledge and practices on EWS.	Stable [63%]	C
2.5. Local security situations related to disputes over water or any other natural resources.	Local security situations related to disputes over water or any other natural resources.	Afraid to comment on this topic [39%]	D
2.6. Awareness on costs of deliverable services and conflicts.	Awareness gap analysis.	Partially informed-medium [30%]	C

Early Warning Services Variables	What to analyse? [Maximum/the most frequently occurring]	Description (findings)	Description (Grading the positives)
2.7. Views on stakeholders' participation on setting water services tariffs.	Rate of agreement.	Disagree [57%]	D
2.8. Institutions' awareness of EW - projects related to water resources management, environmental protection and flood control activities			C
2.8.1. Level of awareness	Level of awareness	High [32%]	B
2.8.2. Awareness on sponsor institutions in the region	Local communities awareness on sponsoring stakeholders	Government [51%]	C
2.9. The aim that helps to eliminate or reduce violence and human crises	Availability of tools, plans or methods	Not available [43%]	D
Rating communities' and institutions' awareness on EWS		**Mean (C, C)**	**C**

B. Categories of Some of the Major Traditional Prediction Services in the Region

The survey respondents indicated that modern methods of drought prediction practices made by government institutions do not show the reality and are not fully acceptable to local communities. However, there is no valid evidence to support this opinion. The following are some of the traditional prediction services practised in the region.

- **Gignili' (male) or 'kaluwale' (female) -** is a fortune telling Afar tribal tradition mainly accepted and respected for the prediction of any political, social and related events.
- **'Buta'a'** – Afar traditional ways of prediction to search for a lost person and make market predictions for livestock.
- '***Dhaagu*'** – helps to move livestock whenever there is information about any epidemics within a radius of 100km. Today, this tradition is distorted by politicians for their political benefit. However, the system has a strong cross-checking mechanism.
- '**Hitokobiya'**: traditional ways of astrology used for predicting the future of the local people and environment including development, disaster, war, etc.

C. Specific Method- Traditional Tools Used by Local Communities for Drought-Prediction Purposes

Table 5-26 gives summary data of Chapter 6 §6.12.2 (Table 6-93 on traditional prediction practice) and shows that Afar pastoral communities mainly use traditional practices for drought predictions. While the majority of the community are pastoralists, about 50% of their main prediction come from observation of domestic and wild animals and birds. The detailed lists of the categories are displayed below.

Table 5-26: Categories of traditional observation for drought prediction practices

No.	Categories of observation for prediction	Number of list (sub categories)	Percent
1	Domestic animals	6	27.2%
2	Wild animals and birds	5	22.7%
3	Wind and tornado	3	13.6%
4	Astronomy	**3**	13.6%
5	Weather	1	4.6%
6	Trees	1	4.6%
7	People	1	4.6%
8	Food consumption	1	4.6%
9	General observation	1	4.6%
	Total	22	100%

D. Purposes of Traditional Prediction Services (EW) in the Afar Region

This section describes and summarises the survey and interview data about the availability of the traditional early warning prediction practices of local communities in the region. Table 5-27 contains a list of data where 58% of respondents claimed that conflict prediction custom as one of a major traditional EW practices.

Table 5-27: Summary of traditional early warning services/practices

Summary of local EWP Practice					
No.	**Purposes of local EWP Practices**	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
1	Conflict, war, arbitration and reconciliation	61	41.8	58.1	58.1
2	Weather	12	8.2	11.4	69.5
3	Drought	8	5.5	7.6	77.1
4	Communities/personal livelihood-related	7	4.8	6.7	83.8
5	Fortune telling	6	4.1	5.7	89.5
6	Astrology	4	2.7	3.8	93.3
7	Cattle pasture situation	2	1.4	1.9	95.2
8	Identification of robbery/theft	1	0.7	1	96.2
9	Livestock market	1	0.7	1	97.1
10	Migration	1	0.7	1	98.1
11	Mythology (traditional story)	1	0.7	1	99
12	Water supply situations	1	0.7	1	100
	Total	105	71.9	100	
	Missing	41	28.1		
	Grand Total	146	100		

E. Status of Modern Methods of Prediction Practices in Institutions

Table 5-28 shows a summary of the collected data in which 43% of respondent institutions agreed that there were no forecasting tools, plans and methods useful in the process of avoiding or reducing violence and human crises at local level during the last 5 years.

Table 5-28: The aim that helps to avoid or reduce violence and human crises

	Tools Plans Methods	Availability Check				Total
		Available	Partially available	Not available	Not sure	
1	Forecasting Plan	2	1	5	2	10
2	Forecasting tools	1	1	5	2	9
3	Forecasting methods	1	3	3	1	8
4	Preparedness action-plan	2	3	2	1	8
	Total	**6**	**8**	**15**	**6**	**35**
	Percent	**17%**	**23%**	**43%**	**17%**	**100%**

5.4.9 Availability of Local Preparedness Data Analysis Output

A. Main Results on the Status of Local Availability for WEC Preparedness

Table 5-29: Summary of local preparedness availability and awareness analysis variables

Category	Description	Status	Grading the positive aspects
Local Experience	Communities' and institutions' local or traditional experience, on activities related to WRD, early warning and conflict resolution practices.	Minimum	D
Location Identification	Identification locations and main reasons for study.	The entire Afar Region, Zones 3 and 5	A
Community Participation	Communities' participation and awareness of local water-resource-development-related study/research in the area.	Not available-74%	D
Water Security Plans	Local institutional practices, awareness or concerns related to the water security plan.	Moderate-38%	C
Policies And Strategic Plan	Availability of water resources management policies and strategic plan that are useful for local communities.	Prepared and available at Federal level only	D
IWRM	Integrated water resources management.	Not satisfactory	D
WRM	Institutions' efficiency and mandate on activities related to water resources management.	Inadequate mandate (25%)	D
Cumulative grade (assuming all conditions have equal values)		Moderate	

B. Local Opinion/Recommendations of Specific Areas in the Region for Further Study or that Require more Attention

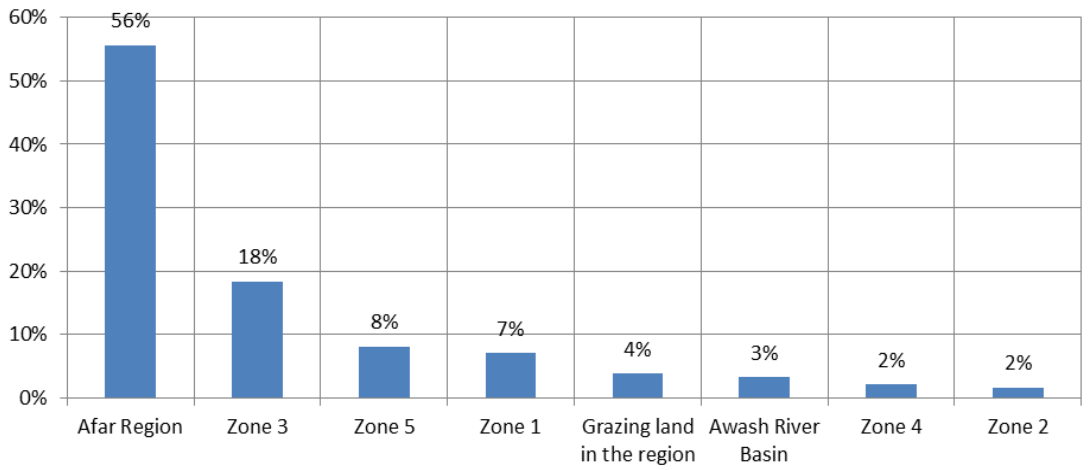


Figure 5-23: Local people proposed area for studying the reduction of local conflicts

C. Frequency and Areas of Concern by Local Community (Opinions of the Public for Recommending the above Specific Location)

Table 5-30: Summary of analysis of key words on public reasons for recommendation of locations for further study/research

Keywords Reason Summary	Frequency	Percent	Valid Percent	Cumulative Percent
Water	101	55	54.6	54.6
Conflict	54	30	29.2	83.8
Water supply and grazing	18	10	9.7	93.5
Displacement and settlement	3	2	1.6	95.1
Grazing	3	2	1.6	96.8
Livelihood and population	3	2	1.6	98.4
Ethnic boundaries areas	2	1	1.1	99.5
Central location for many tribes	1	1	0.5	100
Total	185	103	100	

5.4.10 Summary of WEC Data: Observation and Analysis

Table 5-31 summarises and presents the major data observation and analysis of the results of the 10 major WEC variables presented at Chapter 6 (§6.3.2) and Chapter 3 of the framework of the study. The consolidated results of the data as compared to fundamental assumptions stated in Chapter 6 (§6.11.3.1, Table 6-85) show that the region is exposed to conflicts. The data contributes to understanding the status of pre-identification, preparedness and early warnings of local water conflicts in the region.

Table 5-31: Local water conflict EWS major variables summary

No.	Categories of major variable	Description	Status	Grading the positives
1	Vulnerability	Daily labourers, farmers, having no job -jobless, pastoral nomads and pastoralists.	Majorities of the communities are vulnerable.	D
2	Awareness	Awareness of resource ownership, information use and analysis, costs of conflict effects and water tariffs.	Minimum level of awareness.	D
3	WEC Information	WEC information availability and preparedness status.	Minimum level of awareness and preparedness.	D
4	Risks and hazards	Rate of exposure to risks and awareness of risk-reduction activities.	High level of exposure to risks.	D
5	Communication and networking	Communication and networking problems in the basin within communities sharing the resources.	Minimum - (Encouraging communication but low level of networking and high intensity of conflict problems among different tribes in the region).	D
6	Cooperation	The rate of cooperation among communities and institutions consisting of different clans and tribes in the river basin.	Unsustainable and average level of cooperation between stakeholders in the basin due to low level of networking.	C
7	Transparency	The status of local communities and stakeholder institutions experience	High levels of traditional transparency practices were affected by other factors related to governance, finance, media and justice system (Partially transparent).	**C**
8	Sustainability	Communities' and institutions' views, contribution, participation and satisfaction with the sustainable development of water resources (SRCDF).	Not sustainable.	**D**
9	Early warning services	The status of local-based early warning services implemented by communities and concerned institutions.	Moderate level of awareness of local WRD practices, EWS, understanding of cost-effects of pre- and post-conflict problems (Medium).	C
10	Availability of preparedness	Status of awareness and experience on reducing, resolving and managing problems related to WRD, early warning and conflict resolution practices	Moderate.	C
	Mean		***Exposed to conflicts***	***D***

5.5 List of 180 Local Opinions on Main WEC Problems

The fourth **research questions** of the framework of the study - "**What are the main hazards, risks and costs associated with local water-conflict-related problems?"-** helps in identifying key problems that are creating different levels of pressure on communities, which are a cause of local conflicts. Under this section, the researcher has organized lists of 180 major WEC problems that have been collected from local communities and institutions. Most of them are key problems related to water supply, conflict and early warning services. In particular, most of them are related to livestock, water consumption and water-saving practices, water resources, water quality, irrigation and hydro-climatic prediction information. Table 5-32 below, lists the problems and the level of intensity related to water, conflict and early warning services in the Awash River Basin of the Afar region, Ethiopia. The level of the intensity of the problems are marked by 'H', 'M' or 'L' indicating '**H'** for **High intensity, M** for **Medium intensity** and **L: Low intensity**. It was prepared based on the interviews and survey results from local communities and institutional respondents participating in the process.

Table 5-32: Local opinions on the size and categories of WEC problems in the region

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
I. Local conflict- related problems (8H, 10M, 8L)		
H	*#1.*	Major conflict with neighbouring Eritrea that was primarily caused as a result of issues related with the federal government and still affecting the local communities in the region directly.
H	*#2.*	Major conflict with Issa (Somali) tribes that has existed for over 70 years. There is no clearly demarcated border between the Afar and Issa tribes. The main causes of this tribal conflict in border areas of the regional administration are due to grazing land, water resources and expansionist interests. "Afars and Issa tribes act like a rat and a cat. Originally, they belong to the same family and are difficult to identify based on physical appearance. One can identify them based on the language they are speaking only. Yearly, more than 10 incidents occur between the two tribes." (COM-2). "Issas do not want to see Afars in any area and go heavily armed whereas Afars defend themselves on their own land"- COM-81. The main conflicts in the region are between Afar and Issa/Somali tribes over control of water resources, wetlands and grazing lands. These conflicts mainly occur on the main road from Addis Ababa to Djibouti located in the basin. In addition, the border conflict between Ethiopia and Eritrea has direct effects on the local communities of the region. Furthermore, tribal politics also fuel conflicts within the Afar clans and between Afar and other neighbouring tribes.
L	*#3.*	Minor conflict with other neighbouring tribes such as Amhara, Arguba, Oromo and Tigre. "With Oromos the conflict is not so serious. Some time ago, a boy from Afar killed a neighbouring Oromo tribe. On behalf of this a father from Afar killed his own son who killed the Oromos in seeking peace with the neighbouring communities [*sic.*]" (*Source*: respondent: COM-81).
L	*#4.*	Minor conflict within Afar clans.
M	*#5.*	Conflict with big government-run projects that affect the resources of the local community. Especially, people were unhappy over sugarcane plantations established on fertile grazing lands though they are paid compensation money for leaving the land.
L	*#6.*	Conflict as a result of incompatibility between traditional and modern

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
		administrations.
M	*#7.*	Conflict over unfair competition between businesses run by government-affiliated parties and businesses run by local people.
M	*#8.*	Conflict-image conflict… most urban residents in the region and those coming to the region view the Afar pastoral communities as arrogant, killers and terrible makers (feeling them inferior and themselves superior). In contrast, the Afar pastoralists also look on others as uneducated terrible makers (feeling themselves superior and others inferior).
M	*#9.*	Conflict over the use of natural resources policy including water, grass and land… traditionally land is owned by local people whereas the government policy is that land must be owned by the government.
H	*#10.*	The main road that leads from Addis Ababa to the port of Djibouti is insecure. In most cases heavy truck drivers, local people and members of the police force have died. This has a negative impact on the development of the region in general.
H	*#11.*	The geo-political environment of the region is exposed to conflicts. Among 36 Wereda (Districts) of the region, 30 (91%) of them are sharing borders with other regions or have international boundaries.
H	*#12.*	Unpredictably, conflicts in the region sometimes increase during the flooding season and drought season at the time when there was a lower water discharge rate. *Source*: Expert from Afar Water Resources Bureau.
M	*#13.*	Currently, 90% of the population in the Afar region are living in rural areas. Only 10% live in urban areas. Most people in urban areas are not local indigenous people. Due to sugarcane plantations, many people are coming from other areas. The local people have shown their fear that this is an indirect way of settlement in the region and are afraid that they will become a minority in their own local land. This is a developing conflict between the government and the local community.
M	*#14.*	Conflict of interest on prioritising local communities' farmland during the flood protection dam construction work season (Lower Awash Basin Office). However, the bureau is working for the satisfaction of all people in agreement with traditional leaders.
L	*#15.*	Temporary break of works because of social problems until the conflict is resolved. Sometimes clashes occur between the workers and local community members.
L	*#16.*	Conflicts between the old and new investors in irrigation projects regarding the distribution of water. These also include the local communities.
L	*#17.*	Illegal immigrants that want to travel to Arab countries are illegally coming from other regions of the country. The situation has created a tense scenario and has a negative impact on the security of the local pastoral communities.
M	*#18.*	People have a great fear of talking about politics. They are afraid of the government. This makes the community very unhappy. The situation contradicts openness, which is part of their tradition.
H	*#19.*	Most of the grazing lands suitable for agriculture was taken and controlled by the government and government-affiliated business organizations. The local communities developed negative attitudes towards this situation and highly disagree with concerned bodies in the region.
L	*#20.*	Conflict between the local people and government regarding the recognition of handgun use.
H	*#21.*	Contradictory Opinion Problems: Local endemic respondents say the Federal government wants conflict and instability to occur in the region due to its ethnic, federalism-based, political policy and governance. On the other hand, people who came from other places and are living in the same local area say that local administrators want conflict in the region whereas the federal government does not. The local administrators see conflict as a means of income generation that takes place during the resolution process (*Source*: INS-8).

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
M	*#22.*	Inadequate mediation service providers between neighbouring and inter-regional conflicts.
L	*#23.*	Inadequate level of tolerance among the people in the basin.
H	*#24.*	Pastoralist movements increase greatly during the drought season with the result that conflict escalates during these seasons.
M	*#25.*	There is decreased reliance on traditional regulations on resource utilization. In the past, major conflicts did not occur within the members of the Afar tribes due to the availability and implementation of 'Fima': a strong local, traditional, disciplinary, law institution.
M	*#26.*	In urban areas, access to a water supply is by far better than for rural pastoralists. As pastoralists have been the majority of the Afar community, their difficulty in getting pure water increases their dissatisfaction with the existing system of governance. Most of the water resources in the region are highly polluted, odourless and colourless. They travel a maximum of 60-70km in summer, and a minimum of 10-15km in winter to find drinking water both for the people and livestock.
II.	**Water resources-related problems (9H, 13M,3 L)**	
H	*#27.*	Water shortage; reduction in water resources due to drought-related problems; decrease in water discharge rate; lack of pure underground water, unavailability of underground water.
M	*#28.*	Recurrent drought causing shortage of surface water and affecting water discharge rate in underground water.
M	*#29.*	Loss of the scarcely available water supply because of different man-made reasons such as improper use of water resources and poor management.
L	*#30.*	Over-utilization: Over-exploitation and misuse of water by the local community due to lack of awareness.
M	*#31.*	Inadequate flood protection system causes many problems for the people.
M	*#32.*	Lack of an adequate surface and ground water resources map at the regional level.
H	*#33.*	There was a wide range of water supply shortage problems and narrowness of grazing land mainly during the winter season. Most pastoralists believe that the water shortage problem is not good for political stability in the region.
M	*#34.*	Problem in identification and selection of appropriate water points/sites.
M	*#35.*	Landslides. Boreholes were frequently damaged due to natural landslides. In the past, the boreholes were operating for about 30 years without any problem. Now-a-days geological formations in the region are changing rapidly and the problem occurs frequently.
M	*#36.*	Drying-up of springs, rivers, shallow wells and boreholes due to high temperature.
H	*#37.*	Some water points do not give water during dry seasons.
M	*#38.*	Rivers and ground water resources have started drying-up and need the construction of dams everywhere.
H	*#39.*	Low rainfall.
M	*#40.*	Delta river type.
H	*#41.*	High amount of siltation also a big problem for water quantity.
H	*#42.*	High level of corrosion of the water pipes.
H	*#43.*	Lack of appropriate water pumps in the local market compatible with the local ground water temperature that exceeds 52°C.
H	*#44.*	High evaporation rate and deep percolation also affects the quantity of water supply.
M	*#45.*	Lack of sufficient effective water reservoirs.
H	*#46.*	Some water points are very salty.
L	*#47.*	Any water resources in Ethiopia are owned by the government and in some areas by the public/communities. The UWSS (government) mainly controls water resources in urban and semi-urban areas. This reduces communities' responsibilities in protecting the resource adequately.
M	*#48.*	People are not protecting wetlands. Moreover, they are closing wetlands in

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
		order to keep their environment safe from malaria.
L	*#49.*	People are using traditional knowledge to search for water supply sources. There are no formal mapping facilities for the identification of water sources in the region.
M	*#50.*	In the past, a borehole operated for about 30 years in the region. Nowadays, many boreholes are destroyed much more quickly. The area is also exposed to great geological changes.
M	*#51.*	There is no regulation on surface water flow monitoring both at federal and regional levels. There is a federal regulation on water quality control. *Source*: Afar Water Resources Bureau.
III. Administration, finance and coordination-related problems (3H, 17M, 1L)		
M	*#52.*	General administrative problems.
M	*#53.*	Lack of proper administration of water resources.
M	*#54.*	Lack of efficient or well-organised municipalities.
M	*#55.*	Inadequate coordination between water, hygiene and sanitation-related activities.
M	*#56.*	Inadequate environmental impact assessment studies on large projects implemented in the area.
M	*#57.*	Lack of organizations who effectively work on the socio-economic activity of the region.
H	*#58.*	Lack of accountability.
H	*#59.*	Lack of capacity on water quality assurance.
M	*#60.*	Weak cooperation between Federal and Regional governments.
M	*#61.*	Weak coordination among institutions working on EWS.
M	*#62.*	Lack of coordination of various sectors during construction works creates many problems for the water quantity of the region.
H	*#63.*	Lack of an adequate budget for improving the quality and quantity of the region's water supply.
M	*#64.*	The incompatibility of the high cost and poor quality of water pumps and generators.
M	*#65.*	Lack of efficient follow-up for hand-dug wells exposes the water to pollution.
M	*#66.*	Lack of appropriate priority for water sector development in the region.
M	*#67.*	Lack of a community participatory approach in activities related to water sector development projects causes many problems and hampers the project implementation.
M	*#68.*	Lack of committed and competent leaders. The persons who are appointed to administrative positions have no commitment and are not accountable.
M	*#69.*	Absence of law enforcement to maintain water quality in the absence of a strong water use policy.
L	*#70.*	Ignorance or inadequate awareness of local water resources administration.
M	*#71.*	Weak watershed management practices.
M	*#72.*	A problem with transparently communicating information by administrators who work for government organizations (Investment Office).
IV. Water quality related problems (9H, 1M, 1L)		
H	*#73.*	Lack of pure underground water. Naturally, the ground water has a high fluoride and chloride (salty) content. Many people's health in the basin has been affected by this problem. There is a serious problem of water quality due to the fluoride, salt and trace element rich chemical composition of the ground water.
H	*#74.*	The water resources are also polluted by upstream chemical and tannery wastes. The molasses from the sugar factory is also dumped in the river. The people and livestock downstream are affected by these problems.
H	*#75.*	High temperature of the water. The temperature of the ground water resources can go up to 52^0C. Sometimes it kills camels and other livestock when they drink such hot water.
H	*#76.*	Shortage of water purification chemicals and materials. There is no water treatment facility (much sediment visible, no supply pumps).

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
H	*#77.*	The use of stagnant ponds of water for humans and livestock, without first devising a separate mechanism for the livestock so that they will not enter and pollute the water.
H	*#78.*	Constructing toilets near pipelines of the water distribution system in urban and semi-urban areas.
H	*#79.*	Number of people who drink polluted water is greater by far than those who have access to a pure water supply (*Source*: LCOM-2).
H	*#80.*	Lake Basaka in the Awash River Basin has a high fluoride content. Furthermore, 2% of the water from the lake is discharged into the Awash River. Moreover, an increase in the size of Lake Basaka would critically damage the population, resources and eco-system of the area unless immediate measures are taken. The problem cannot be resolved locally without the support of national and international concerned bodies.
L	*#81.*	According to local opinion, in some areas, agricultural production is reducing due to the polluted water supply.
H	*#82.*	Ground water in the Afar region is mainly salty and difficult to use for domestic purposes.
M	*#83.*	Laboratory technicians from the MoWR are coming to take water samples from the upper and lower Awash River Basin areas in order to monitor it at head office in Addis Ababa. The only water lab in the region and for the lower Awash basin is located in Werer and serves the Middle Awash only.
V. Water consumption and saving practices (2H, 7M,0 L)		
M	*#84.*	There are limited water resources in the area.
M	*#85.*	The same water sources are commonly used for household, farming and livestock, including wild animals.
M	*#86.*	Traditionally, the local pastoralists are armed to protect themselves from wild animals and disputes with neighbouring tribes (Somali-Issa, Oromo-Kerreyu…) over water and grazing resources.
M	*#87.*	Water resources are not the main problem as compared to the key problem related to poor water supply services.
M	*#88.*	The majority of the population in the region are Muslims. Water use for Muslim religious purposes must fulfil at least two criteria according to traditional leaders: It should be odourless and can be used if the sources of water have a minimum of over one barrel (100 litres) of water. This tradition was not efficiently incorporated in improving the water supply and sanitation facilities in the region.
M	*#89.*	People in urban areas get clean water as compared to rural communities. In urban and semi-urban areas, people pay for the use of a water supply. In rural areas pastoralists have a tradition of free water use. This tradition has an impact on future water cost recovery and management practices.
M	*#90.*	People usually fetch water during the evening due to high daytime temperatures in the region.
H	*#91.*	In the past, communities could save water for at least five months. Today, the situation has changed and saving, even for a month, is very difficult due to the water scarcity problem.
H	*#92.*	Pastoral communities cannot carry water using a barrel. They fetch it every day with a traditional water collection **vessel** called a 'Saar', which is made from goat skin and very useful for cooling water. There is no efficient water storage system in pastoral communities. This comment contradicts the points discussed in bullet number 1.
VI. Major problems that Increase the vulnerability of people in the region (4H, 5M, 0L)		
H	*#93.*	People from all over the country use the Afar region as an illegal hub in order to leave the country illegally to Yemen and other neighbouring countries. Mainly people from the tribes of Oromo, Tigre and Amhara come to the region to go out illegally. This increases the insecurity of the region and, as a result, creates tensions for the local people. Local people are dissatisfied with this situation.

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
M	*#94.*	Individual and community migration to other areas.
M	*#95.*	Displacement and dislocation of the local community.
M	*#96.*	Increase in homelessness as compared to past times, although it is not a major problem.
M	*#97.*	The Awash River floods every year frequently and devastates the population causing damage to property and loss of houses.
H	*#98.*	Hunger and poverty: In most cases, pastoralists do not care about politics as long as the local water, grazing land and other natural resources are protected and not affected. Their main problem is poverty and this is currently a serious problem in the region.
H	*#99.*	Human loss/ death of human beings.
M	*#100.*	Increase in urbanization of the residents who were originally pastoralists.
H	*#101.*	Economic-related problems.
VII. Human health-related problems (7H, 1M, 1L)		
H	*#102.*	The growing industrial area in the region is overpopulated by the number of labourers coming from the upstream area. The sanitation facilities for these people were not effectively prepared in advance. Because of this, local people are exposed to many transmittable diseases such as diarrhoea and cholera. The local people say that the increase in investment opportunities in the local area also damaged the health of the local community.
H	*#103.*	Increase in 'Shisha' smoking. Traditionally, this was not known previously by local people. It is believed that it affects the young generation and the economy of the local people.
H	*#104.*	Death of children caused by malnutrition.
M	*#105.*	Diarrhoea.
H	*#106.*	Malaria.
H	*#107.*	Increase in HIV/AIDS.
L	*#108.*	Occasionally, exposed to outbreaks of cholera due to shortage of clean water.
H	*#109.*	Poor supply of medicine for both human beings and livestock.
H	*#110.*	Increase in the number of people having mental or psychological illness in the region.
VIII. Livestock-related problems (7H, 1M, 1L)		
H	*#111.*	Shortage and/or absence of pasture for cattle.
H	*#112.*	Many livestock died due to lack of grazing land and water shortage that occurs as a result of severe drought problems.
H	*#113.*	Livestock disease.
M	*#114.*	Farmers in the region have a few quality livestock whereas pastoralists have many but poor quality livestock due to the lack of an adequate livestock health facility in pastoral areas.
H	*#115.*	Animal production decreases due to shortage of animal feed.
H	*#116.*	Migration of wild life due to deforestation.
H	*#117.*	Disappearance of some species, such as the disappearance/death of wild donkeys, horses and chickens. Traditionally, having chickens and livestock is the sign of wealth.
L	*#118.*	Camels and goats are very popular animals in the region as compared to others. The Afar pastoralists have limited options and prefer camels and goats because they can eat dry grasses and live anywhere for a long time without water. Cattle and sheep are a secondary choice because they need grass to survive, live by riverbanks and are hard to rear.
H	*#119.*	Calves are considered as members of the household and lots of care is given to them. Traditionally, issues related to women, children and calves lead to serious conflicts. Calves consume the same water supplies as human beings.
IX. Information on security-related problems (3H, 3M, 2L)		
H	*#120.*	Increase in thefts of camels and livestock. The researcher witnessed a lady who had been searching for lost camels and goats.

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
H	*#121.*	The problem of political instability in the region.
M	*#122.*	The regional administrative and security affairs experts do not have access to statistically validated data regarding vulnerable people in the region.
M	*#123.*	Lack of data inconsistency related to water resources… and from the Regional Water Resources Development Bureau.
L	*#124.*	Suspicious predisposition.
M	*#125.*	Lack of secured technical knowledge.
L	*#126.*	Misconception of the role of Afar Administration Justice and Security Affairs Bureau. It is considered to be a service for militaristic purposes.
H	*#127.*	Politics as a problem: The respondents to these questionnaires believed that government diverts people's attention from asking economic and political questions by magnifying ethnic-related issues. Because of this, many conflicts occurred due to many ethnic-based political parties and election-related problems. Many people said that there were many political prisoners in the country. Some said "I do not want to talk about politics because I am afraid of it". Religious leaders become politicians and people are not happy with that.
X. Natural resources and nature-related problems (5H, 2M, 1L)		
H	*#128.*	Deforestation – local people are extremely unhappy with the high level of deforestation that is being undertaken to benefit agriculture in the region, mainly for state and private farming activities. Traditional ways of charcoal production for business activity is one of the income sources and it is a cause for losing many endemic trees. The pastoral communities are unhappy at loosing endemic plants and grazing lands because their day-to-day life is dependent on these natural resources. As a result, the process frequently fuels local conflicts in the region. The respondents agreed that 80% of the forests and wild animals were lost and many local people believe that most wild animals migrated to Kenya.
H	*#129.*	There has been little rain in the region due to climate change and related problems; lots of dam construction in the upper reaches of streams and around the riverbanks has destroyed many parts of the natural forests. There was lots of disagreement on the utilization of natural resources due to their limited availability.
H	*#130.*	There is a plant called 'Woyane' that consumes more water and has negative impacts on the land and water resources of the region. It damages any other nearby plants. It is believed by local people that the plant can be destroyed by burning only. Farm Africa, an NGO supported by the UK, has been working and supporting the communities in avoiding these trees. Eucalyptus is another tree that consumes lots of water that does not get more recognition by local communities.
L	*#131.*	Forest fire damaging the resources.
H	*#132.*	Wood charcoal production for income generation.
H	*#133.*	Deforestation for firewood for household energy. Deforestation for charcoal and sugarcane state farms.
M	*#134.*	Lack of efficient conservation of natural resources caused an increase in temperature.
M	*#135.*	Volcano, earthquakes and landslide problems.
XI. Irrigation and Agriculture related problems (5H, 2M, 0L)		
H	*#136.*	Large-scale irrigations canals and dams are constructed by MoWR at Federal level. During the construction works, there was no adequate cooperation with the Regional Water Bureau. However, when a problem arises only then do they consult the Water Bureau. This approach was not more successful in resolving development related problems in the region.
H	*#137.*	Pastoralists' grazing land was over taken by government projects for sugarcane plantations. This caused a loss of pastoral and agricultural land owned by local communities and led to many complaints from local people. Compensation money was paid to pastoralists but they are not satisfied.

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
M	*#138.*	Local people are not happy by the sugarcane plantation. They prefer maize, cotton and other types of plantation. They say sugarcane is not useful for both themselves and their livestock.
M	*#139.*	Crop failure and lowered productivity.
H	*#140.*	Damage on fertile farm lands located around rivers banks; and increase in dry land.
H	*#141.*	Decreasing number of the local private farming activities in the areas of maize and oil seeds production due to inadequate level of water supply management problems. The production of these seeds requires a high level of water management practices (*Source*: Bureau of investment).
H	*#142.*	The communities are highly dissatisfied due to limited water supply for irrigation occurred as a result of a lot of water usage and dam construction at upper stream areas.
XII. Planning-related problems (1H, 5M, 0L)		
M	*#143.*	Lack of vision and planned activities.
M	*#144.*	Absence of frequent analysis.
M	*#145.*	Under or over estimation of costs.
M	*#146.*	Projects based only on water supply coverage. There is a lack of system to educate the community about water resources management.
H	*#147.*	Designing water supply projects without detailed survey of the socio-economic condition of the area concerned.
M	*#148.*	Lack of participatory planning during project design (local community participation)
XIII. Communication and cooperation-related problems (1H, 4M, 1L)		
M	*#149.*	Existence of a technological and institutional communication gap between Regional Office and Wereda Office (e.g., Wereda Net is not effectively functional in the region).
M	*#150.*	In the region, water scheme information was collected separately by the Water Bureau, the Economic and Finance Bureau and private water consultancy firms. This creates a problem in getting accurate data as well as a wastage of resources.
M	*#151.*	There were communication problems and information gaps among government organization employees working at both high and low levels (Regional and District). The communication gap problem was serious during the construction of water supply distribution systems.
L	*#152.*	Sometimes, language is a barrier to communication between local communities and people from other areas.
H	*#153.*	Lack of transportation.
M	*#154.*	Less integration with stakeholders e.g. industry.
XIV. Construction, operation and maintenance-related problems (5H, 0M, 0L)		
H	*#155.*	Using non-standard materials during the construction phase (water tankers and pipe fittings).
H	*#156.*	Poor operation and maintenance; lack of technical personnel for maintenance of machinery and water pumps.
H	*#157.*	Lack of rehabilitation and maintenance work on ponds and surface water collecting systems, once constructed.
H	*#158.*	Surface water re-entering into hand dug wells (hand pump installation and construction problems).
H	*#159.*	Lack of spare parts, other technical materials and water pipes.
XV. Infrastructure-related problems (3H, 1M, 0L)		
M	*#160.*	Transportation problems: Lack of efficient road construction works, which make it difficult to reach some Wereda towns and rural communities.
H	*#161.*	There was inadequate or a lack of electric power, roads, water utility and communication systems e.g. telephone, internet.
H	*#162.*	Poor construction; lack of budget for maintenance; lack of proper operation and maintenance manuals.
H	*#163.*	Weak follow-up of water infrastructure like pipes (Absence of frequent

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
		inspection); unavailability of technical materials and water pipes.
XVI. Capacity building-related problems (4H, 0M, 0L)		
H	*#164.*	Lack of knowledge and skilled manpower; lack efficient water resources professionals.
H	*#165.*	Lack of efficient supervision during construction leads to poor construction; inadequate supervision and control during construction phase.
H	*#166.*	Lack of efficient education system; some of the existing schools are teaching a few hours only in a day due to hot weather conditions and poor facilities and teaching materials.
H	*#167.*	Settlement problems: scattered people, many uneducated people, lack of awareness.
XVII. Transparency and corruption-related problems (1H, 3M, 0L)		
M	*#168.*	Corruption is growing strongly in the region. It is difficult to implement any tasks in the region without having money. The author has witnessed many things… especially related to investment and investment bureau.
M	*#169.*	People are concerned and dissatisfied about how NGOs are functioning in the region though they believe that they are useful for the community. The same concern also applies to government institutions.
M	*#170.*	Significant problems of transparency, accountability and administration in rural and urban areas.
H	*#171.*	Lack of adequate level of free and fair participation in local politics/democracy/good governance including the poor periodic elections.
XVIII. Economy related-problems (2H, 0M, 0L)		
H	*#172.*	There is inadequate private capital movement by local communities in terms of the livestock market with the neighbouring regions and countries. All livestock-related businesses are strictly controlled by government-affiliated parties and the local community are unhappy about this.
H	*#173.*	Due to inflation problems, life for grassroots people is very difficult and getting worse. Most people's income is reduced due to inadequate business opportunities in the region; financial inflation made life at grassroots level very difficult; Food and fuel prices increased greatly.
XIX. Technology-related problems (2H, 0M, 0L)		
H	*#174.*	High cost of technologies.
H	*#175.*	Lack of water drilling machines with the necessary installation materials.
XX. Institutions and regulatory framework-related problems (0H, 2M, 0L)		
M	*#176.*	Capacity and system of implementation and the role of the ultimate beneficiaries of the system such as the community at the grassroots level, etc. are poorly considered.
M	*#177.*	In the past, major conflict was not occurring between the members of Afar tribes due the availability of strong local traditional disciplinary laws/institutions called 'Fima'. The local people are updated by using this law regarding incidents that have occurred. Today, conflict in the region is the major problem due to government-imposed regulations, which are not effective in resolving the problem (COM-4).
XXI. Development projects-related problems (1H, 0M, 0L)		
H	*#178.*	In some areas the local community was not informed and do not have adequate awareness regarding the development projects underway in the region. As a result of this, some members of the community disrupt some of the development programmes.
XXII. Communities participation-related problems (1H, 0M, 0L)		
H	*#179.*	The government offices and concerned bodies are not doing adequate work in finding water resources for the community. Hence, this has limited the communities' participation in this field of activity.
XXIII. Hydro-climatic prediction information-related problems (0H, 1M, 0L)		

Intensity of the Problem	Problem Number	Description of problems (Status of the problems are indicated by 'H' for *High*, 'M' for *Medium* and 'L' for *Low* level of intensity.)
M	*#180.*	Traditional elders use traditional climatic information prediction practices frequently and this is supported by a high level of traditional ways of analysis. Though it is effective, at present, the tradition is on the verge of extinction due to religious influences and the death of old predictors without replacing the tradition in the young members of the community.

5.6 Chapter Summary

In Figure 5-24, below, the researcher has summarised and integrated the wide-ranging results for the WEC variables in one frame to clearly indicate the status of the problem, and the dimensions of exposure to water conflicts in local communities. The figure shows four (about 40%) of the variables (cooperation, transparency, EWS and preparedness) have relatively improved status as compared to 60% of the variables.

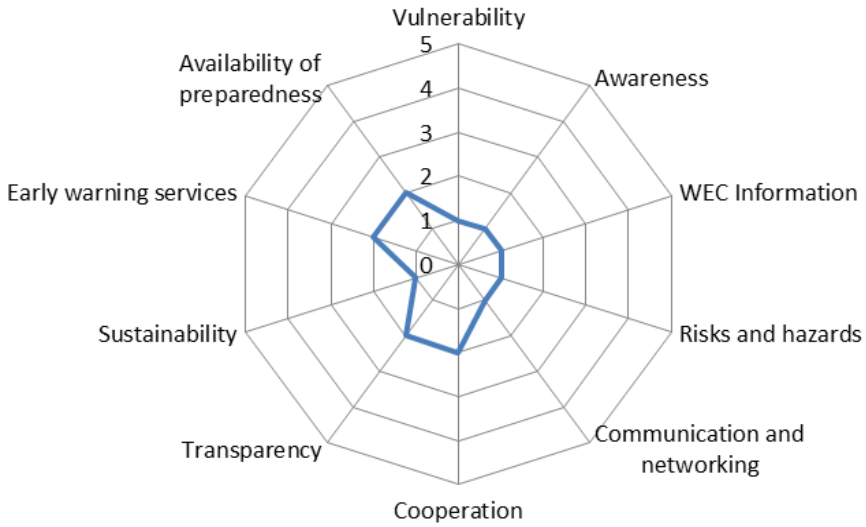


Figure 5-24: Pictorial illustration of the results of the WEC variables summary

In addition, the researcher has presented a list of 180 main problems occurring in the Awash River Basin of the Afar region, that are related to water, conflict and early warning service situations. The report also includes categories of 27 local opinions on water resources utilization and the conflict status within pastoral communities in the region. The researcher has made a maximum effort on translation so that the opinions of the communities could be taken without any changes. This was particularly important since these opinions may form the basis for more discussions and future research work in relation to local water conflicts. In the next chapter, the details of the data analysis will be explained.

Chapter Six
DATA ANALYSIS

"Never ask who is right. Start out by asking what is right. And you find that out by listening to dissenting, disagreeing opinions." (Peter Ferdinand Drucker) [7]

The data analysis chapter describes the main components and patterns of local water conflict early warning system data-mining, which include data preparation, cleaning, transformation, classification and analysis. In particular, the data analyses covers the core components of the research framework and DIPTI parameters including vulnerability, WEC awareness, local WEC information availability, risks and hazards, networking, communication and cooperation, transparency, sustainability, early warning services status and local existence of preparedness.

6.1 Introduction

Field (2009), in his book 'Discovering Statistics Using SPSS', agrees that the final stage of the research process is to analyse the data you have collected. Data mining is the process of analysing data to extract information not offered by the raw data alone (Baltzan and Phillips, 2009). This chapter introduces and provides the process of descriptive data analysis and forecasting procedures for each of the 10 classifications of local water conflict identification, early warning and conflict neutralization variables. Accordingly, the research is based on data collected through survey held in the Afar region. Additional information is presented at Appendix E.

The research data collected were left open and flexible at a simple and optimum level to facilitate the understanding of the analysis by a variety of audiences. In Chapter 4 (§4.13), the methodology, the researcher has identified the key statistical operation tools applied in the process of data analyses. Thus, SPSS and Microsoft Excel software are used to analyse and clean the survey data on local water conflicts.

6.2 Mapping the Process of Data Analysis

The process of data analysis and design for this research includes a six-stage flow chart. It starts by introducing the general purpose of the analysis followed by data preparation, a justification of the operational rules, measuring the gateway for analysis, data classification and data mining. The main purpose of data analysis was to find applicable frameworks. The analysis is based on investigating local water-conflict survey data that reflects the existing theoretical and practical knowledge, as displayed in Figure 6.1, below. The researcher has further explained the three purposive approaches of the analysis as follows:

[7] Source: http://www.afterquotes.com/great/quotes/conflict.htm#.

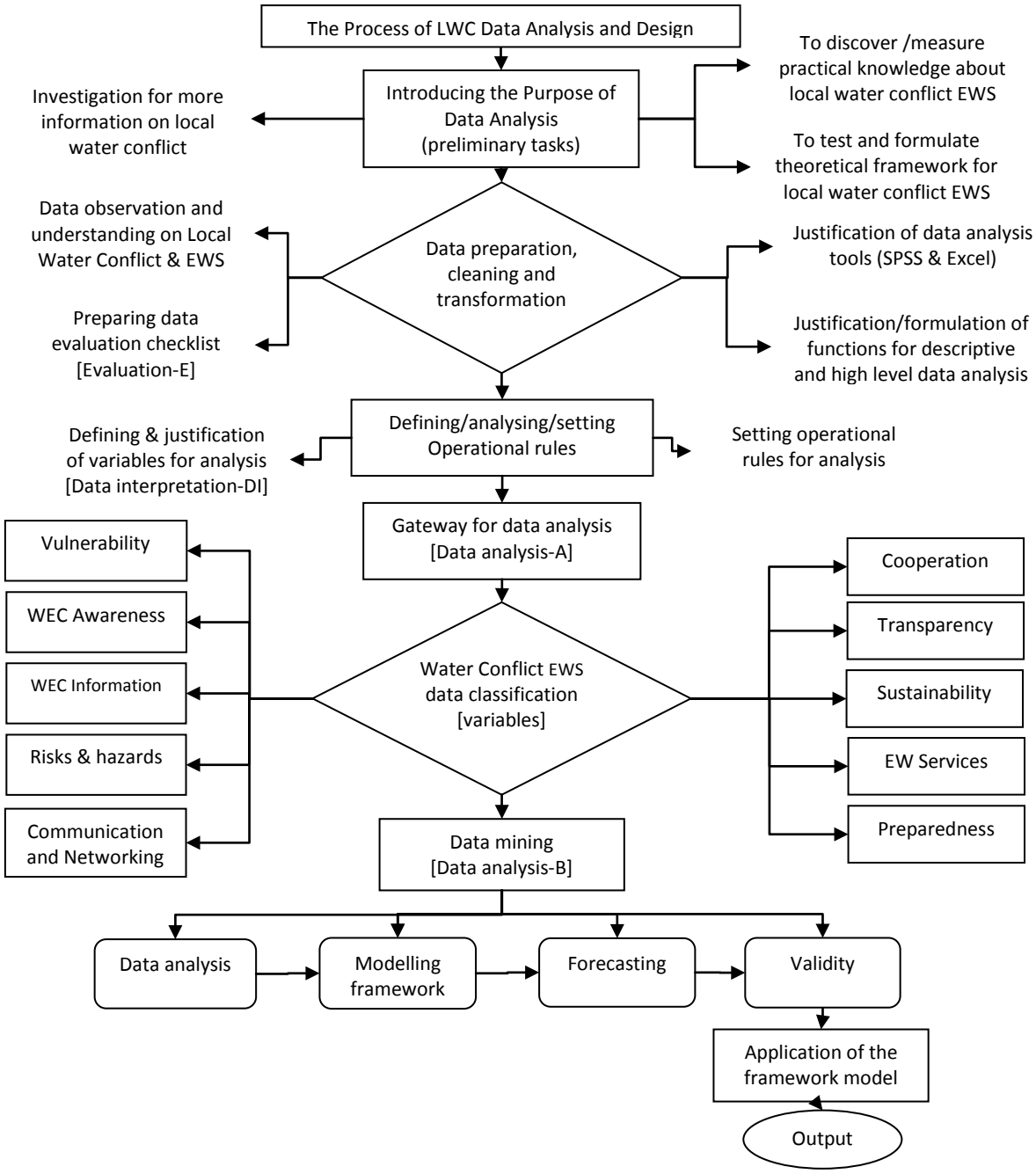


Figure 6-1: Components of data analysis for LWC pre-identification, neutralization and EWS

- *Exploratory Activity*: This is an investigative activity looking for more information in order to resolve the research questions and test the hypothesis of the research on local water conflicts in the Afar region.
- *Theoretical Framework*: To test and amend the theoretical frameworks of local water conflict early warning system developed prior to data collection on local water conflicts.
- *Practical Knowledge*: To secure better applicable knowledge and procedures based on field observation and opinions about local communities' retained knowledge in identifying, resolving and predicting the local water-conflict-related problems in the region. In addition,

an investigative approach developed based on the findings of local reality and beliefs incorporates Plato's theory of knowledge.

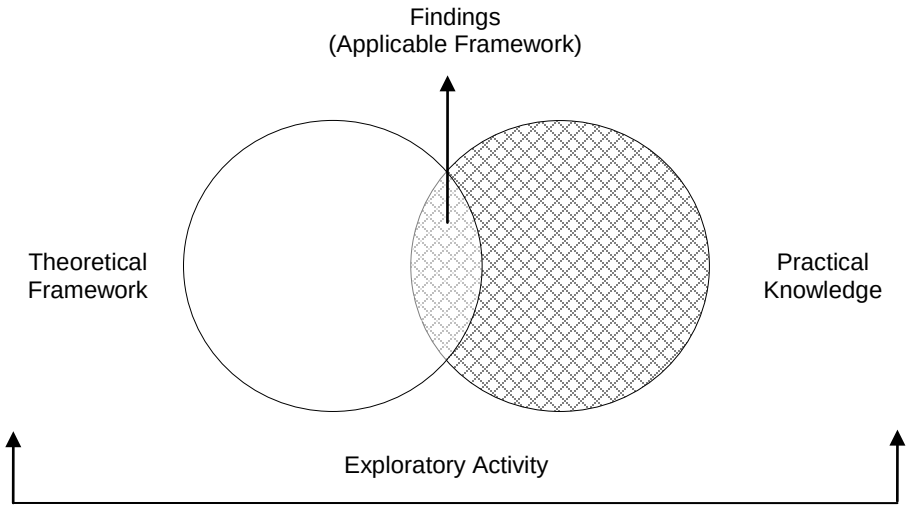


Figure 6-2: The core purposes of data analysis

6.3 Data Preparation, Cleaning and Transformation (DPCT)

This preliminary data analysis stages are mainly focused on the process of observation and understanding of data intelligence as it has a positive impact on predicting and preparing for local water conflicts related to local community, traditional and modern institutions in low-income developing countries, focusing specifically on the Afar region. The DPCT process also includes further justification of SPSS and MS-Excel software for data analysis and the extraction or formulation of their respective functions useful for data analysis. Moreover, the researcher has prepared the key raw data validity evaluation checklist on the key variables and units of analysis that have a major impact on the process of DPCT, as displayed in Tables 6-1 and 6-2.

The previous chapters have discussed all options of units of analysis related to local water conflicts (see Appendix E1). In this respect, the researcher has mainly focused on local communities in the region, which contain 90% of pastoralists, and local institutions. In the process of data collection, triangulation was achieved through information gathered from local institutions in the region.

6.3.1 Mapping Approaches to Data Entry and Key Components for Data Analysis Using SPSS

The next integrated map of variables is derived from the concept of the research unit of analysis and core variables explained in Chapter 4, the methodology, and Chapter 3, the framework of study. Its main purpose is to facilitate and consolidate the operation rules of the process of data entry and analysis.

Table 6-1: Mapping variables for data entry and data analysis using SPSS

Local communities and local institutions		
Water supply resources in the Awash River Basin of the Afar Region	Local conflict in the Awash River Basin of the Afar Region	Local early warning related services status (Preparedness)

V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}	.	.	.	.	.	.	.	V_{116}

C: Criterion/Criteria (It could be multiple or complex criteria)

Operation Rules (Y/N)										
Information	Awareness	Transparency	Networking	Communication	Cooperation	Vulnerability	Risks and hazards	Warning Services	Availability of preparedness	Sustainability
DI[8]	DI	DI	DI	DI	DI		DI	DI	DI	DI
A	A	A	A	A	A		A	A	A	A
E	E	E	E	E	E		E	E	E	E
WEC Information			Interaction			Tolerance capacity		Preparedness		Development

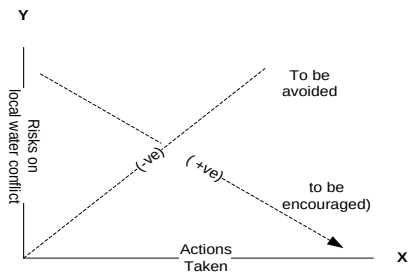
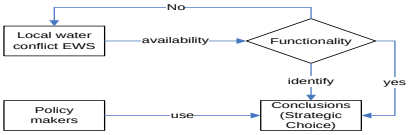
[8] DI: Data Interpretation, A: Analysis, E: Evaluation, V: variables and sub-variables (The researcher used over one hundred and sixteen major variables).

6.3.2 Primary Concepts for Definition, Justification and Setting Operation Rules for Local Water Conflict EWS Data Analysis

The framework of the study in Chapter 3, the survey questionnaires and variables framework shown in Appendices B and E helped in producing 11 Assumptions (see Table 6-3 below) for building the next criterion for further qualitative and quantitative justification of operation rules for data analysis. The researcher has developed over 116 variables and designed survey questionnaires as indicated in the framework, Chapter 3, (see Table 3-6). In addition, the information indicated in the table helps in initiating and expanding further discussions, and in the conceptualisation of the research (theory development) that leads to new knowledge about local water conflicts.

Table 6-2: Categories of variables and validity description for local water conflict EWS (Criteria)

Categories of Local water conflict EWS Information (*Source*: Chapter 3, the framework)		Qualitative Justification (Descriptive explanation by the author) (ASSUMPTIONS)	Quantitative justification (Numerical equations formulated by the author) (ASSUMPTIONS)
Variables	Local water conflict EWS (Criteria)		
Information	Collection, analysis and communi-cation of relevant and effective information.	**Collecting information**: The more information available in relation to water resources to certain area, there will be less probability of conflicts. Inaccurate information is one of the major causes of conflicts.	**(ASSUMPTION #1)** • The availability, type, amount and quality of information (I) is inversely proportional to the causes of conflicts (C) for any constant K. **$I \approx k\,(1/C)$**
		Analysis: Data should be analysed efficiently based on appropriate theories and other processing tools. This analysis should help to indicate the sequential occurrence of conflicts. The power of analysis is a key factor in having further predictive information.	**(ASSUMPTION #2)** • Application of Sequential Models based on correct and valid information. • The use of computers for further analysis. • Designing a database. • Conflict-predictive data analysis (A) is also inversely proportional to causes of conflict. **$A \approx k\,(1/C)$**
Communication, Cooperation and Networking (Interaction)		**Communication**: The better the communication we have with our opponent, the less conflict will occur. In general, good communications are measured by three factors: sending, receiving and acknowledging timely and relevant information on conflict. The best communication is the result of better networking that leads to sustainable cooperation, which plays a paramount role in reducing conflicts.	**(ASSUMPTION #3)** • Relevancy (r), time (t), sending (S), receiving (R) and acknowledging (A) are factors for good communication. The failure of one of these components in relation to time may motivate or enhances the causes of conflicts. **$X\,(r, t, S) \approx Y\,(r, t, R)$,** *Where,* • X and Y are representative communication points, • r for relevancy of information, • t for appropriate time, • S information sent, and • R information received.

Categories of Local water conflict EWS Information (*Source*: Chapter 3, the framework)		Qualitative Justification (Descriptive explanation by the author)	Quantitative justification (Numerical equations formulated by the author)
Variables	Local water conflict EWS (Criteria)	(ASSUMPTIONS)	(ASSUMPTIONS)
Vulnerability (Tolerance capacity)	Identification of institutions that help to take actions in reducing risks.	**Availability of institutions**: Availability of efficiently-working modern and traditional institutions.	**(ASSUMPTION #4)** Factors to be included for mathematical analysis: • Efficiency (service) (E), • Formal users feedback (FF), • informal users feedback (IF), • corruption (-CR), • availability of capacity; manpower, training and regulation. **E ≈ (kFF +rIF)/2 – tCR,** *for any constant k, r and t.*
		Actions taken: Proper actions	**(ASSUMPTION #5)** • Proper action (PA) leads to less/no conflict (C), • Improper action leads to more conflict or initiates conflicts; No action leads to more conflict or initiates conflicts. Hence PA is inversely proportional with 'C' **PA ≈ k(1/LC)** for any constant **K.**
		Reducing risks: Less risk means less exposure to conflict.	**(ASSUMPTION #6)** Risks (R) are directly proportional to conflicts (C) for any constant k **R ≈ kC,** Or/and **Risk ≈ Hazard * Probability of occurrence* Vulnerability**
	Identification of individuals exposed to hazards.	Exposed individuals detail justification:	• Vulnerable people: Number of people exposed to risks. • Number of prediction areas. • Status of resource utilization. • Population growth.
		Types and volume of hazard justification:	• Enumerate the size of hazards. • Identify factors for probability of risks.
Risks (Tolerance capacity)	Identification of actions taken to reduce risks.	Actions taken versus risks: • Type of actions- sequentially. • Type of risks, problems in the basin. • No action-more risks. • More proper action can reduce risks.	 **Action taken (X) ≥ Risks (Y)**
Preparedness	Identification of effective responses towards local water conflicts.	Effective response vs. local conflicts.	
	Identifications of conclusions to policy-makers to make strategic choices.	1. Availability of major conclusions or strategy choice. 2. Availability of policy-makers. 	**(ASSUMPTION #7)** • Past history of strategic choice. • Future plan of strategic choice. • List of strategic choices. • Quality of strategic choice. • Favourable environment for policy makers. • Capacity of policy makers

Categories of Local water conflict EWS Information (*Source*: Chapter 3, the framework)		Qualitative Justification (Descriptive explanation by the author) (ASSUMPTIONS)	Quantitative justification (Numerical equations formulated by the author) (ASSUMPTIONS)
Variables	Local water conflict EWS (Criteria)		
Early warning	Consideration of timely warning.	Comparison of Timely warning, Untimely warning and No-warning or negligence.	**(ASSUMPTION #8)** Lack of timely warning increases the effect of the damage arising as a result of water conflict. Hence, timely warning (TW) is inversely proportional to conflict (C) with some constant k. **TW ≈ k(1/C)**
	The aim that helps to avoid or reduce violence and human crises.	1. Any plan/aim to avoid/reduce violence/crises. 2. Efficiency. 3. Factors that lead to the fulfilment of the aim in terms of water.	**(ASSUMPTION #9)** P= availability of any feasible plan/aim in avoiding crises. E= efficient implementation of the plan. F= Factors that leads to aim being achieved. **F ≈ kF(P,E)** for any constant k
Sustainability	Contribution to sustainable development.	• What contributions are made? • What are the indicators used to measure sustainability and how can we measure it?	Identify variables that help to measure sustainable development of the local area. The six sustainability indicators: • Air quality in terms of ground-level ozone. • Freshwater quality in terms of meeting government criteria. • Greenhouse gas emissions. • Forest cover to track the extent of our forests. • Extent of wetlands in the area. • Human capital measured by education *Source: The Sustainability Report. Available at: http://www.sustreport.org/indicators/nrtee_esdi.html*
Transparency	The issue of transparency.	Identify the relationship between conflict and transparency. Develop criteria for transparency in water sector development and service provision.	**(ASSUMPTION #10)** T=transparency for water sector, C=Local water conflict, M= Other mediating variables, and k=any constant. **T ≈ k(1/C)**
Awareness	Local awareness related to information on effects of conflict and resources.	• The level of local communities' and institutions' awareness of information on effects of conflict and resources. • More awareness helps to prepare in reduce the problems.	**(ASSUMPTION #11)** Awareness (A) is inversely proportional to Conflicts (C) for any constant k. **A ≈ k(1/C)**

The above Table 6-2 shows, the qualitative and quantitative justification of local water conflict EW information describing the set of criteria for each variable analysis. The main part of the components of the framework (see Chapter 3 and Figure 3-6), will be summarised into the following three parts in order to enhance the pre-identification and preparedness for local water conflicts (the local water conflict early warning system).

- Early warning system variables,
- Local water conflict intensity or magnitude identification variables, and
- Local water supply availability and satisfaction status.

The future implementation of the preliminary process of this mathematical formulation requires further complex work involving numerical analysis. The researcher has formulated a general component for local water conflict early warning services. The process helps to conceptualise the research area as a continuation of the explanations manifested in Table 6-3. The function that is denoted by **f(R)** has three fundamental components: Water, Conflict and EWS. Each variable is threaded equally within a justified time 't' and location 'l'. The functions for each sub-category are formulated as follows:

A. Early Warning Services in this aspect are defined as a function of timely warning e.g. data (x, y), risk prediction factors that affect the sustainable development of human beings, transparency or visibility, communication, warning services, systems or forecasting models and preparedness. Equation (6.1) below indicates key factors that are useful for defining the fundamental components of early warning services.

Early Warning System (EWS)=)= ***f***(Time, WEC Data, Risk, Sustainability, Transparency, Communication, Warning services, Preparedness) (6.1)

Whereas:

- Data (x) = **f** (awareness, availability, accuracy, trend)
- Data availability(y) =**Variables** (conflict related, predictive power)
- Risk= **f** (expected damage/hazard, probability of occurrence/vulnerability)
- Warning services= **f**(hazard prediction, availability of effective data, provision of timely warning

Transparency= **f**(traditional/cultural, modern/gov.)

B. Defining the sub function conflict (C) is also measured by the following key factors:

Local Conflict Magnitude (C) = ***f*** (Socio-Economic Conflict Diversity Factors, Conflict stakeholders, Conflict patterns, Change in private and social behaviour/culture/value) (6.2)

C. Defining the sub function *f* (W) is measured in terms of quantity, quality, accessibility, management and its sustainability. Equation (6.3) shows the fundamental components of local water supply magnitudes.

Local Water Supply Magnitude (W) = ***f*** (Quantity, Quality, Accessibility, Management, Sustainability) (6.3)

D. Defining the general function *f* (R) as the fundamental research component is the basis for the starting point of exploration. This is derived from the conceptual framework of the study. The function leads to the maps showing the relationships between the major variables indicated in the process of exploration of the framework of the study. Equation (6.4) shows fundamental components of the research on local water conflicts.

f (R) =***f*** (Local Water, Local Conflict, Local Early Warning Services) defined at a time 't' and location 'l' (6.4)

6.4 The Process of Data Analysis, Modelling and Forecasting

Baltzan and Phillips, (2009) in their book on Business Driven Information Systems defined a model as a simplified representation or abstraction of reality and modelling as the activity of

drawing a graphical representation of a design. In Chapters 7 and 8, the researcher has further organised the variables in comparison to the output of the analysis and developed a framework modelling. In this chapter, the researcher mainly focused on primary data analysis to formulate general conclusions based on observed data supported by the objectives of the process that include:

- The simple use of descriptive statistical analysis required to investigate the data further and to draw general conclusions and relationships from them.
- Draw useful flow charts for analysis and further mathematical algorithms and programming.
- Exploring trends of local data on local water conflicts
- Construct a solution and build a framework model that provides the tools for answering the research questions.
- Design an applicable framework supported and proved by theoretical and practical inputs of data gained through data analysis.

In the next sections, the data analysis of the major parameters of the local water conflict early warning and preparedness variables will be described in detail.

6.5 Vulnerability Data Analysis

In Chapter 3, the framework, we have indicated that exposure to vulnerability (variable 1) is one of the core components that helps to pre-identify and prepare for local water-conflict-related problems. This section deals with measuring exposure to vulnerability and its links with local water conflicts. The analysis of vulnerability includes the identification of individuals exposed to hazards related to local water conflicts and other major problems in the region that increase the vulnerability. The qualitative data analysis focuses on the justification of the exposure status and the effects of hazards on local people. The quantitative parts of the analysis focus on enumerating and predicting the number of people exposed to risks in comparison to population growth and sustainable ways of water resources utilization. From the literature review and the previous chapters, the following two major premises on the bases of limited water resources and natural resources utilization were proposed, which is useful for measuring the vulnerability status:

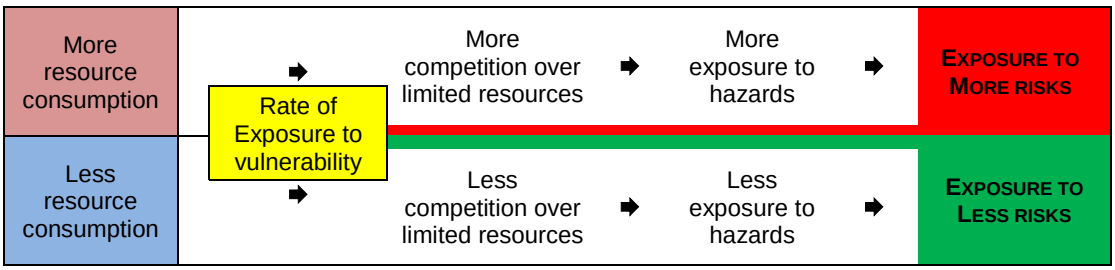


Figure 6-3: The link between people, resources and risks related to local water conflict

6.5.1 Data Types Applicable to Vulnerability

In this study, the vulnerability data analysis focuses on information related to vulnerable people, unemployment status, local people's income and expense status and the water supply satisfaction status in the region. It is also focused on analysing separate information collected from institutions working on vulnerability. It helps to compare with the validity of data collected directly from communities.

Table 6-3: Vulnerability data types at local level

Vulnerability data category	What to analyse?
1) Vulnerable people status and trend	
• Work/unemployment	Identification of types and status of work conditions exposed to vulnerability (How far related to water and natural resources?).
• Education	The level of education in the region.
• Religion	Distribution and tolerance.
• Demography (Age and Gender)	Number/percentage of vulnerable people (Categories of vulnerable people in a household).
• Vulnerable people in a household/family	Trends and ratio of vulnerability in a family.
2) Homelessness trend	
• Community's response	Trends and percentage of homelessness.
• Institutions' response	Trends and percentage of homelessness.
3) Exposure to vulnerability	
• Community's response	The status of unemployment, income, expense and water supply.
• Institutions' response	The status of unemployment, income, expense and water supply.
4) Local institutions awareness/availability	
• Institutions' awareness of institutions	Status of awareness of institutions working on vulnerability.
• Institution's awareness of local vulnerable people	Status of awareness of local vulnerable people.

6.5.2 Descriptive Analysis of Data on Vulnerability

6.5.2.1 The Link between Exposure to Vulnerability and Duration

Table 6-4 gives and compares the status of vulnerability in the region, which is a key component in predicting the status of risks related to conflicts in the region. Thus, 75% of the respondents' location data shows the region to be vulnerable.

Table 6-4: Percentage of the level of vulnerability by duration of stay and gender

Gender	Duration in years	Vulnerability Category		Total
		Vulnerable	Not Vulnerable	
Male	1 - 5	**1** (11.1%)	**8** (88.9%)	**9** (100.0%)
	6 - 10	**3** (37.5%)	**5** (62.5%)	**8** (100.0%)
	11 - 15	**4** (66.7%)	**2** (33.3%)	**6** (100.0%)
	15 +	**70** (85.4%)	**12** (14.6%)	**82** (100.0%)
	M Total	**78** (74.3%)	**27** (25.7%)	**105** (100.0%)

Gender	Duration in years	Vulnerability Category		Total
		Vulnerable	Not Vulnerable	
Female	1 - 5	**0** (0.0%)	**1** (100.0%)	**1** (100.0%)
	6 - 10	**1** (25.0%)	**3** (75.0%)	**4** (100.0%)
	11 - 15	**2** (100.0%)	**0** (.0%)	**2** (100.0%)
	15 +	**20** (90.9%)	**2** (9.1%)	**22** (100.0%)
	F Total	**23** (79.3%)	**6** (20.7%)	**29** (100.0%)
Total		**101** (75.0%)	**33** (25.0%)	**134** (100.0%)

6.5.2.2 Vulnerability and Education

There was a negative link between vulnerability and education. In the UNESCO (2002) technical paper on conflict and cooperation related to international water resources, it was suggested that reduced skills means increased actual vulnerability; and an increase in actual vulnerability means increased actual risk which leads to increased flood losses. Educating the local people helps to create a sustainable path towards development. Efficient use of water supply resources helps to emancipate the pastoral community from backwardness. Illiterate people are highly vulnerable and exposed to risks. Equation (6.5) below, shows the inverse relationships of vulnerability and education. Education plays a major role and is an irreplaceable tool for improving local people's capacity in various fields of activity.

$$\text{Vulnerability} = K \frac{1}{f(Education)} \qquad (6.5)$$

where, *f* is education function and k stands for any constant

In the researcher's opinion, lack of adequate local education (knowledge) could be balanced by other non-knowledge-based (illogical) ways of reasoning. In most cases, an accumulation of non-logical approaches leads to a firm set of disagreements that lead to conflicts.

Table 6-5 shows every one of two household heads is illiterate. The figure in Table 6-6 shows, 68% or 7 of every 10 people in the region are illiterate or at the level of elementary school. In addition, the finding shows the numbers of female infants and under-aged children are less than that of male categories.

Table 6-5: Respondent household heads distribution by education

Respondents Education	Gender		Total	Percent	Group Percent
	Male	Female			
Illiterate	56	16	72	54%	
Elementary	17	2	19	14%	68%
High School	10	5	15	11%	
College or University	22	2	24	18%	
No comment[9]	1	3	4	3%	32%
Total	106	28	134	100%	100%

[9] 'No comment' could be considered as illiterate. In occasional cases, illiterates prefer not to comment on the questions. This is indicated in Table 6-6.

Table 6-6: Members of respondent households' distribution by education and gender

Education	Gender		Total	Percent	Group Percent
	Male	Female			
Not applicable (e.g. infants, under age)	78	19	97	13%	13%
Illiterate	126	129	255	33%	
Elementary	148	119	267	34%	67%
High School	72	56	128	16%	
College or University	18	12	30	4%	20%
Total	442	335	777	100%	100%

Among the survey data shown in Table 6-5, 54% of respondents are illiterate, which affects regularly on information sharing. As a result, they are exposed to a low level of critical analysis and less tolerant on resolving disagreements. Illiteracy plays a leading role in conflicts in the region. The correlation coefficient 0.5 indicates there was medium level of dependency between education and duration of stay in the region. In the previous Table 6-6, 67% of the people in the region are vulnerable. The pastoral communities in the region lack adequate access to education.

Table 6-7: Correlation coefficient of respondent's HH** distribution by education

Correlations		Education Vulnerability	Duration
Education Vulnerability	Pearson Correlation	1	.449**
	Sig. (2-tailed)		.000
	N	130	130
Duration	Pearson Correlation	.449**	1
	Sig. (2-tailed)	.000	
	N	130	134

**. Correlation is significant at the 0.01 level (2-tailed); HH: Household Head

6.5.2.3 Conflict and Religion

The theoretical findings in Chapter 2 (Table 2-3) shows that lack of tolerance and difference in religion is one of the major causes for creating high levels of conflict. However, the survey in the region shows that majorities of the believers have a uniform religion and it was observed that this was not a major problem in the region. The causes of a problem occurring as a result of a difference in religion are insignificant in the region and in the country in general. We will further discuss the level of tolerance among the people in Chapter 7.

Table 6-8: Respondents' distribution by religion

Respondents' Religion	Gender		Total	Percent
	Male	Female		
Islam	91	27	118	88
Christian	12	1	13	10
Indigenous/ traditional religions	1	0	1	1
No comment	1	1	2	1
Total	105	29	134	100

6.5.2.4 Vulnerable Population in the Region

A. Demographics (Age and Gender) and Vulnerability

Technically, women, children and seniors are considered as vulnerable members of the community. Hynes (2007) stated "a cross-national analysis of WHO data found that women and children suffered more death and disability from civil wars in the years 1991–1997 than men". The data in Tables 6-9 and 6-10 showing age and gender-based vulnerability in a family shows that two thirds of the community members in the Afar region are vulnerable to risks related to conflicts.

Table 6-9: Age group * family members' vulnerability cross-tabulation

Gender			Age- and gender-based vulnerability		
			Not Vulnerable	Vulnerable	Total
	Male	Count	218	224	442
		% of Total	28.1%	28.8%	56.9%
	Female	Count	0	335	335
		% of Total	.0%	43.1%	43.1%
Total		Count	218	559	777
		% of Total	28.1%	71.9%	100.0%

B. Number of Vulnerable People in a Family

The above figures are derived from 134 respondent households who claimed that 41 (28%) vulnerable people existed in their family. We find that there is nearly one vulnerable person in every 3 households. Among the vulnerable, most of them are people with disabilities and those displaced from other neighbouring areas due to conflict and economic-related problems.

Table 6-10: Trends of vulnerable people in a family

Gender			Trend					
			Not sure	Stable	Decreasing	Increasing	Fluctuating	Total
	Male	Count	2	0	1	14	5	22
		% of Total	4.9%	.0%	2.4%	34.1%	12.2%	53.7%
	Female	Count	3	1	2	11	2	19
		% of Total	7.3%	2.4%	4.9%	26.8%	4.9%	46.3%
Total		Count	5	1	3	25	7	41
		% of Total	12.2%	2.4%	7.3%	61.0%	17.1%	100.0%

The above Table 6-11 is summarised as follows:

Description	Mean
Vulnerable People in a family(V)	41
Respondent households (R)	134
Raito (V:R)	0.31 (1:3)

6.5.2.5 Vulnerability and Homelessness

Both local communities and institutions proportionally agreed about the increasing number of of homelessness in the region as indicated in the following tables. The finding shows there was no awareness gap in this respect.

Table 6-11: Local community observations on trends of homeless people

Trends		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Stable	3	2.0	2.6	
	Fluctuating	20	13.1	17.4	
	Decreasing	25	16.3	21.7	
	Increasing	37	24.2	32.2	73.9
	Not sure	7	4.6	6.1	
	Not available	21	13.7	18.3	
	No comment	2	1.3	1.7	26.1
	Total	115	75.2	100.0	100.0
Missing		38	24.8		
Total		153	100.0		

When it comes to specific vulnerability issues of homelessness, in Table 6-12, 68% of respondents agreed about the availability of institutions working on this problem. One third of the respondents believe there is no organization working on homelessness.

Table 6-12: Availability of institutions working on homelessness

Availability of Institutions working on homelessness		Organization Type					Total
		Gov.	NGO	Private	Public	Not available	
Available	Counted	3	8	1	1	0	13
	Expected Count	2.1	5.5	.7	.7	4.1	13.0
	% of Total	15.8%	42.1%	5.3%	5.3%	.0%	68.4%
Not available	Counted	0	0	0	0	6	6
	Expected Count	.9	2.5	.3	.3	1.9	6.0
	% of Total	.0%	.0%	.0%	.0%	31.6%	31.6%
Total	Count	3	8	1	1	6	19
	Expected Count	3.0	8.0	1.0	1.0	6.0	19.0
	% of Total	15.8%	42.1%	5.3%	5.3%	31.6%	100.0%

6.5.2.6 Vulnerability and Unemployment, Finance and Water Supply Services

In Chapter 3 of the framework of the study, exposure to problems associated with unemployment, finance and water supply are among the key factors that determine the status of vulnerability in the region. Table 6-13 shows that 64% of the people in the region are not satisfied and exposed to unemployment-related problems. Table 6-14 shows opinion gaps between communities and institutions with respect to the indicated problem

Table 6-13: Communities view on vulnerability - unemployment, finance and water supply

Vulnerability Category	Vulnerability Description	Satisfaction Rate						Total
		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	No comment /sure	
Unemployment	Unemployment rate is decreasing	2	19	28	73	11	1	134
	Homelessness rate is decreasing	2	17	41	61	6	5	132
	Sub total	4	36	69	134	17	6	266

Vulnerability Category	Vulnerability Description	Satisfaction Rate						Total
		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	No comment /sure	
Income and expense	Satisfied by daily or monthly income	2	4	24	84	18	1	133
	Expense or debt is less than respective income	11	11	28	69	13	1	133
	Sub total	13	15	52	153	31	2	266
Clean, adequate and affordable water supplies	Access to clean and safe water	0	8	27	76	22		133
	Access to adequate water supplies	0	4	36	68	25		133
	Affordable water supplies	1	11	43	55	23		133
	Easily-accessible water supplies	1	8	46	54	24		133
	Sub total	2	31	152	253	94		532
	Total	19	82	273	540	142	8	1064
	Percent	2	7	26	51	13	1	100%
	Combined Percent	10%		26%	64%		1%	

Table 6-14: Comparative analysis of communities ‘and institutions’ response on exposure to vulnerability

Trend	Local community respondents (%)	Local Institution respondents (%)	Gap in %
Strongly agree	2	3	-1
Agree	7	19	-12
Neither agree nor disagree	26	20	6
Disagree	51	41	10
Strongly disagree	13	14	-1
Not comment /applicable	1	3	-2

6.5.2.7 Vulnerability and Institutions

Most respondents (91%) agreed on the availability of government institutions and NGO’s that are working on issues related to people exposed to vulnerability, as displayed in Table 6-15. The data in the previous Table 6-5 (§6.5.2.1) also shows those who stayed long in the region are vulnerable. In principle, the more people stay in one place, the higher the probability of having secured a sustainable life. In this case, the data from the two tables contradicts the acceptable reality. Government and NGO employees and private business people are those who have been there for a short period. Pastoralists, farmers, daily labourers and jobless people that are exposed to a vulnerable way of life are those who have lived in the region for a long period. In conclusion, it seems that the longer the people stay, the more they depend on locally available and limited resources and it is precisely this lack of mobility that leads to their increased vulnerability. More information is displayed in Appendix F.

Table 6-15: Status of institutions working on the issue of vulnerability

Institutions awareness category	Level of awareness on functionality status			Total	Percent
	Functional	Partially functional	Non functional		
Government	18	0	0	18	51
NGO	11	2	1	14	40
Private	1	0	0	1	3
Traditional	0	1	0	1	3
NGOs and Religious	1	0	0	1	3
Total	31	3	1	35	100

6.5.3 Measuring Vulnerability to Local Water Conflicts

In reflection, the links between the vulnerability variables are useful for measuring the status of exposure to vulnerability related to local water conflicts. The researcher proposed the next three major assumptions derived from concepts generated in an overall assessment of the study based on Chapter 3 (Figure 3-6), the framework of the study.

ASSUMPTION #1: Setting Categories of Functions: the study and the above data analysis reflects that **Local Water Conflict Vulnerability** is measured as a combined effect of eight functions with a constant, **K,** and some other functions $f(Xtn)$ expressed below.

1) *f(U): Unemployment/occupation;*
2) *f(L): Location stay (localization of residence);*
3) *f(E): Education;*
4) *f(D): Demographics (Age and gender status);*
5) *f(P): People with special need;*
6) *f(H): Homelessness;*
7) *f(F): Financial status (Income and expense);*
8) *f(W): Water supply (Clean, adequate and affordable water supplies services) with a constant **K** which stands for the flexibility and implementation constant for each of the functions that indicate the uniqueness of function's property such as any local area (farm areas, pastoral areas, etc.).*

ASSUMPTION #2: Trend Values: the trend level of each of the above functions varies between **high (4)** and **low (1)** values of exposure to vulnerability where the weighted characteristic of each function varies from unit 1 to unit 4. The function limit ($\lim_{t\to 4} f(Xtn)$ will express the situations:

Trends of exposure to vulnerability: WORST (high level of vulnerability) to LOW			
Worst 4,	Bad 3,	Medium 2,	Low 1

ASSUMPTION #3: Function Formulation: The mean value of e*ach of the above eight functions (Assumption#1) and their trend values (Assumption#2) with flexibility and implementation constant K (Assumption#1) provides the next function* $f(v)$ *that indicates the magnitude of vulnerability in the region. Equation (6.6) shown below helps in measuring the magnitude of local vulnerability.*

$$f(v) = K + \sum_{n=1}^{n=8} \lim_{t\to 4} f(Xtn) \Big/ 8 \qquad (6.6)$$

where,

- f stands for vulnerability function,
- n varies from 1 to 8 for each function
- t is a constant that varies from 1 to 4
- v stands for vulnerability

6.5.4 Data Analysis, Modelling, Forecasting and Validity Design (Data Mining)

The researcher has designed a framework model for the local vulnerability in the Afar region based on the data analysis and the functions developed on measuring the status of local people's vulnerability. The details are displayed in Table 7-35 of Chapter 7, Discussion of Research Findings. In understanding the general status of vulnerability in the region, one should design a process *flowchart* and develop a database by incorporating the vulnerability as a primary key and a list of variables as fields that will convert the values of the survey findings and the formulated functions. At the end of all this, we will have a refined model framework tested for deployment of the theoretical frameworks. Further application of the model requires more research work.

6.5.5 Grouping Data for Vulnerability Analysis

In this table, the researcher has summarised the components vulnerability conceptual frameworks, variables and the findings of data analysis. This helps in formulating the general conclusions from observed data in order to validate the applicability of the framework model (Chapter 3) specifically in identification of the risks and hazards (parts of research question 3): (converting primary to secondary data analysis).

Table 6-16: Grouping primary data analysis for modelling the framework of vulnerability

Categories of Vulnerability	Units of measurement	Male (in %)		Female (in %)		Overall		Trends (exposure to Vulnerability) HIGH to LOW			
		Vulner-able	Not Vulner-able	Vulner-able	Not Vulnerable	Vulner-able	Not Vulnerable	4	3	2	1
1. **Occupation** (types of work)	% within work category	74.3%	25.7%	79.3%	20.7%	75.4%	24.6%	Pastoralist	Having no Job-jobless	Farmer	Daily labourer
2. **Location** by long staying (over 15 years)	% staying within the location- years	74.3%	25.7%	79.3%	20.7%	75.4%	24.6%	15 + years	11 – 15 years	6 – 10 years	1 – 5 years
3. **Education-** respondents' family status	Educated family members	58.3%	56.0%	41.7%	44.0%	67.0%	20.0%	Illiterate	Elementary	High School	College or University
- **Education**- Head of household	Head of household/ respondent	53.8%	46.2%	61.5%	38.5%	68.0%	32.0%	Illiterate	Elementary	High School	College or University
4. Demographics- Age and gender status	Infants, women and seniors	28.8%	28.1%	43.1%	-	72%	28%	Infants and children	Women and seniors	Adults	Youth
5. **People**- Highly Vulnerable people in a family	People with special need and disabilities	46.3%	7.3%	31.7%	14.6%	53.7%	46.3%	Increasing	Fluctuating	*Decreasing*	*Stable*
6. **Homelessness**						73.9%	26.1%	Increasing	Fluctuating	*Decreasing*	*Stable*
7. Vul. Exposure Status						64.1%	10.0%	Agree	Disagree	Neutral	*Stable*
- **Unemployment**						56.8%	15.0%	Agree	Disagree	Neutral	*Stable*
- **Income and expense**						70.0%	11.0%	Agree	Disagree	Neutral	*Stable*
- **Water supply**						60.0%	6.0%	Agree	Disagree	Neutral	*Stable*

Note**:** The underlined marks indicate the current status of the findings.

6.6 Analysis on WEC Awareness Data

Local communities' and institutions' awareness (variable 2) related to information on water, conflict and early warning situations, which was stated in Chapter 3, has a vital importance in measuring the local people's exposure to water conflicts. This section reflects the level of local communities' and stakeholder institutions' awareness gap on water, conflict and early warning services. It includes:

- the level of awareness on the costs of the effects of local water conflicts;
- the status of local communities' participation on water tariff settings;
- the rate of satisfaction on the status of ownership and utilisation of local water resources;
- the level of awareness on the boundaries of information analysis.

6.6.1 Data Types on Local WEC Awareness Variables

Table 6-17: Data types on the local WEC awareness variables

Awareness variable category	What to analyse?
1. Costs of conflicts	
1.1. Costs of conflicts-communities.	- Awareness of costs and effects of conflict.
1.2. Costs of Conflict- stakeholders/Institutions observation on the awareness of stakeholders.	- Awareness gap analysis.
2. Categories of information that institutions want to know	
2.1. Types of requested information and their use.	- Comparing information need and propose.
2.2. Comparing information demand and supply awareness.	- Comparing information need and propose
3. Awareness/boundaries of information analysis	- Awareness/boundaries of information analysis.
4. Water resources ownership status	- Awareness of resource ownership.
5. Community participation on water tariff settings	- Community participation.

6.6.2 Descriptive Data Analysis on Awareness

6.6.2.1 The Level of Awareness on the Cost of the Effects of Conflicts

A. Local Communities' Awareness of the Service Costs of Conflicts

Table 6-18: Categories awareness of the costs of the effects of conflicts

Gender	Categories of Awareness	Awareness on Costs of Conflicts			Total
		Yes	Partially	No	
Male	Fees and service charges awareness (DC)?	23	54	23	100
	Time spent due to conflicts (PC-DL)?	26	54	19	99
	Opportunities due to local conflicts (PC-OC)?	27	40	34	101
	Effects on relationships with local communities (CC)?	47	42	11	100
	Effects on health due to local conflicts (EC)?	50	40	10	100
	Male Total/ Percent	173	230	97	500
		34.6%	46.0%	19.4%	100.0%
Female	Fees and service charges awareness (DC)?	4	11	12	27
	Time spent due to conflicts (PC-DL)?	6	12	9	27
	Opportunities due to local conflicts (PC-OC)?	7	10	10	27
	Effects on relationships with local communities (CC)?	11	9	7	27
	Effects on health due to local conflicts (EC)?	10	10	7	27
	Female Total/ Percent	38	52	45	135
		28.1%	38.5%	33.3%	100.0%
Grand Total/ Percent		211	282	142	635
		33.2%	44.4%	22.4%	100%

The next table (Summaries of the above Table 6-18) shows ranks of the level of awareness on the costs and effects of conflict by gender.

Categories of Awareness	Communities' Awareness Rank	
	Male	Female
Fees and service charges awareness (DC).	4th	5th
Time spent due to conflicts (PC-DL).	3rd	3rd
Opportunities due to local conflicts (PC-OC).	5th	4th
Effects on relationships with local communities (CC).	2nd	1st
Effects on health due to local conflicts (EC).	1st	1st

When it comes to overall awareness of the cost-effects of conflict at the local level, evidence shows that men have a better awareness than women do. In contrast, women are equally concerned about health and social relationships whereas for men, social relationships rank second to health. Both men and women give equal emphasis to issues related to time spent because of conflict problems, and ranked them third. Among respondent communities, 44% have agreed that they have partial awareness on the costs of conflicts. The remaining 33% of them noted that they have full awareness, and 22% do not have any awareness. The result shows that 77% of the respondents' have between a moderate and a high level of awareness of the cost-effects of conflicts. The reason for this could be due to the availability of *Dhaagu* traditional communication practices within the indigenous members of Afar communities. For further detail, see the above Tables 6-18 and 6-17.

B. Local Institutions'/Stakeholders' Awareness of the costs of the Effects of Conflict

Most formal and informal institutions in the region belong to the government and the probability of things being otherwise is very limited or zero. Among 26 respondent institutions, 92% of them are government institutions and the remaining 7% are NGOs and private institutions. As a result, the feedback mainly reflects the views of government institutions on their awareness of the service costs of conflicts.

Table 6-19: Stakeholders institutions awareness gap analysis

No.	Stakeholders	Less informed or not informed	Partially informed (medium)	Fully informed	Total
1	Local professionals	11	3	1	15
2	Students	11	3	1	15
3	Local communities	7	5	3	15
4	Traditional leaders	7	4	4	15
5	Local administrators	4	6	5	15
6	Local politicians	4	7	4	15
7	Others	3	0	1	4
	Total	47	28	19	94
	Percent	**50%**	**30%**	**20%**	**100**
Maximum- for awareness in the eyes of institutions		Students and professionals	Local administrators and politicians	Local politicians, administrators	

The above figure shows that, primarily, government institutions believe that local professionals and students are less informed and less concerned about the effects of conflict or the service costs of conflicts. Whereas they believe that local administrators and politicians are fully aware of these costs. In the views of government institutions, the existing information awareness gap between the educated people (students and professionals) and institutional representatives (administrators and politicians) is very high.

The result also shows, that local communities' and traditional leaders' awareness fall in between, which means between partly informed and partly uninformed. This could create a pressure on the local communities by pulling them from two opposing directions.

6.6.2.2 Institution's WEC Information Demand and Supply Awareness

***Step-1:* Comparing Information Need Awareness with Purpose**

Table 6-20 shows local Institutions' awareness of information need, availability and the gap analysis. Most of the local institutions require water quantity and quality information mainly for planning purposes. This shows that there is no adequate information on water quantity and quality. Another reason could be that there was an inadequate level of information dissemination activity on water quantity and quality in the region or that the cooperation among the institutions could be very limited. On the other hand, at the time of this survey data collection, almost all government organizations were busy in doing five year business strategy planning. The national campaign for planning work also motivates them to request more information.

Table 6-20: Tabular data for the above figure for the purpose of analysis

A-Information required for awareness (WHAT?)			B-Purpose of information (WHY?)		
Categories of information required	**Frequency**	**Percent**	**Categories of information use**	**Frequency**	**Percent**
1. Water quality	6	18.8	1. Planning	12	37.5
2. Water quantity	6	18.8	2. Health	4	12.5
3. Water resource	4	12.5	3. Information	4	12.5
4. Water information	4	12.5	4. Awareness	2	6.3
5. Population	2	6.3	5. Basic needs	1	3.1
6. Water distribution	2	6.3	6. Conflict	1	3.1
7. Water knowledge	2	6.3	7. Demand and supply	1	3.1
8. Water supply systems	2	6.3	8. Design	1	3.1
9. Health	1	3.1	9. Existence	1	3.1
10. Water consumption	1	3.1	10. Financial allocation	1	3.1
11. Water coverage	1	3.1	11. Investment	1	3.1
12. Water sources	1	3.1	12. Knowledge	1	3.1
			13. Water treatment	1	3.1
			14. Water use	1	3.1
Total	32	100.0	Total	32	100.0

***Step-2*: Comparing the Status of WEC Information Within Respondents' Institutions**

Table 6-21: Comparing awareness of WEC information demand and supply by institutions

Ranking the first three	Information request and purpose awareness				Organization and respondents' profession			
	Requested info (R)		Objective/Purpose/e of information (O)		Organization/institution category (C)		Profession(job title)- (P)	
	Info. Request awareness	Percent of **Request** awareness	Info. Propose awareness	Percent of **Purpose** awareness	Organization Category	Percent of Institutions **Category** awareness	Respondents' Profession (Job title)	Percent of respondent's' **Profession** awareness
1st	Water quality	18.8	Planning	37.5	Water	38.5	Planning	19.2
2nd	Water quantity	18.8	Health	12.5	Pastoral Development	11.5	General manager	15.4
3rd	Water resource	12.5	Information	12.5	Security	7.7	Project Administration	15.4
Total Percent		50.1		62.5		57.7		50.0

***Step-3:* Comparing the Rankings of Institutions' Information Requests, Purpose/Objective, Category and Profession Awareness**

Rank	Converging the above awareness table	Percent of observed (top three ranked)	Comparing each other
1	Purpose/objective of info. type (O)	62.5	28%
2	Institution category type (C)	57.7	26%
3	Requested info. Type (R)	50.1	23%
4	Respondents' profession/work type (P)	50.0	23%
	Total		100

In principle, information requested (R) should be comparable or greater than objective of information needed (O). However, in this case R<O by 5%. Could these mean professionals in the institutions do have less awareness in relation to having the necessary information for their work? The next point was that the percentage of types of information requested (R) is relatively proportional to respondent's profession (P) but much different from O and C. Information requested (C) is compatible with respondent's profession, P. Did these respondents simply reflect their profession only without considering the correlating organizational needs or demands? The most astonishing point was that those institutions requesting the availability of more information mentioned above were fully or partially responsible for collecting the same information by themselves. That poses questions such as, is there a lack of coordination among professionals and institutions within and outside the same institutions? If this is the case, then what are the underlying reasons for this? Why has this situation developed?

6.6.2.3 Awareness on Boundaries of Information Analysis

A majority of institutions (55%) primarily believe in political boundaries as the method of analysis and 11% do not know the boundaries of analysis. Overall, 65% of them use unsustainable methods of analysis. The feasible methods of establishing information analysis awareness constitute approximately 12.2% of the river basin analysis approach. The process of incorporating traditional boundaries of analysis was limited to 13 % only, but it is encouraging. Less emphasis was given to information related to early warning systems.

Table 6-22: Types of boundary of information analysis (BIA)

WEC Information Types	WEC Information Boundaries of analysis							Total
	Political admin. boundary	River basin boundary	Traditional	Both political admin and river basin boundary	Both political and traditional	Other	I do not know	
Water resources	14	4	3	2	1	0	1	25
Natural resources (other than water)	14	3	2	2	0	1	4	26
Conflicts	12	3	4	1	0	0	4	24
Early warning situations	14	2	4	1	0	0	2	23
Total	*54*	*12*	*13*	*6*	*1*	*1*	*11*	*98*
Percent	*55%*	*12%*	*14%*	*6%*	*1%*	*1%*	*11%*	*100%*
Observed Rank	*1st*	*3rd*	*2nd*					
Expected Rank	*3rd*	*1st*	*2nd*				*See the next follow-up table:*	

Comparing** Percentage of Observed and Expected Boundaries of Information Analysis (BIA)**:

	HIGH (River basin)	MEDIUM (Traditional)	LOW (Political)
Observed awareness on BIA (O)	12%	13%	55%
Expected Rank	1st	2nd	3rd
Expected awareness on distribution based on ranks of BIA (E)	50%	33%	17%
O-E	-38%	-20%	38%

6.6.2.4 Awareness over Natural Resource Ownerships

Institution's awareness (a)

Ownership of Resources	Agreement rank in %
Government	46%
Public/Community	23%
Gov and Community (JOINT)	23%

Community's awareness (b)

Ownership of Resources	Agreement rank in %
Community/Public	47%
Municipal/Gov	26%
Private	21%

6.6.2.5 Community Participation in Water Tariff Settings

Table 6-23: Communities' satisfaction and participation in setting local water supply tariffs

Agreement rate	Frequency	Percent
Disagree/highly disagree	8	57%
Agree/highly agree	5	36%
No comment	1	7%
Total	14	100%

6.6.3 Measuring the Level of Awareness Variables and Relationships on LWC

STEP-1: Assumptions on level of awareness on WEC information

Value (Grade)	A	B	C	D
Rank (r)	4	3	2	1
% of $f(r)$	≤ 100%	≤ 75%	≤ 50%	≤ 25%
Qualitative description of $f(r)$	High level of awareness	Have an awareness	PARTIALLY/medium awareness	Negative, less/not informed (ignorant)
Mean value of WEC awareness results				✓

6.6.4 Grouping Data for WEC Awareness Analysis

WEC awareness variables are the key component in determining the process of local water conflict pre-identification, preparedness and early warning situations as discussed in Chapter 3 - the Framework of the Study (Figure 3-6). The primary problem in the field of local water conflict was the lack of adequate awareness of information. Analysis of the observed data on WEC awareness created groups in order to find out general conclusions and prepare a framework model by converting primary data to secondary data. In Chapter 7, the researcher has mapped and integrated the public's and stakeholder institutions' levels of awareness, in comparison to factors related to local water conflicts, and WEC information in particular.

Table 6-24: Grouping primary data analysis for modelling –WEC awareness variable

	Categories of Awareness	%	Overall awareness level[10]				Grouping/measuring the level of awareness			
							HIGH to LOW			
			FA	PA	LA	NA	4	3	2	1
1.	Costs of conflicts							Have medium level of awareness (44% to 50%)		
	1.1. Community's awareness	%	33.2%	44.4%	22.4%			Have medium awareness		
	1.2. Institution's and other stakeholders awareness	%	50%	30%	20%		More than average level of awareness (fully informed)			
2.	Institution's information demand and supply awareness comparison					-Ve				Negative Awareness
3.	Awareness on boundaries of information analysis	%	12%	13%	55%					River basins (commonly use Political boundaries)
4.	Awareness on Resource ownership (between communities and institutions)	%				-Ve				Negative Awareness
5.	Community participation on water tariff settings awareness	%	36%	7%	57%				LOW, [Disagree/highly disagree]	

[10] FA: Fully aware, PA: Partial/ Limited awareness, LA: Less Awareness, and NA: Negative awareness or not aware of it (ignorant).

6.7 WEC Information Availability and Preparedness Analysis

Information is data that has been shaped into a form that is meaningful and useful for human beings (Loudon *et al*., 2011). In this section, we have identified the linkages and the relevance of WEC information (variable 3) as shown in Chapter 3 and in Table 6-3, the guidelines for variable analysis. WEC information data analysis is mainly based on the concept of *general* local information preparedness and the availability of *specific* local water conflict early warning services where detailed major sub-components of the variables are summarized as follows:

6.7.1 Premises and Summary of 'WEC Information' Data Analysis

A. Awareness

Most modern institutions do not give sufficient recognition to traditional institutions in the region. In contrast, the communities' day-to-day life is directly linked with their own traditional institutions. However, stakeholder institutions from the private sector, the federal government and local NGOs have better awareness as compared to local government institutions. One of the reasons for this could be the lack of adequate manpower at the local level, and the increasing practice of creating a centralised working environment. Local people's awareness of early warning and conflict-related information was minimal and limited to 15% only. Inadequate information on EW and conflict shows the region to be highly exposed to problems related to water conflicts and to lack an adequate level of preparedness to tackle them.

B. Amount of information

The data analysis shows that the region is exposed to local conflicts due to the lack of adequately significant WEC information. Information on water resources is more available as compared to that on conflict and EWS-related activities. However, 72% the respondents still believe water-related information in the region is inadequate or unavailable. With respect to information sources, 41% of the communities get information primarily through traditional *dhaagu* methods as compared to 24% of people who get their information *via* modern methods (radio, TV and newspapers). In terms of Information accuracy, 74 % of the communities agreed that they are getting accurate WEC information mainly through traditional ways of communication; however, 26% of them believed modern ways are more accurate.

C. Preparedness and prediction

The finding shows local communities and institutions have partial preparedness through having the necessary WEC preparedness information. The finding is witnessed by a wide range of five-year plans or preparedness in strategic planning and the management preparation activities that take place in all government organizations. 63% of the communities believe in having climate prediction practices and agreed that traditional ways of prediction are more accurate than the modern ways. In contrast, 37% of them do not believe in climate and related prediction practices because of religious influences. Members of the communities are

divided into two opposing views: those who believe and who do not believe in prediction practices.

D. The Problems

The main challenges to the local community's traditional prediction practices related to local WEC information availability and preparedness are (1) lack of practically acceptable recognition of local prediction practices by government, (2) lack of alternatives and (3) religious influence risks. 85% of the local community believe that they have been affected by climate changes mainly causing drought, the deaths of humans and animals, change in temperature, water shortage and flooding problems. Only a few (15%) believe that there are no climate change effects in the region. On the problems of livestock, 72% of the respondents agreed that the numbers of livestock were greatly decreasing. As a result, most of them are dissatisfied and worried by the declining numbers of livestock in the region. In terms of agricultural products, a cotton plantation is highly preferable to the pastoral communities but these are significantly decreasing and are being gradually replaced by state sugarcane farms. In general, local communities are dissatisfied by the decline of both livestock and agricultural farming in the region.

6.7.2 Data Types on WEC Information Availability and Preparedness

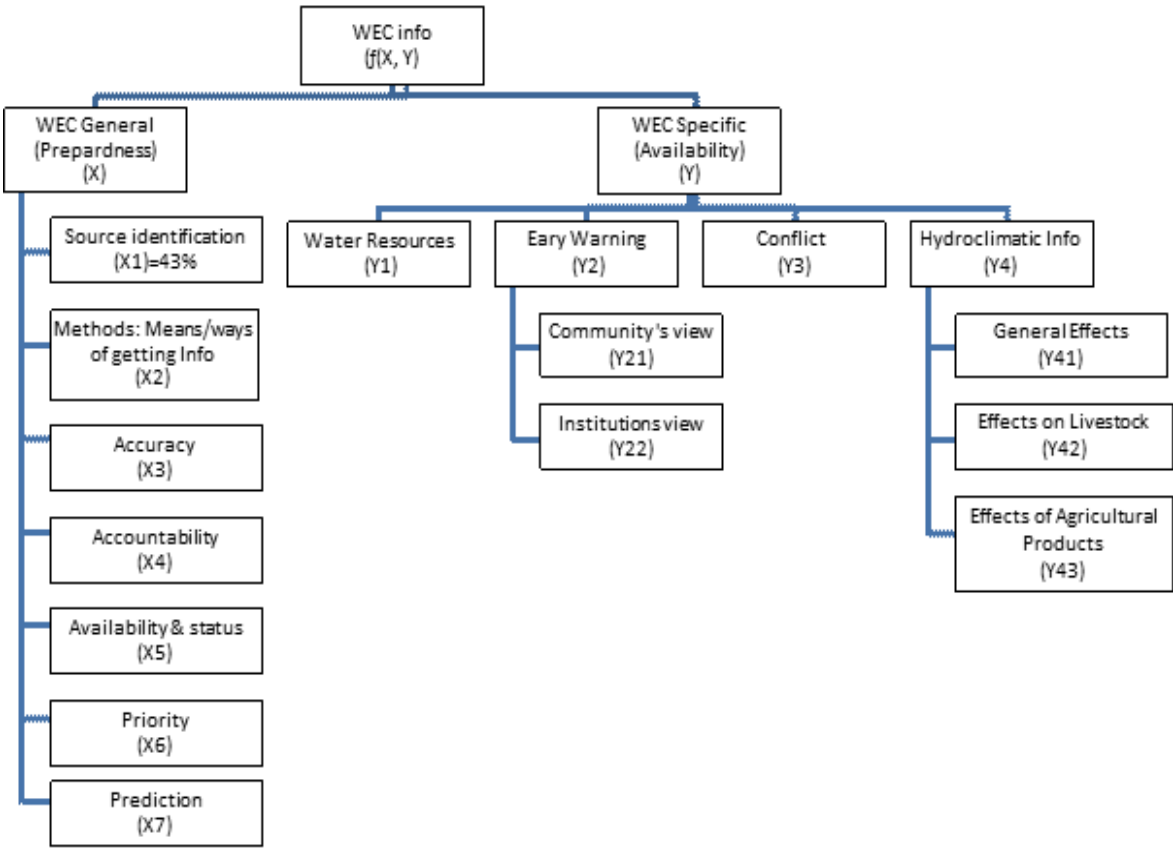


Figure 6-4: Summary of variables analysed on WEC information availability and preparedness

6.7.3 Data Analysis of 'WEC Information' Preparedness (General)

WEC information (Chapter 3 - the Framework of the Study) that is used in answering parts of the second research question deals with the type and availability of the required WEC information. The general and specific information availability sub-variables are mainly focused on local communities' and institutions' information sources, means, accuracy, awareness, accountability and identification of priority (details displayed in Chapter 3, Figure 3-6).

6.7.3.1 Source: WEC Information Source Identification Awareness

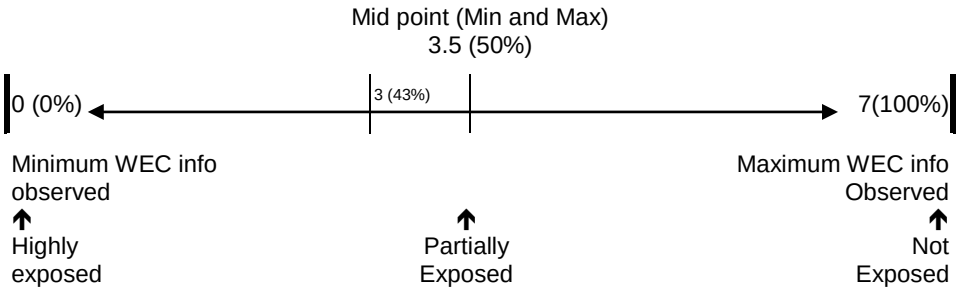
This section deals with the list of respondent institutions' awareness and frequency of identifying the sources of local WEC information that are relevant to the region.

Table 6-25: Percentage of WEC information awareness category and list of institutions

No.	Respondent Institutions for WEC awareness	Information Category Awareness			Total
		Water Resources	EWS	Conflict	
1	Total number of respondent institutions' awareness of WEC information.	*	*	*	26
2	Total number of awareness frequencies on institutions working on WEC information.	56	6	3	65
3	Percentage of awareness frequencies of institutions working on WEC information.	86%	9%	5%	100 %
4	Mean of the awareness of institutions working on WEC information: Mean (WEC).	2.2	0.2	0.1	2.5 ≅ 3.0
5	Maximum number of awareness of institutions working on WEC information : Max (WEC).	7	2	2	7
6	Minimum number of awareness of institutions working on WEC information: Min (WEC).	0	0	0	0

Appendix G shows that local private sector, government institutions at federal level (MoWR) and local NGOs have better awareness about recommending responsible institutions for information required. On the other hand, local-based government institutions have inadequate awareness of their own local region, which is puzzling. In contrast to water resources information, Table 6-25 shows that not all institutions have adequate awareness of information related to early warning and conflicts. Secondary data analysis on the above WEC sources' identification awareness deals with comparing the mean, maximum and minimum number of observations of WEC information identification as indicated in the next Figure 6-5.

Figure 6-5: Each institution's WEC source identification analysis: mean, max. and min.



The mean data of WEC source awareness of 26 institutions (see Table 6-26 below) is 3. The figure is between the lower bound (0) and middle bound (3.5) but not close to the upper bound

(7). It is located at 43% in Figure 6-5, which is close to the negative borderline of the partially exposed area. Table 6-26 shows that the region is partially exposed to LWC-related problems.

Table 6-26: Institutions' awareness of comparative analysis of WEC information

Institution's responsibility awareness	Water Resources	EWS	Conflict	Mean
1. Percent of Awareness Status	86%	9%	5%	3 (43%)
2. Awareness description	<100%	<25%	<25%	<50%
	Full Awareness	No Awareness	No Awareness	LESS Awareness
3. Exposure status	Not Exposed	Highly exposed	Highly exposed	Exposed

Twenty-six institutions responded at an average rate of 3 institutions that are responsible for local WEC information. Many institutions (86%) have adequate information on institutions working on water-related activities. There are a few respondents on EWS and conflict-related institutions. This could be for several reasons, such as inadequate awareness of the availability of WEC information, inadequate capacity or non-functionality of the institutions and lack of adequate institutions on EW and Conflict.

6.7.3.2 Communities' Awareness of Ways of Getting WEC Information

In Table 6-27 and Appendix G, the researcher has presented local communities' daily livelihood awareness of WEC information sources.

Table 6-27: Local communities' ways of getting information

Ways of getting WEC info	Frequency	Percent
Traditional methods	61	41%
Modern methods	36	24%

The most commonly used local information exchange methods are traditional '*Dhaagu'* and modern ways of government media sources. The *Dhaagu* method is highly preferable as compared to others. In the same way, 41% of the respondents are communicating through traditional methods as compared to the 24% of people who gets information through modern methods.

The traditional WEC systems used to manage specific information related to supporting the day-to-day life of the local community. In addition, the method helps in strengthening communication and cooperation within the neighbouring communities. Modern methods of getting information in the region are through radio and TV and these are traditionally considered as *outside sources* in contrast to '*dhaagu*', which is an *inside* source.

Traditional ways of getting WEC information increase the physical interaction of the people whereas the modern methods decrease the physical interaction of the people. As body language plays a great role in communication, its lack can create a gap or a problem in having sustainable human interaction. Table 6-28 compares the traditional and modern sources of

information communication practised in the region. In the table, the researcher has labelled traditional methods (Internal or Local Sources) as LS; and modern methods (Outside Source) as OS.

Table 6-28: Assumptions on exposure to conflict related to WEC information

Comparing LS and OS information sources	WEC source awareness suitability and exposure	Exposure to conflicts
If LS > OS	Sustainable communication and it strengthens local tolerance and understanding within community.	Not exposed to conflicts
If LS = OS	Equilibrium between local and external communication. If the equilibrium breaks, it leads to the direction of positive or negative communication immediately. High-pressure area.	Partially exposed to conflict
If LS < OS	Not sustainable, which means the area is exposed and pressurised by outside source media. This has the potential to expose the local community to problems.	Exposed to conflicts

In this case, LS (41%) is greater than OS (24%), which indicates that the area is not exposed to conflicts as a result of WEC information sources

6.7.3.3 Percentage Accuracy Rate of Local Community Information

Table 6-29: Comparing WEC information accuracy

No.	Local Community Information Sources	Information Accuracy Rate					
		Accurate (A)		Partially accurate (P)		Not reliable and needs to cross-check (N)	
		N	%	N	%	N	%
1	Traditional ways (*dhaagu*, family, friends)	*133*	*74%*	*96*	*42%*	*2*	*4%*
2	Modern ways (Radio, TV, meeting, newspaper)	*47*	*26%*	*130*	*58%*	*44*	*96%*
	Total	*180*	*100%*	*226*	*100%*	*46*	*100%*
	Percent	*40%*		*50%*		*10%*	

The above table shows, 74 % of the communities agreed that they have been getting accurate WEC information mainly through traditional ways of information exchange, e.g. *dhaagu*. 26% of them believed that modern ways are more accurate. The data shows that the local people do not have full confidence in radio, TV and newspapers, which are owned by the government. In general, the local community believes that any information that reaches the community through modern methods of information communication is partially accurate or not reliable and they need other ways to check its validity. In the above section, it was discussed that most local people are getting information through traditional ways of communication. The next table shows that traditional ways are more accurate than the modern ways of getting information. See the next Assumptions and Conclusions of the above table:

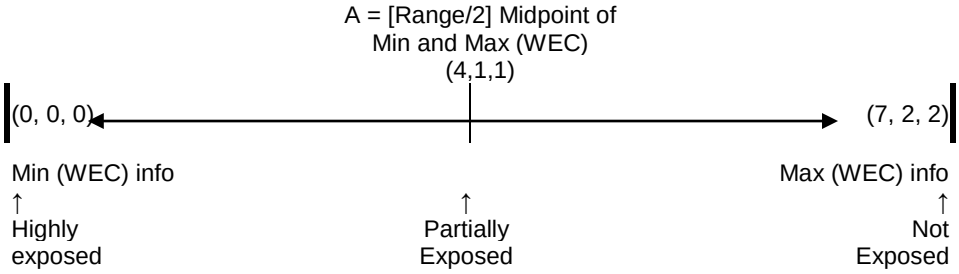
Assumption	WEC source awareness suitability and exposure	Exposure to conflicts
If percentage of A > P and N	Accurate or reliable information transfers within the community	Not exposed to conflicts
If percentage of If P > A and N	Partially accurate information transfers within the community	Partially exposed to conflict
If percentage of If N > A and P	Not reliable, information transfers within the community	Exposed to conflicts

In this respect P > A and N, which means the area is partially exposed to conflicts that occur as a result of getting accurate information..

6.7.3.4 Accountability on WEC Information

In reference to the above Table 6-26, the researcher look at the level of respondent communities together with institutions' awareness and proposals on recommending a list of responsible institutions for the purpose of information collection and analysis related to water resources management, hydro-climatic information, conflict and early warning and preparedness.

Figure 6-6: Accountability (Responsible institutions) data analysis



Assumptions and analysis of Figure 6-6:

Assumption	WEC awareness on accountability	Exposure to conflicts
If Range (Max-Min) > (A: Accurate)	Less awareness on accountability and exposed to problems.	Exposed to conflicts
If Range (Max-Min)= A	Critical point, only half of the people are aware of the accountability. which means partially exposed to problems.	Partially exposed to conflict
If Range (Max-Min)< A	More awareness of accountability and the region is not exposed to problems.	Not exposed to conflicts
If Mean (WEC) or Min (WEC)=0	There are institutions and people who do not have an awareness of accountability information, which leads to a poor decision-making process.	Exposed to disagreements that lead to conflicts

Note*: In this case, the Range (WEC) is greater than 'A' (Accurate) indicating the region is exposed to conflicts.*

6.7.3.5 Communities' View on Responsible Institutions for WEC Information

Table 6-26 (§6.7.3.1) shows that 86% of the respondents believe that they have more awareness regarding the institutions responsible for water resources-related information activities. Awareness of EW and conflict-related information was minimal at only 15%.

Table 6-30: The top-ranked lists of institutions working on WR, EW and conflicts

Water Resources			*EWS*			*Conflict*		
Responsible Institution [1st three]	N	52%	Responsible Institution [1st three]	N	5%	Responsible Institution [1st three]	N	5%
Ministry of Water Resources (MoWR)	18	27%	Afar Administration Justice and Security Affairs Bureau	2	3%	Afar Administration Justice and Security Affairs Bureau	2	3%
Afar Water Resources Bureau	12	18%	Ministry of Federal Affairs	1	1%	Ministry of Federal Affairs	1	1%
Afar Bureau of Finance and Economic Development	5	7%	Afar Health Bureau	1	1%	Afar Police Bureau	1	1%

Note: Detail list of data collected from institutions are displayed in Appendix C2

It was amazing that most respondents do not have adequate awareness of the activities of the Afar Disaster Prevention and Food Security Bureau, which is working on activities directly related to early warning situations. There are a few respondents (1%) who believe that the Regional Police Bureau is working on early warning and conflict-related activities. The possible reasons why this situation was observed could be (1) because they do not have awareness, (2) they do not trust the police department or (3) it is possible that the police office is not efficiently working on these activities, as seen in Table 6-31.

6.7.3.6 Institutions Awareness on Recommending Responsible Institutions Working on EW and Hydro-climatic Information

(1) Specific-1: Awareness on Responsible EW Institutions

Table 6-31 indicates that adequate emphasis was not given by institutional respondents in works related to listing the traditional institutions with respect to EW information. This contradicts the views of communities' *Dhaagu* information communication.

Table 6-31: List of proposed EW responsible institutions for information

Ranking the frequency of awareness	Proposed Organization Name	Categories of institution				Total	%
		Modern			Traditional		
		Gov't	NGO	Private			
1st	Afar Water Resources Bureau	9	0	0	0	9	23
2nd	Ministry of Water Resources	8	0	0	0	8	21
3rd	Meteorological Service Agency	3	0	0	0	3	8
3rd	Regional Water Bureaux	3	0	0	0	3	8
5th	Awash Basin Authority	2	0	0	0	2	5
5th	NGOs	1	1	0	0	2	5
7th	Afar Health Bureau - Hygiene and Sanitation Department	1	0	0	0	1	3
7th	Ecological Surveys	1	0	0	0	1	3
7th	Ethiopian Science and Technology	1	0	0	0	1	3
7th	Higher Educations	1	0	0	0	1	3
7th	Municipalities	1	0	0	0	1	3
7th	Other volunteers	1	0	0	0	1	3
7th	Private sector- Sewerage construction	0	0	1	0	1	3
7th	Research Centres	1	0	0	0	1	3
7th	RRC	1	0	0	0	1	3
7th	UN	0	1	1	0	1	3
7th	Water Bureau, other gov. organizations and private companies	1	0	0	0	1	3
7th	Werer Agricultural Institute	1	0	0	0	1	3
	Total	36	2	1	0	39	100
	Percent	92%	5%	3%	0%	100	

(2) Specific-2: Awareness on List of institutions working on hydro-climatic prediction

Table 6-32: List of proposed responsible institutions for hydro-climatic information

No.	List of institutions	Frequency of awareness	Percent
1st	Afar Water Resources Bureau	8	29.6
2nd	Ethiopian Meteorological Agency	6	22.2
3rd	MoWR	3	11.1
4th	Afar Regional Administration	1	3.7

No.	List of institutions	Frequency of awareness	Percent
4th	Afar Rural Development and Pastoral Development Office	1	3.7
4th	Awash Basin Authority	1	3.7
4th	Ethiopian DPWEWA	1	3.7
4th	Regional food Security and Disaster Prevention Bureau	1	3.7
4th	Regional Meteorology Department	1	3.7
4th	Semera Meteorological Station	1	3.7
4th	UN EUE	1	3.7
4th	USAID FEWS NET	1	3.7
4th	No information	1	3.7
	Total	**27**	**100.0**

6.7.3.7 Institutions' Awareness and Capacity on WEC Information

Table 6-33: Institutions' awareness of WEC information availability, status and capacity

Information Category		Availability Rate			Total
		Available	Partially available	Planned	
Water Resources	Count	22	30	4	56
	% within Info Category	39%	54%	7%	100%
	% of Total	34%	46%	6%	**86%**
EWS	Count	3	3	0	6
	% within Info Category	50%	50%	0%	100%
	% of Total	5%	5%	0%	**9%**
Conflict	Count	1	2	0	3
	% within Info Category	33%	67%	0%	100%
	% of Total	2%	3%	0%	**5%**
Total	Count	26	35	4	65
	% within Info Category	40%	54%	6%	100%
	% of Total	40%	54%	6%	100%
	Mean	9	12	1	
	% Overall	40%	60%		100%

Information availability rate for water resources is 86% and 14% for EWS and conflicts. On the other hand, the 'Awareness Variable' data analysis shows that the majority of (38.5%) of institutions in the region were in need of 50% of water-resources-related information for their strategic management and planning activities. The variation between these two findings may indicate that there could be a need for more information on water resources and it might be an indication of a lack of effective cooperation among institutions in exchanging information. Limited information on EW and conflict shows the region was highly exposed to problems related to water conflicts and lacked the preparedness to tackle the problems. The planning data is less than expected, especially in comparison to what is partially or fully available. This shows the available information is not up-to-date or dynamic. If all decisions could be made based on data, which is not up-to-date, it may possibly lead to wrong or inappropriate conclusions, which could lead to disagreement and conflicts.

6.7.3.8 Priority: Rating Information Source Priority

Table 6-34: Data analysis on WEC information priority

No.	Ways of getting Information	Priority rate (source choice)								Percent	
		1st	2nd	3rd	4th	5th	6th	7th	Total		
1	Traditional-*Dhaagu*	92	14	5	1	3	1	1	117	31%	Traditional (56%)
2	Family and Friends	11	51	30	2	0	0	0	94	25%	
3	Radio	13	8	30	19	2	0	0	72	19%	Modern (44%)
4	Meeting (e.g. agricultural extension, political, religious, etc.)	1	21	12	10	2	2	0	48	13%	
5	Television	1	2	5	6	8	1	0	23	6%	
6	Newspaper	1	1	0	4	4	4	2	16	4%	
7	Flyer	0	0	0	0	0	2	4	6	2%	
	Total	119	97	82	42	19	10	7	376	100%	
	Percent	32	26	22	11	5	3	2	100		

Premises, assumptions and explanations for Table 6-34:

Traditional *dhaagu*, family and friends are the first and second choice of the community for information source priority. Modern ways are considered as a secondary choice. Local communities are giving priority to traditional and family-based information sources. It seems the communities are not showing preference for modern sources of information. Is it due to infrastructural problem or any influence or tradition? It requires adequate justification. The figure shows that the communities are highly aware and focused on issues surrounding their local area. It is part of a traditional pastoral way of life. As a result, the communities do not have exposure to high levels of predictive information and therefore do not show an appropriate level of awareness that one should expect from a well-informed community in relation to early warning and preparedness. Hence, they are exposed to problems caused through the lack of the latest information.

6.7.4 Data Analysis on WEC Information Availability (Specific)

Under this section, the researcher will investigate the fundamental components of WEC information, namely: water resources, hydro-climatic information, conflict and early warning situations in Afar region. These variables are also integrated in the framework of study (chapter 3).

6.7.4.1 Water Resources Information Availability Details

Table 6-35: Awareness on water resources and sanitation information

Availability of information	Types of Information									
	Water Resources	River basin information	Water consumption	Water pollution	Ground water	Hydro-climatic information	Others-Hygiene and sanitation	Total	Percent	
Available	6	4	4	0	2	3	0	19	13%	
Sufficiently available	1	2	1	0	3	1	0	8	5%	18%
Partially available	7	6	4	6	6	3	1	33	22%	
Inadequate	6	6	7	10	8	9	2	48	32%	54%
Not available	3	5	7	8	5	8	1	37	25%	
No comment	1	1	1	0	0	0	1	4	3%	28%
Total	24	24	24	24	24	24	5	149	100%	

The above tables and figures show that 54% of water related information in the region is inadequate or partially available. Some 18% of the respondent institutions only believe they have adequate information mainly on water resources. Inadequate information has major impact on sustainable development of the region and leads to incorrect decision-making that has counter effect on the community. The information inadequacy gap was seen in the areas of daily water consumption, water pollution, ground water resources and hydro-climatic information. These problems partially expose or fuel the region for local water conflicts.

6.7.4.2 EW Related Information Availability

Table 6-36: Communities awareness on hydro-climatic information prediction

Prediction Category	Prediction *Category * Accuracy Rate						Total	%
	No comment	Less than 25%	25%	50%	75%	100 %		
Traditional ways	1	2	6	12	10	1	32	42
Modern ways	1	1	1	8	5	0	16	21
Do not know/No comment	28	0	0	0	0	0	28	37
Sub total	30	3	7	20	15	1	76	100
Grouped total	30	10		20	16		76	
	39%	13%		26%	21%		100%	
t: Assumptions	D: Do not know	I: Inaccurate		P; Partially accurate	A: Accurate			

Table 6-40 indicates that 63% of the community believes in having climate prediction practices. Data shows that 42% of them believe in the accuracy of traditional ways of practices as compared to the 21%of them who believe in modern practices. Survey data shows 37% of them do not believe in climate and other prediction practices because of religious influences. Some even explained that they lost their old ways of traditional prediction practices due to the increasing influence of religion. Thus, the community is almost divided in two opposite directions, specifically those who believe and who do not believe in prediction practices. This is part of the data analysis for checking the reliability of EW prediction practices in the region. See the next premise, assumption and explanation (1):

Comparing Maximum of D, I, P, A (Max Percent (D, I, P, A)=t)	Reliability of information	Explanation	Conclusions
If t=D	Ignorant (no information)	Highly exposed to unsustainable development because lack of awareness on WEC information that leads to wrong decision that can cause conflicts.	Highly exposed to conflicts
If t=I	Inaccurate	Exposed to unsustainable development because inaccurate information leads to wrong decision that can cause conflicts.	Exposed to conflicts
If t=P	Partially accurate	Less opportunity for sustainable development	Partially exposed to conflicts
If t=A	Accurate	High opportunity for sustainable development	Not exposed to conflicts

Note: In this case Max Percent (D, I, P, A) is equal to D=39% that shows the area is highly exposed to conflicts.

6.7.4.3 Comparing Modern and Traditional EW Prediction Practices

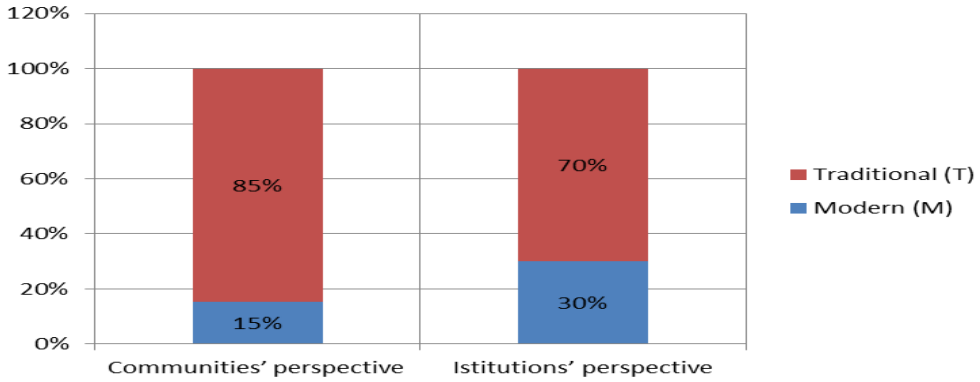
Table 6-37: Comparing communities' and institutions' practices on EW prediction

No.	List	Communities view	Institutions view
A	Modern ways:	Specifics - weather and drought	Meteorology, water supply, sometimes flooding
	N (Number of purposes)	*Appx. ≥2*	*Appx.* ≥3
B	Traditional ways	More general and multi-purpose (weather, daily life and as parts of traditional communication)	Drought, weather, general purpose-related
	N (Number of purposes)	Appx. ≥11	Appx.≥ 7
	Total	Appx ≥13	Appx ≥10

Table 6-38: Comparing views in Table 6-37

Categories	No. of purposes of EW (N)		Mean	Mean in %	Range
	Communities' perspective	Istitutions' perspective			
Modern (M)	2	3	2.5	22%	1
Traditional (T)	11	7		8%	4
Total	13	10	11.5	100	

Figure 6-7: Illustrating the above comparison data table



Premises, assumption and explanation (2):

Both members of the community and local institutions believe that the communities mainly (78%) rely on traditional ways of prediction. It also shows that there is lack of adequate provision for modern prediction methodology that would help the community. In today's fast-changing world, prediction practices should be highly supported and depend on science in order to attain sustainable development. Thus, there is lack of modern ways of prediction practices in the region.

Mean comparison of M and T (If…..)	Mean	Mean percentile
Mean (M) ≥ Mean (T)	High opportunity for sustainable development	Not exposed to conflicts
Mean (M) < Mean (T)	Less opportunity for sustainable development	Partially exposed to conflicts
Mean (M) =0	Exposed to unsustainable development because the local area is influenced by traditional approaches and closes a door for modern approach supported by science	Exposed to conflicts
Mean (T)=0	Exposed to unsustainable development. It is influenced by modern approaches and undermines the long tradition of the community by breaking the links among the local people	Exposed to conflicts

Premises, assumption and explanation (3)

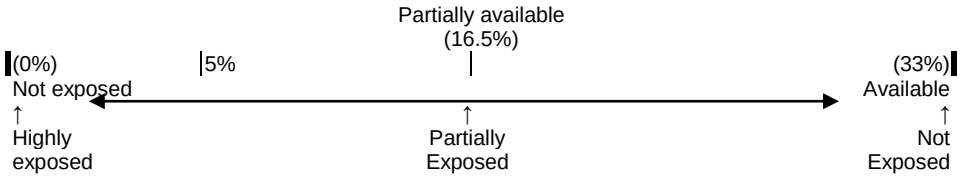
In this case, Mean (M) = 22% is less than Mean (T) = 78%, which means the location is partially exposed to conflicts due to an exposure to unsustainable development.

6.7.4.4 Conflict Related Information Availability as a Percentage

Table 6-39: Conflict-related information category

Information Category	Availability Rate			Total	Percent
	Planned	Available	Partially available		
Water Resources	4	22	30	56	86%
EWS	0	3	3	6	9%
Conflict	0	1	2	3	5%
Total	4	26	35	65	100%
Percent	6%	40%	54%	100%	

Table 6-39 shows that conflict and EW-related information is not adequately available. In the above table, all planned, available and partially available conflict information is only limited to 5%. The next figure shows summary of the analysis based on Table 6-39, above.



In other words, 5% of information is very close to highly-exposed lower bound of the above figure.

6.7.4.5 Hydro-climatic Information: Communities' and Institutions' Response

A. Effects of Climate Change on Local Communities

Table 6-40: Comparing communities' and institutions' views on the effects of climate change

No	Effects of climate change on local community	Communities' view		Institutions' view	
		%	Rank-1	%	Rank-2
1	Drought	21	1st	17	2nd
2	Change in temperature	16	2nd	-	
3	Death of animals and human	11	3rd	-	
4	Water shortage	11	4th	16	3rd
5	Flooding	7	5th	18	1st
6	Dislocation of people	5	6th	-	
7	Health related problems	5	7th	12	4th
8	Loss of natural forest	-	-	11	5th
9	Loss of wild life	-	-	10	6th
10	Loss of Vegetable and animal species	-	-	9	7th

Premises, assumption and explanation: Table 6-40 shows the primary causes and effects of climate change on local people. The impact of climate change is observed by changes in local temperature, death of animals, and death of human beings and dislocation of people. The problems related to flooding, which are listed as the seventh problem among the communities in the region, are considered to be as the first major listed problem by the local institutions. Any problems related to natural resources are part of an issue that can cause high levels of conflict. The data shows that the effect of climate change is not in the major priority list of local communities. In contrast to this, as a result of the cause and effects of climate change, the area is losing natural forests, wildlife and vegetables and animal species, which shows that the region is greatly exposed to a high level of conflicts. On the other hand, local

community and institutional respondents agree on the priority of problems associated with drought and water supply.

Climate relate major problems in the region	Comparing frequencies of views rank (Communities vs. Institutions)	Mean Rank (C+I)/2	Amended ranking
Drought opinion rank	(1st , 2nd)	1.5 ≈ 2nd	1st
Flooding opinion rank	(5th , 1st)	3rd	2nd
Water shortage opinion rank	(4th , 3rd)	3.5 ≈ 4th	3rd

The above data indicates 'who prefers to talk what' as compared to each other and why major priority variation is occurring about opinion on flooding. As drought is the major focus area for communities, so the issues on flooding are for institutions. The table shows people's response in the region, which reflects that drought, flooding and water shortage are the main problems in the river basin. These are key factors creating a high level of problems and the researcher can deduce that the region is exposed to a high level of conflicts.

B. Livestock and Agricultural Production Status Summary

Table 6-41: Institution's view on effects of climate change related to livestock and agricultural products

(a) Effects of climate change on livestock

N□.	List of Livestock products	S□able	Decreasing	Increasing	Total
1	Sheep	0	11	2	13
2	Goats-2nd choice	1	10	2	13
3	Camel-1st choice	1	9	4	14
4	Assess	2	9	2	13
5	Beehives	2	7	2	11
	Total	6	46	12	64
	Percent	9%	72%	19%	100%

Conclusion: Decreasing (72% agree); highly dissatisfied communities because their daily life is based on livestock since they are pastoralists.

(b) Effects of climate change on Agricultural products

No.	List of Agricultural products	Stable	Decreasing	Increasing	Total
1	Sugarcane	0	1	16	17
2	Cotton	0	11	6	17
3	Others	1	3	5	9
4	Onion	0	0	1	1
	Total	1	15	28	44
	Percent	2%	34%	64 %	100%

Conclusion: Increasing (64% agree); Increase in sugarcane state farms for a cash crop; cotton production that was preferred by the communities is highly reduced. Cotton leaves are used for animal pasture and preferred by pastoralist.

General conclusion: Decreasing by 8% (72-64); Highly dissatisfied; Highly exposed to conflicts.

Three quarters of the community believe that the number of livestock in the region is decreasing due to the effects of climate change in the order of sheep, goat and camel, respectively. In general, agricultural products are increasing in the region by 64%, contrary to livestock products. Most of the pastoral lands are in the process of being converted to sugarcane state farms as cash crop plantations. Cotton production is highly decreasing. The local communities dislike the sugarcane farms, as it's the leaf is not useful for pasturage. They prefer cotton while the camels and other livestock use the leaf for pasturing after harvesting cotton. The problem with this scenario is very high and increasing all the time.

6.7.5 Grouping Data for WEC Information Data Analysis

Table 6-42: Grouping primary data analysis for modelling –Information availability

	Categories of Awareness	Overall information level (**A**: Available, **PA**: Partially available, **P**: Planned, and **NA**: Not available)				Grouping/measuring the level of information HIGH to LOW				Final conclusion
		A	**PA**	**P**	**NA**	**Not Exposed <100%** [3]	**Partially Exposed <75%** [2]	**Exposed <50%** [1]	**Highly exposed <25%** [0]	
1.	**Institutions' preparedness on WR, EW and Conflict related information**									Partially exposed to conflicts (PE)
1.1	Information source awareness			43%		FULLY, Awareness	PARTIALLY, Awareness	LESS, Awareness	NOT Aware	PARTIALLY, Awareness (PE)
1.2.	Ways/means of getting WEC information: LS (41%) > OS (24%)	41%				Sustainable (If LS > OS)	Equilibrium partially sustainable (If LS = OS	Not sustainable (If LS < OS)		Not Exposed (Sustainable) (NE)
1.3	Accuracy of WEC information N (50%) > A (40%) and P (10%)			50%		Not exposed to conflicts (If A > P and N	Partially Exposed to conflicts (If P > A and N)	Exposed to conflicts (If N > A and P)		Partially Exposed to conflicts (PE)
1.4	Accountability (responsible Institutions) for WEC awareness (Range (WEC)> Range (WEC)/2, and max-min-Mean (WEC) and Min (WEC)=0			(18, 0,0)		Not exposed to conflicts	Partially Exposed to conflicts	Exposed to conflicts		Exposed to conflicts (EX)
1.5	Information availability rate in each institutions - institutional awareness	40.0% (Available)	53.8% (Partially available)	6.2% (Planned)	-	YES, Available	PARTIALLY, Available	LOW, Planned	NOT available	PARTIALLY, exposed to conflicts
1.6	Information priority secondary data analysis							Exposed to problems due to lack of modern info.		PE (Partially exposed to conflicts)
2	**Water resources information**		54%				Inadequate (Partially available)			PE(Partially exposed to conflicts
3	**EW related information** (Max. risk of 3.1 and 3.2 below)							Exposed to unsustainable development		Max (PE, EX) = EX (Exposed to conflicts)
3..1	Modern and traditional ways of EW prediction practices						Partially exposed (M<T)			Partially exposed to conflicts (PE)
3.2	Reliability of EW prediction practices			26%				Exposed to unsustainable development (t<50%)		Exposed to conflicts (EX)
4	**Conflict related information availability**				5%			Exposed to unsustainable development		Exposed to conflicts (EX)
5	**Hydro-climatic information**									Max (2EX) = 2EX(Highly exposed to conflicts)
5.1	Effects of climate change on local communities (Availability of problems that can cause conflicts)								Exposed to high level of conflicts	Exposed to high level of conflicts (EX)
5.2	Livestock and agricultural production status summary			Decreasing by 8% (72%-64%)					Exposed to high level of conflicts	Exposed to high level of conflicts (EX)

In conclusion, Table 6-42 shows that there is no adequate information and pre-preparedness for problems related to water conflicts and early-warning-related situations. The region is partially prepared in terms of information on WR, EW and Conflict-related activities and problems. The indication on the partial availability of preparedness could be as a result of on-going, wide-ranging, five-year preparations of strategic planning and management activities in

all government organisations. However, the availability of information is still insignificant. At Appendix M, more information is shown on the findings of the local WEC preparedness.

6.7.6 Data Analysis, Modelling, Forecasting and Validity Design (Data Mining)

In Chapter 7 of the discussion section the researcher has mapped and integrated public and local institutions' WEC information availability and preparedness.

6.8 Risks and Hazards of LWC Data Analysis

The fourth research question (stated in Chapters 1 and 3) clearly states the identification of the potential risks and hazards (variable 4) that are affecting the local people. The researcher has mapped in Figures 9 and 10 the premises useful for measuring the exposure to risks and hazards related to local water conflicts. The data analysis in this section starts from re-defining the hazards and risks in the following ways.

HAZARD: In this research, a hazard is a potential natural or manmade problem that can harm the local communities, local water resources and any other natural and traditional resources of the local people living in the area by causing or triggering local water conflict problems.

RISKS: are the likelihood of the potential occurrence of hazard and its effect or damage on the local communities, local water resources and any other natural and traditional resources of the region. It is expressed as a combined effect of HPV[11] and as a function of the type and *intensity* of *hazards*, p*robability* of occurrences and v*ulnerability* shown in Figures 6-9 and 6-10.

Figure 6-8: Local water-conflict hazard identification map

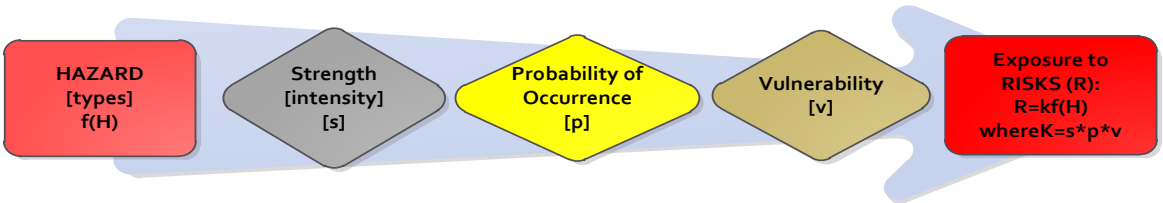
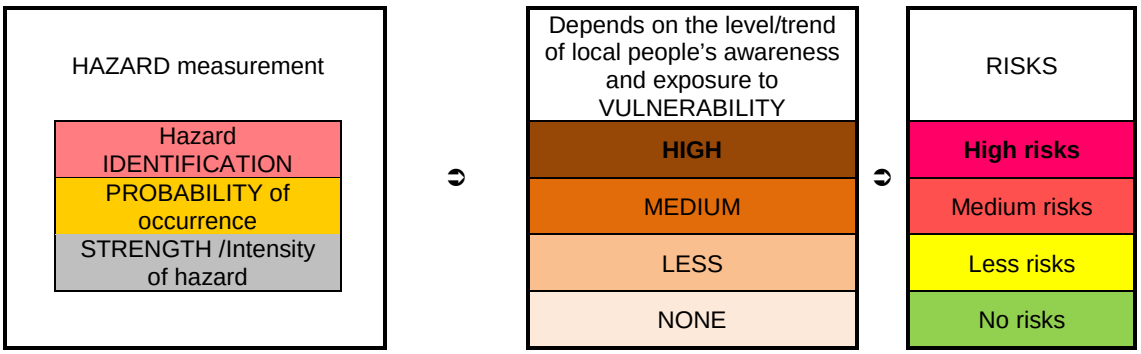


Figure 6-9: Pictorial illustration and detail analysis of reflection on LWC risk identification



[11] The amount/level of **H**azard, **P**robability of occurrences and **V**ulnerability of the people to conflict diversity factors.

6.8.1 Descriptive Data Analysis on Risks and Hazards

6.8.1.1 List of Hazards and Severity Status in Afar Region

In Appendix H, Tables 6-43 and 6-44, the researcher has displayed a list of hazards that are occurring in the region including their severity status. The data shows, 73% of the respondents believe that hazards occur in the region occasionally. In addition, 42% of the majority believed that the severity of the hazard is at its critical stage. In general, due to the high vulnerability of the region and critical condition of hazards, there is a high level of risks observed occasionally.

The study also shows that the region is highly exposed to natural hazards as compared to man-made hazards. During the last five years (2005-10), flooding, conflict, drought, car accidents and tornados are the first main five hazards that affected the livelihood of the communities and the water supply resources in the region. Conflict, car accident, robbery, looting and crimes are the key man-made hazards and they are considered as major problems. 3% of the respondents believe that flooding occurs as a result of both natural and man-made effects.

Table 6-43: Hazard category in the Afar region * Severity cross tabulation

Hazard Category		Severity					Total
		Minor	Moderate	Major	Critical	Catastrophic	
Natural hazards	Count	26	7	23	78	12	146
	% of Total	9.7%	2.6%	8.6%	29.1%	4.5%	54.5%
Man-made hazards	Count	14	17	34	22	9	96
	% of Total	5.2%	6.3%	12.7%	8.2%	3.4%	35.8%
Both natural and man-made	Count	2	0	9	12	3	26
	% of Total	.7%	.0%	3.4%	4.5%	1.1%	9.7%
Total	Count	42	24	66	112	24	268
	% of Total	15.7%	9.0%	24.6%	41.8%	9.0%	100.0%

6.8.1.2 Probability/Frequency of Hazard Occurrence

The data representation in Table 4-44 shows the main natural and man-made hazards that occurred in the region over the last 5 years (2005-10). This includes associated risks re-occurring on water bodies and to the livelihoods of the community.

Table 6-44: Hazard category * Probability of occurrence cross tabulation

Hazard Category		Probability of Occurrence			
		Unlikely	Occasionally	Frequently	Total
Natural hazards	Count	6	116	24	146
	% of Total	2.2%	43.3%	9.0%	54.5%
Man-made hazards	Count	5	69	22	96
	% of Total	1.9%	25.7%	8.2%	35.8%
Both natural and man-made	Count	1	11	14	26
	% of Total	.4%	4.1%	5.2%	9.7%
Total	Count	12	196	60	268
	% of Total	4.5%	73.1%	22.4%	100.0%

6.8.1.3 Vulnerability to Exposure on Hazards

A. Impacts of Major Water Resources Development Projects

There is a high expansion of government projects in the region. Dislocation, conflict, over-flooding, shortage of grazing lands, loss of farmlands, damage of private farms and deforestation are the major problems occurring in the region due to the impacts of expansion of government projects.

Table 6-45: Negative impacts of development projects on local communities

No.	List of Problems/Damage	Project Category						
		Canal construction	Dam construction	Expansion of irrigation development projects	Road construction	Not available	Total	Percent
1	Competition due to loss of grazing, agricultural and forest land s	0	5	8	0	0	13	16%
2	Dislocation	0	6	4	0	0	10	13%
3	Flooding	3	4	2	1	0	10	13%
4	Disagreement/Conflict	0	2	3	0	0	5	6%
5	Water shortage at lower stream	0	3	0	0	0	3	4%
	Sub total	3	20	17	1	0	41	52%
	Percent	7%	49%	41%	2%	0%	100%	
6	Not available	0	0	0	0	38	38	48%
	Sub total	3	20	17	1	38	79	100%
	Percent	4%	25%	22%	1%	48%	100%	

Assumptions:	≤ 25%	≤ 50%	**≤ 75%**	≤ 100%
Exposure:	Not exposed	Less exposed	**Exposed**	Highly exposed
Vulnerability:	Not vulnerable	Less vulnerable	**Vulnerable**	Highly vulnerable

52% of respondents explained that they are exposed to problems mainly as a result of dam construction and the expansion of irrigation projects. The other 48% of the respondents are not aware of on-going development projects in the region and related problems.

B. The Level of Projects' Cooperation with Local People

Table 6-46: Communities' satisfaction with the level of locally working projects

Project types	Satisfaction rate on project's cooperation with local people							
	Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dis-satisfied	Highly dissatisfied	Not available	I do not know	Total
International projects within the newly established local boundaries	0	3	2	0	1	6	2	14
Unilateral projects: (a project run by one stakeholder)	0	5	7	5	1	0	0	18
Bilateral projects: (a project run by two stakeholders: e.g. Gov. and community)	0	7	6	4	0	1	0	18
Multilateral projects: (a project run by three stakeholders: e.g. Gov, NGO and community)	1	8	4	3	0	1	1	18
Other projects	0	1	1	0	0	1	1	4
Total	1	24	20	12	2	9	4	72
Percent	1%	33%	28%	17%	3%	13%	6%	100%
	34%		28%	20%		29%		

The local communities are satisfied by the functions of some of the multilateral and bilateral projects in the region. However, they are neither satisfied nor dissatisfied with the works performed by unilateral projects in the region.

C. Local Water Resources Protection and Vulnerability

Appendix F, Tables 6-47/48/49 indicates the status of local water resources protection techniques applied by individuals, communities, governmental institutions, non-governmental organizations or other stakeholders in the region.

Table 6-47: Summaries of local water resources protection types

Water resources protection method		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Traditional	41	28.3	33.9	33.9
	Modern	25	17.2	20.7	54.5
	Both	54	37.2	44.6	99.2
	Neither of them	1	.7	.8	100.0
	Total	**121**	**83.4**	**100.0**	
Missing		24	16.6		
Total		145	100.0		

Table 6-48: Operation and maintenance capacity for water resources

Status of Local Maintenance Capacity	Frequency	Percent	Valid Percent	Cumulative Percent
Available	2	10.0	10.0	10.0
Partially available	10	50.0	50.0	60.0
Not available	8	40.0	40.0	100.0
Total	20	100.0	100.0	

Table 6-49: List of stakeholders who protect the local water resources

No.	Who protects water resources	Protection Schedule						Total	Percent
		Not available/occasionally/yearly			Monthly	Weekly	Daily		
		Not available	Occasionally	Yearly					
1	Local communities	0	11	5	12	3	18	49	40%
2	Private/Individuals	0	2	1	6	3	23	35	29%
3	Government	0	11	3	0	1	2	17	14%
4	Both individuals and local communities	0	2	0	1	0	7	10	8%
5	Gov and Local community	0	5	0	0	0	0	5	4%
6	NGOs	0	2	1	0	0	0	3	2%
7	Gov and NGO	0	0	0	0	0	1	1	1%
	Not available	1	0	0	0	0	0	1	1%
	Total	1	33	10	19	7	51	121	100%
	Percent	1%	27%	8%	16%	6%	42%	100%	
			36%			64%			

Assumptions for Table 6-49:

Yearly, or occasionally or not available	Monthly	Weekly	Daily
Worst Highly exposed 8% + 27% + 1% = 36%	Bad Exposed 16%	Good Less exposed 6%	Very good Not exposed 42%

D. Access to Safe Water Supply: the Current Status of Water Supply Sources

Table 6-50: Access to safe water supply: the status of water supply sources

No.	Water sources	Frequency	Percent	Valid Percent
A	***Unsafe water supply sources (hazardous/risky)***			
1	River water	76	43.9	46.9
2	Hand dug well	21	12.1	13.0
3	Pond	8	4.6	4.9
4	Spring water	8	4.6	4.9
5	Borehole	5	2.9	3.1
6	Ground water	3	1.7	1.9
7	Lake water	2	1.2	1.2
8	Multiple sources	2	1.2	1.2
	Sub total	125	72	77
B	***Safe water supply sources***			
9	Tap water	23	13.3	14.2
10	Hand pump	8	4.6	4.9
11	Public stand posts	4	2.3	2.5
12	Rain water	1	.6	.6
13	Governmental water supply resources	1	.6	.6
	Sub total	37	21	**23**
	Total-Valid	162	93.6	100.0
	Missing	11	6.4	
	Total-overall	173	100.0	

The above Table 6-50 shows that 77% of the respondents are highly exposed to unsafe water supply sources and very vulnerable in comparison to the following descriptive assumptions formulated from Table 6-51.

≤ 25%	≤ 50%	≤ 75%	≤ 100%
Not exposed	Less exposed	Exposed	Highly exposed
Not vulnerable	Less vulnerable	Vulnerable	Highly vulnerable

E. Water Resources Utilization Problems

The respondent institutions indicated that (1) general water resources management problems (44%), and (2) chronic water scarcity (33%), are the two key problems in the region affecting the water utilisation of the community as displayed in Table 5-52.

Table 6-51: Key problems of water resource utilization in the region

Main Problems	Frequency	Percent	Cumulative Percent
Chronic water scarcity	3	33.3	33.3
Water stress	2	22.2	55.6
General management problems	4	44.4	100.0
Total	9	100.0	

F. The level of Local People Exposure to Incidents

Identification of the local people exposed to incidents related to conflicts over local water resources and any natural resources during the last five years (see Table 6-52/53).

Table 6-52: Types of incidents that have occurred in the region

No.	Incident Category	Not available/no comment				Available		
		No comment	I do not know	Not available	Sub total	Sometimes	Always	Sub total
1	Verbal Aggression	32	107	110	249	322	51	373
2	Physical aggression	38	133	139	310	273	39	312
3	Sexual abuse	53	148	147	348	255	19	274
4	Indecent-impolite exposure	49	169	170	388	182	52	234
5	Acquisitive-greedy	52	196	227	475	116	31	147
6	Arson-inflammable	57	216	241	514	86	22	108
	Total	281	969	1034	2284	1234	214	1448
	percent	8%	26%	28%	61%	33%	6%	39%

Table 6-53: Victims and patients exposed to incidents related to conflicts

No.	Victims and Patients Category	Incident not available/no comment			Incident availability		Total	Sorted by incident availability
		No comment	I do not know	Not available	Sometimes	Always		
1	Adult women	42	112	188	367	41	750	408
2	Adult men	61	89	190	359	45	744	404
3	Property	86	63	218	326	27	720	353
4	Children	50	224	336	88	52	750	140
5	Patients	42	481	97	89	47	756	136
6	Others	0	0	5	5	2	12	7
	Total	281	969	1034	1234	214	3732	
	Percent	8%	26%	28%	33%	6%	100%	
			61%		39%			

The results show adult women are victims of adult men and that is why the figures are very close to each other. Women are highly exposed to incidents that occurred as a result of conflicts over local water supply or any natural resources. In most cases, women are those who fetch water in a household, whereas adult men are watering and grazing livestock. Verbal aggression, physical aggression and sexual abuses are the three major incidents that occur in the region.

6.8.1.4 Risk Reduction Awareness

Table 6-54: Institutions response on reducing risks in the region

No	List of risk reduction awareness	Frequency	Percent
1	Provision of basic education and training for local communities to increase awareness and participation	6	23.1
2	Setting effective water resources management rules and regulation	5	19.2
3	Construction of water supply resources and related infrastructures	2	7.7
4	Financial support and capacity building	2	7.7
5	Local and international territory/boundary demarcation	2	7.7
6	Natural resources conservation (environmental protection) activities	2	7.7
7	Solidarity/brotherhood facilitation (?)	1	3.8
8	Development of hand pumps water supply	1	3.8
9	Effective ways of water resources management	1	3.8
10	Equitable resource allocation	1	3.8
11	Expanding integrated projects	1	3.8
12	Federal government support	1	3.8
13	Promoting Religious education	1	3.8
	Total	26	100
	Mean	2	

Assumptions:

≤ 25%	≤ 50%	≤ 75%	≤ 100%
Do not have awareness High risks	Have less awareness Average risks	Have an awareness Less risks [67%]	Have high awareness No risks

It is assumed that respondent institutions should know a minimum of three types of risk reduction methods, one from each category of water, conflict and early warning services. In this case, the mean awareness shows 2 out of 3, which means institutions have 67% of awareness about local risk reduction methods.

6.8.2 Measuring Hazards and Risks on Local Water Conflicts

Step-1:Representation

$f(x_1)$: Exposure to hazards,

$f(x_2)$: Probability of hazard occurrence,

$f(x_3)$: Vulnerability of the people and water resources in the region,

where

x_{31}= Due to water related dev. projects (dam, irrigation projects)

x_{32}= Satisfaction rate on project's cooperation with local people

x_{33}= Water resources protection methods and capacity of operation and maintenance

x_{34}= Access to safe water supply

x_{35}= Water resources utilization problems

x_{36}= Local people exposure to incidents

$f(Y)$: Awareness on risk reduction methods

Step-2:Findings (The result)

$f(x_1)$= Max [Percentage of Severity] = Critical = 42%

$f(x_2)$= Max [Percentage of probability of occurrence] = Occasional = 73%

$f(x_3)$=Mean (Max Percentage of [x_{31}, x_{32}, x_{33}, x_{34}, x_{35}, x_{36}])

$f(y)$= Max [Percentage of mean for awareness] = less risks = 67%

Step-3: Fundamentals for formulating WEC risk equations : *Equation (6.7)*

LWC risk equation is defined as a combined effect of (6.7)

$$(f(x_1, x_2. X_{3i}), f(y))$$

with a constant k where 'i' varies from 1 to 6 as shown in steps 1 and 2 above.

6.8.3 Grouping Data for the Analysis of LWC Risk Identification

The fourth research question enquires, the type and the process of pre-identification of local risks and hazards: **"What are the main hazards, risks and costs associated with local water conflict related problems**?". In this section, the researcher has summarised and organised the results of data in accordance to the key components of the frameworks of study (Chapter 3), which is called the ***Risk Identification Matrix*** for local water conflicts.

In chapter 7, the discussion, the researcher has mapped and integrated the WEC risk-identification framework model that incorporates the basics of the contents displayed in addition to Figure 6-10, displayed below.

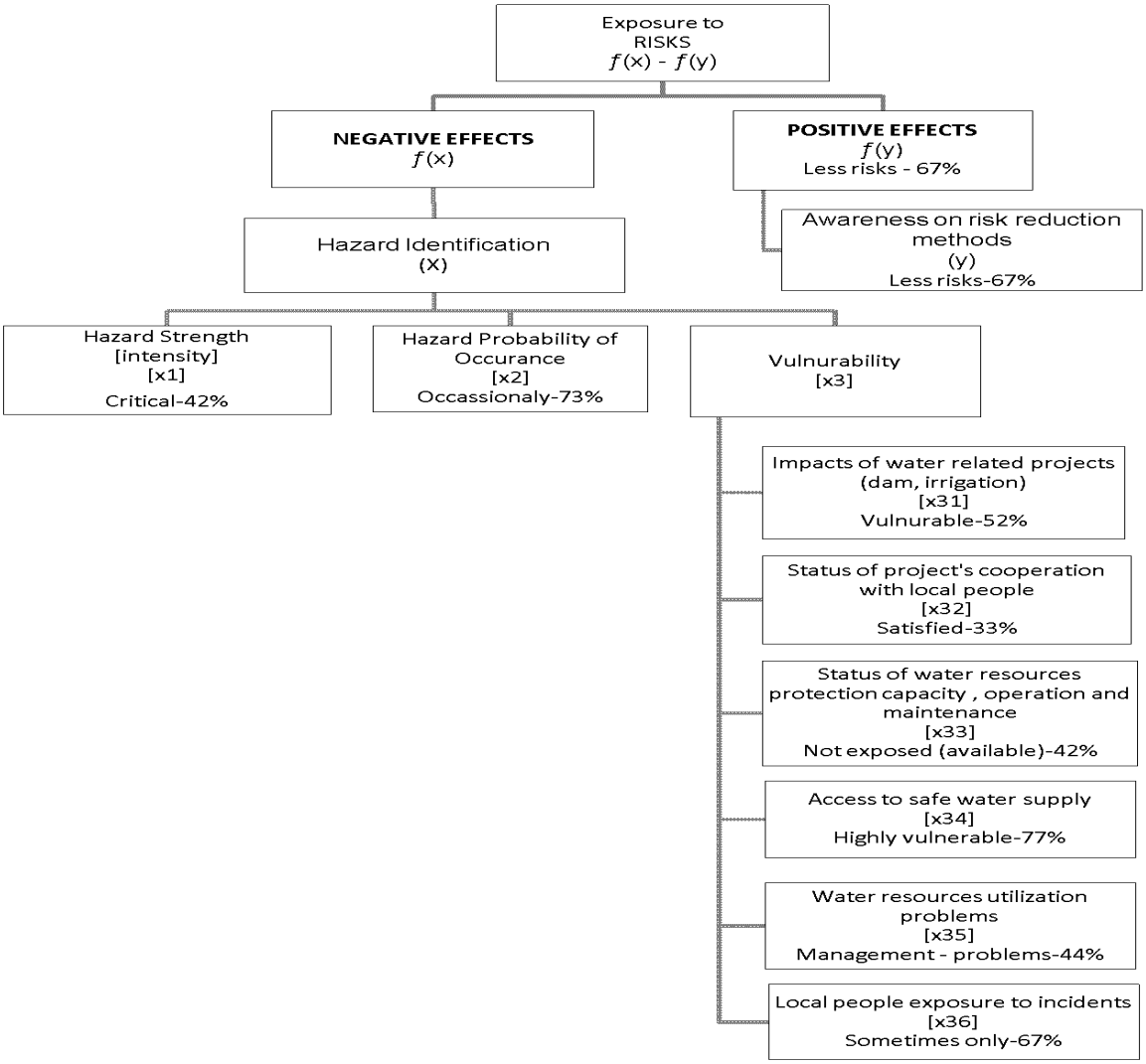


Figure 6-10: Local water conflict risk identification findings matrix

6.9 Networking, Communication and Cooperation (NCC)

Healthy social networking, communication and cooperation (NCC) are the key elements of collaboration that help to enhance the level of interaction. Collaboration means working with others to achieve shared and explicit goals (Loudon and Loudon, 2011).

In Chapter 3 of our study, the three variables: networking, communication and cooperation were linked within the frameworks of the study. To support this, the third research question directly states the level of collaboration among the stakeholders in the region. This section incorporates three interlinked sub-variables of parts of the interaction at local level that includes the status of Networking, Communication and Cooperation (NCC) among communities and stakeholder institutions working in the region at different levels.

Figure 6-11: NCC coordinated approach - observation-map 1

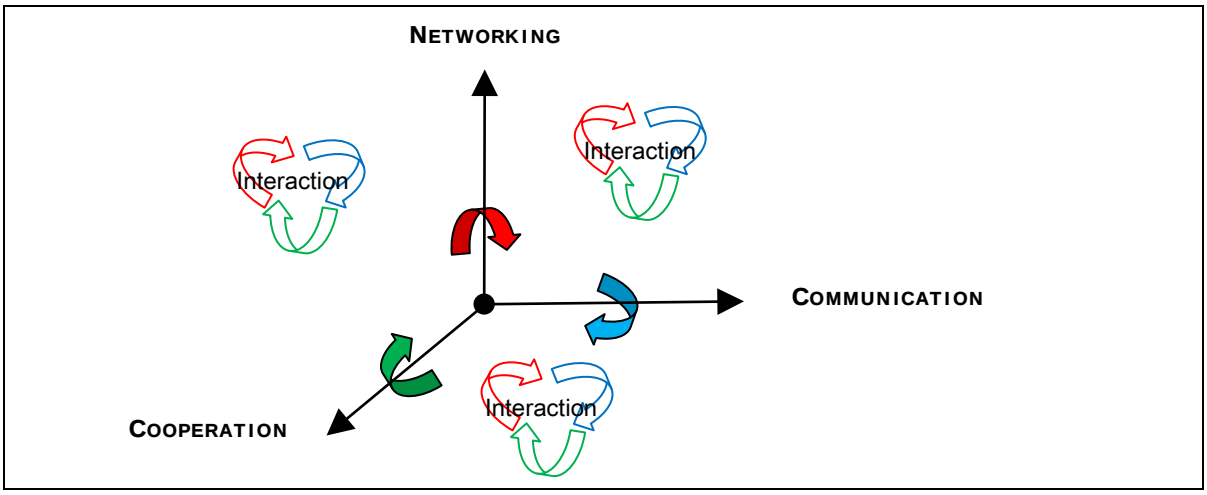


Figure 6-12: NCC linear approach - observation-map 2

Table 6-55: NCC stakeholders: a tabular approach measuring the level of interaction observations among major stakeholders in the region – observation-map 3

Institution respondents		INS-X (e.g. Water Bureau)	INS-Y (e.g. Investment Bureau)	COM-A (Afar Tribe)	COM-B (Issa tribe)
		A	B	C	D
INS-X: (e.g. Water Bureau)	*1*	+	-	+	+
INS-Y: (e.g. Investment Bureau)	*2*	-	+	+	+
COM-A: (Afar Tribe)	*3*	+	+	+	-
COM-B : (Issa tribe)	*4*	+	+	-	+

The figure shows there are 12 major positive interactions and 4 major negative interactions among the selected two different institutions and two different tribes selected in the Awash River Basin, which means 75% of the existing communication in the region is positive. 25% of negative interactions occurred due to lack of efficient communication among institutions and communities in the region concerning the topics of water, conflict and early warning system. For every three positive interactions, there was one negative interaction among concerned stakeholder institutions and communities in the region. 62% of the respondent institutions' representatives agreed that they do not know the specific objective of their respective organization and are unable to transmit it to local communities in the region.

6.9.1 Premises and Summary of Observations on NCC Data Analysis

Local NCC is mainly hampered by conflicts caused by critical pressure coming from neighbouring people living in the lower and middle valley of the Awash River Basin. This includes people from Issa, Oromo and Amhara tribes due to competition over limited water and natural resources. The level of local NCC between communities and institutions in the

same region is moderate and slowly increasing, in contrast to the widening gap of communication between communities from different tribes. Similarly, the level of NCC among local institutions is not encouraging.

6.9.2 Descriptive Data Analysis on NCC

6.9.2.1 Status of Pressure on WS Resources as a Problem on Local NCC

The data analysis in Table 6-56 below indicates that 95% of the NCC problems are created by medium to high levels of pressure on the local communities in the region related to problems about water, natural resources, conflicts and early warning service related issues. In most cases, the pressure on local people comes from external tribes who share the resources.

Table 6-56: Groups pressure on local communities in the Afar region

No.	Groups Location	Groups Pressure On Local People				Total	Percent
		Insignificant	Less	Medium	High		
1	Lower and Middle Awash	2	4	18	46	70	51%
2	Lower Valley Awash	0	0	3	44	47	35%
3	Middle Valley Awash	0	0	2	12	14	10%
4	Upper Valley Awash	0	0	2	1	3	2%
5	Upper Highlands	1	0	0	0	1	1%
6	Middle Valley Highlanders	0	0	1	0	1	1%
	Total	3	4	26	103	136	100%
	Percent	2%	3%	19%	76%	100%	
		5%		95%			

6.9.2.2 Sources/Types of Pressure

The majority (64%) of the pressures are coming from neighbouring tribes such as Issa, Oromo, Amhara, and others living in the highland areas of the basin, including immigrants from Eritrea. The other 36% of the pressure occurs within the internal pressure of the Afar tribal clans.

Table 6-57: Percentage frequency of pressure from local people recorded by respondents

No.	Group of people (Tribes/Clans)	Frequency	Percent	Valid Percent
A.	**INTERNAL PRESSURE**			
1	Afar tribes	**17**	**11.1**	**36.2**
B.	**EXTERNAL PRESSURE**			
2	Issa/Somali tribes	7	4.6	14.9
3	Oromo tribes	7	4.6	14.9
4	Amhara tribes	4	2.6	8.5
5	Many other tribes	4	2.6	8.5
6	Tigre tribes	3	2	6.4
7	Highlanders	2	1.3	4.3
8	Arguba tribes	1	0.7	2.1
9	Immigrant people from Eritrea	1	0.7	2.1
10	Wolayita tribes	1	0.7	2.1
	Sub total	**30**	**19.8**	**63.8**
Total-valid		47	30.7	100
Missing		106	69.3	
Total		153	100	

6.9.2.3 Frequency of the Problems as an Effect on Local NCC

On the key communication and cooperation problems in the region, 50% of respondents agreed that conflict over grazing, water and other natural resources occurs frequently as a

result of competition over resource utilization and allocations. The other 50 % decided that problems occur due to (1) lack of understanding of the neighbouring community's language, (2) livestock and human health problems, (3) lack of adequate awareness of traditional custom laws, rules and regulations, and (4) lack of good communication processes, mainly with Issa tribes in the river basin.

Table 6-58: Summary of keywords of respondents' opinion on problems affecting NCC

No.	Pro keywords on problems affecting local NCC	Frequency	Percent	Valid Percent
Conflict as a problem				
1	Conflict - over grazing and watering livestock.	**18**	**13.7**	**39.1**
2	Conflict - inappropriate cattle riding and herding.	2	1.5	4.3
3	Conflict - disagreement over water allocation.n	1	0.8	2.2
4	Conflict - inappropriate claim on water and other natural resources.	1	0.8	2.2
5	Conflict - increase in bandits at the border area of Eretria.	1	0.8	2.2
	total	**23**	**17.6**	**50**
Language as a barrier				
6	Language - Oromo language incapability as a barrier.	**6**	**4.6**	**13**
7	Language - Somali language incapability as a barrier.	**3**	**2.3**	**6.5**
8	Language - Amharic language incapability as a barrier.	2	1.5	4.3
9	Language - Tigirigna language incapability as a barrier.	1	0.8	2.2
10	Other local language incapability as a barrier.	1	0.8	2.2
	total	**13**	**10**	**28.2**
Health problems				
11	Death of livestock.	2	1.5	4.3
12	Human health problems.	1	0.8	2.2
	total	**3**	**2.3**	**6.5**
Custom laws/tradition				
13	Lack of adequate knowledge about local custom laws over land, water and utilization of other resources.	2	1.5	4.3
14	Deterioration/decline in Afar communities' traditional laws, such as *Fima.*	1	0.8	2.2
	total	**3**	**2.3**	**6.5**
Rules and regulations				
15	Lack of adequate rules and regulations in the region on the utilization of common natural resources in the River basin.	1	0.8	2.2
16	Lack of favourable situations in the region.	1	0.8	2.2
	total	**2**	**1.6**	**4.4**
Lack of Communication				
17	Lack of good communication with Issa communities.	**1**	**0.8**	**2.2**
Other problems				
18	Miscellaneous problems.	**1**	**0.8**	**2.2**
Total		46	35.1	100
Missing		85	64.9	
	Total	131	100	

6.9.2.4 180 Miscellaneous Problems in the Region that Affect Local NCC

Table 6-59, displayed below, describes 23 categories in the list of one hundred and eighty key problems in the Afar region that affect the local people and institutions' NCC situations in the process of achieving sustainable development. These problems are identified through

interview, survey and an investigation of notes collected from local communities and institution respondents participating in the research. Further detailed lists of the problems are presented in the previous chapter 6 of presentation of results.

Table 6-59: The categories and intensity of 180 NCC problems in the Afar region related to water, conflict and early warning services[12]

No.	Categories of Problems/Pressures	Frequency of types of problems and their level of intensity			Total
		High level **'H'**	Medium level **'M'**	Low level **'L'**	
1	Local conflict related problems	8	10	8	26
2	Water resources related problems	9	13	3	25
3	Administration, finance and coordination related problems	3	17	1	21
4	Water quality related problems	9	1	1	11
5	Water consumption and saving practices	2	7	0	9
6	Major problems that Increase vulnerable people in the region	4	5	0	9
7	Human health related problems	7	1	1	9
8	Livestock related problems	7	1	1	9
9	Information on security related problems	3	3	2	8
10	Natural resources and nature related problems	5	2	1	8
11	Irrigation and Agriculture related problems	5	2	0	7
12	Planning related problems	1	5	0	6
13	Communication and cooperation related problems	1	4	1	6
14	Construction, operation and maintenance related problems	5	0	0	5
15	Infrastructure related problems	3	1	0	4
16	Capacity building related problems	4	0	0	4
17	Transparency and corruption related problems	1	3	0	4
18	Economy related problems	2	0	0	2
19	Technology related problems	2	0	0	2
20	Institutions and regulatory framework related problems	0	2	0	2
21	Development projects related problems	1	0	0	1
22	Communities participation related problems	1	0	0	1
23	Hydro-climatic prediction information	0	1	0	1
	Total	83	78	19	180
	Percent	46%	43%	11%	100%

Table 6-60: Comparing communities and institutions view on local problems

Summaries of indicated problems	Respondents' view		Remarks on common views
	Communities' view	Institutions' view	
Conservation	✓		
Local trade	✓		
Health	✓		
Politics	✓		
Poverty	✓		
Water and grazing	✓		
Conflict	✓	✓	Common views
Administrative		✓	
Communication		✓	
Education		✓	

[12] **H**: high level problems/pressures, **M**: Medium level problems/pressures, **L**: low level problems/pressures.

Table 6-60 shows that from the ten key categories of problems identified in the region, both community and institution respondents agreed on one area of conflict, as the major problem in the region. This shows that the rate of agreement between institutions and communities is limited to 10% only. The remaining 90% shows, there are inadequate links for understanding problems and opportunities for cooperation with each other in resolving the most critical problems in the region. For instance, the problems mentioned by communities were not indicated by institutions. Similarly, time problems pointed out by institutions were not emphasized by local communities as a major problem.

6.9.3 Data Analysis on Networking

This section shows primary data analysis on availability and status of local networking tools such as traditional social networking, availability of common communication language for networking together with main areas of relationships. In addition, it indicates the availability of local institutions' mission as the impetus for establishing the necessary networking with communities.

6.9.3.1 Social Networking Availability - Dhaagu

There is no adequate social networking facility that helps to communicate with other tribes in the basin. *Dhaagu* is the main social and traditional networking system practised within Afar communities for information transfer and sharing purposes.

6.9.3.2 Networking and Communication Language -for Information Transfer

Table 6-61: List of communication languages for NT among communities and institutions

No.	Language types	Language usage frequency		Total	Percent	Remarks
		Sometimes only	Frequently			
1	Afar	8	111	119	63%	Local languages (97%)
2	Amharic	30	27	57	30%	
3	Oromiffa	3	1	4	2%	
4	Tigrigna	1	2	3	2%	
5	Aderigna	0	1	1	1%	
6	English	2	0	2	1%	International languages (3%)
7	Arabic	0	1	1	1%	
8	French	1	0	1	1%	
	Total	45	143	188	100%	
	Percent	24%	76%	100%		

Many tribes speaking different languages other than Afar surround the Afar region. A lack of capability in speaking the neighbouring language shows that the region is heavily confined by its internal divisions. Moreover, there is no adequate common networking area like a market, road, school, health centre, etc., which can bring the community together. The data shows there is no adequate NCC among different tribes of the people in the basin, in particular with the Issa tribe, which speaks the Somali language.

6.9.3.3 Key Areas of Networks Available for Local People in the Basin

The next table indicates means and ways of local interaction for connecting local communities living in the Awash River basin.

Table 6-62: Main areas of relationships among local people

No.	Types of Relationships	Level of Communication				Total
		Negative	Normal	Positive	No comment	
1	Territory/border related	113	9	3	2	127
2	Natural resources-water/grass	109	12	4	2	127
3	Political	101	14	6	6	127
4	Economy	77	32	13	6	128
5	Ethnicity/Race	23	53	50	2	128
6	Language	3	44	77	4	128
7	Religion	2	44	80	2	128
	Total	428	208	233	24	893
	Percent	48%	23%	26%	3%	100%

Table 6-62 shows, 48% of the respondents agreed that they have negative relationships with those communities sharing the same water resources. The main causes of the negative types of relationships are based on territory or border-related issues (26%); water, grass and other natural resources (25%); politics (24%); economy (18%); ethnicity/race (5%); language and religion (2%).

6.9.3.4 Networking-Institutional Motto

Among 26 respondent institutions, 10 (38%) of them were clearly aware of their organizational mission that would help them to contact the local communities. This shows that there is a big gap between the communities and local organisations on understanding the specific objectives of the organization.

Table 6-63: Categories of the some of the institutional missions as a means for helping to develop local understanding

Category	List of specific objective (motto) of local institutions
A. Pastoral communities' participation and satisfaction (**30%**)	1. To develop and facilitate community ownership so that they can intervene and respond appropriately on pastoralist related problems. 2. Working with local community using the local language, a participatory approach and the COM (Community, Ownership and Management) method. 3. The maximum satisfaction of the community is our main objective.
B. Education/awareness (**30%**)	4. Bringing the traditional ways to modern means of communication through teaching local community leaders. 5. To create/develop awareness of the development efforts. 6. To have full involvement in having the institution's objective and at the end of the day to create consciousness of responsibility.
C. Good governance (**20%**)	7. Implementation of good government and democracy in order to improve the life standards of pastoralists. 8. Ensuring public safety and security; promoting good governance and the delivery of justice.
D. Water resources management (WRM) - **(20%)**	9. Controlling and managing the Awash River so that local people will not be dislocated from their area. 10. Provision of pure water supply for the community.

Table 6-63 shows institutions' communication awareness in introducing activities related to pastoral communities, education, good governance and water resources management activities. The figure shows that the awareness of good governance and WRM activity is limited to 40% only. Economy and health-related awareness tasks were not mentioned by respondent institutions. The majority (60%) of respondent institutions have agreed that they include pastoral communities' participation, satisfaction and education awareness in their organizational objectives.

6.9.4 Data Analysis on Communication

This section describes data analysis on locally available traditional and modern means of communications. The analysis includes people's preference, style of communication and the level of satisfaction with the use and transfer of information among them.

6.9.4.1 Communication– Types and Status

Among survey respondents, 39% agreed on modern ways of communication and 61% of the majority agreed on using traditional methods of communication, mainly the *dhaagu* system, as primary communication and networking methods. The *Dhaagu*, radio and meetings are the three most common ways of traditional and modern communication systems practised within the local communities of the Afar region. The respondents decided that the level of communication and networking in the region is increasing (50%), normal (45%), decreasing (4%), and seasonally changing (1%).

Table 6-64: Status and types of local communication * Cross tabulation

No.	Communication Type	Normal	Increasing	Decreasing	Seasonal	Total	%
A.	**Traditional ways**						
1	*Dhaagu*	56	43	4	0	103	57%
2	*Edir*	2	1	0	0	3	2%
3	*Equb*	1	1	0	0	2	1%
4	Religion/At mosque	0	2	0	0	2	1%
5	Coffee ceremony (mainly old people)	0	1	0	0	1	1%
	Sub total	**59**	**48**	**4**	**0**	**111**	61%
B.	**Modern ways**						
6	Radio	18	24	1	1	44	24%
7	Meetings	1	4	1	1	7	4%
8	Television	1	7	1	0	9	5%
9	Telephone/mobile	0	6	0	0	6	3%
10	Newsletters	0	1	1	0	2	1%
11	Training/awareness creation on early warning	1	0	0	0	1	1%
12	Telegram	1	0	0	0	1	1%
13	Political organizations	0	1	0	0	1	1%
14	Social organization such as *Kebele* or Farmer's Association	0	0	0	0	0	0%
	Sub total	**22**	**43**	**4**	**2**	**71**	**39%**
Total		81	91	8	2	182	100%
Percent		45%	50%	4%	1%	100%	

6.9.4.2 Communication Preference - Transfer and Information Use Priority

Table 6-65 indicates, 66% of the people have agreed that they are successful at retaining prioritised level information. The figure shows that communities do not have full confidence in secondary sources of information. However, 44% of respondents agreed that they prefer secondary sources of information.

Table 6-65: Communities' preference on information priority

Priority		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	144	64.9	66.1	66.1
	Secondary	74	33.3	33.9	100.0
	Total	218	98.2	100.0	
Missing	System	4	1.8		
Total		222	100.0		

6.9.4.3 Effectiveness of Local Communities' Communication Style

Table 6-66: Comparing local people's communication style with others who share resources

Communication style	**Rating communication style**				**Total**
	Aggressive	**Passive**	**Assertive**	**No comment**	
Own communication style	26	90	11	0	127
	20%	*71%*	*9%*	*0%*	*100%*
Other's communication style	66	25	33	3	127
	52%	*20%*	*26%*	*2%*	*100%*
Total	92	115	44	3	254
	36%	*45%*	*17%*	*1%*	*100%*

In Table 6-66, 71% of the communities considered their own communication style passive as compared to others and 52% of the respondents looked upon others as aggressive as compared to themselves. The finding shows that there is a lower percentage (17%) of assertive ways of communication in the region, which is an indication for exposure to conflicts. The numbers of people who passively interact exceeds those who are aggressively communicating by 11%. This shows that the existing traditional methods of communication could indicate the availability of disagreements among those people. It is an indication of a preliminary stage for violent conflicts. In contrast, a minimum number of aggressive approaches could show a reduced number of violent conflicts in the region.

6.9.4.4 Communication Satisfaction among Institutions and Communities

Table 6-67: Among different institutions working in the region

Community networking area	Satisfaction Rate							Total
	Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissat isfied	Highly dissatisfied	Not applicable	No comment	
1. IWRM	0	5	7	7	4	0	0	23
2. Conflict management	1	2	6	6	4	3	1	23
3. Early Warning Systems- EWS	0	5	5	8	3	2	0	23
Total	1	12	18	21	11	5	1	69
Percent	1%	17%	26%	**30%**	**16%**	7%	1%	

Table 6-67 indicates the availability of inefficient ways of communication among institutions working on water, conflict and early-warning-related activities. Thus, 46% of the institutional respondents showed their dissatisfaction and 26% of them are neither satisfied nor dissatisfied together with a few of them (18%) who were satisfied.

Table 6-68: Methods of local institutions' communication preference with communities

Modern practices in communicating with local people: 13 lists (76%)
(1) Creating awareness through provision of education/trainings
(2) Creating an awareness on efficient ways for local water resources usage
(3) By facilitating transportation activities for local communities
(4) By establishing a working group/task force
(5) Communicating by making a phone call, writing a letter and/or sending a telegram
(6) Consultation
(7) Government representatives
(8) Meeting
(9) Outreaching directly to local communities
(10) Participatory approach with the local communities
(11) Technical aspects are done in a modern ways through contacts of top MoWR's experts whereas administrative aspects are performed in traditional ways.
(12) By selecting model tribal leaders and communicating using local languages
(13) By preparing a working plan/schedule
Traditional practices in communicating with local people: 4 lists (24%)
(14) Through *Dhaagu* traditional information exchange methods
(15) Through local institutions' representatives
(16) Through religious leaders
(17) Through traditional/tribal leaders/elders

Table 6-69: Communication preference among different institutions and local communities in the region

Communication Approach	Frequency	Percent	Valid Percent	Cumulative Percent
Both modern and traditional approaches	28	75.7	75.7	75.7
Traditional approaches	5	13.5	13.5	89.2
Modern approaches	4	10.8	10.8	100.0
Total	37	100.0	100.0	

Table 6-68/69 both show the importance of traditional and modern ways of communication. However, institutions prefer the modern approach in order to achieve organisational objectives, whereas communities prefer the traditional methods of achieving successful communication in the context of the Afar region.

6.9.5 Data Analysis on Cooperation

The third research question is the identification of the type of collaborations in the process of conflict managements among concerned parties in the region. Availability of the necessary cooperation is one of the major component leading to successful collaboration. Here, the

researcher will present the status of communities' cooperation with institutions and among themselves. Summary of the rationale of communities on cooperation and communication will be presented in detail in the following sections.

6.9.5.1 Institutions Feedback on Communication and Cooperation with Local Communities

52% of the respondent institutions agreed that there was medium and equal level of communication and cooperation feedback from different local communities regarding their interactions with local institutions in the region. The figure shows that the levels of communication and cooperation are directly proportional to each other.

Table 6-70: Communication and cooperation evaluation * Cross tabulation

Communication and Cooperation Feedback Evaluation	Level/amount feedback				Total
	I do not know	Low	Medium	High	
Communication feedback	0	5	11	4	20
Cooperation feedback	1	5	10	4	20
Total	1	10	21	8	40
Percent	**3%**	**25%**	**52%**	**20%**	**100%**

6.9.5.2 Institutions View on Communication and Cooperation with Communities

Table 6-71 shows, 41% of respondent institutions agreed that the level of cooperation they are getting from local communities is moderate with respect to the project activities implemented in the region.

Table 6-71: Institutions' satisfaction rate with respect to communities' cooperation

Institutions' satisfaction rate with respect to communities cooperation	Frequency	Percent	Valid Percent	Cumulative Percent
Very good	3	17.6	17.6	17.6
Good (moderate)	7	41.2	41.2	58.8
Encouraging	5	29.4	29.4	**88.2**
Not applicable (no common projects)	1	5.9	5.9	94.1
No comment	1	5.9	5.9	100.0
Total	17	100.0	100.0	

6.9.5.3 Communities Cooperation within Themselves (at Low/Clan Level)

Table 6-72: Measuring the satisfaction rate of local people's communication and cooperation between members of Afar communities and clans

Communication and Cooperation		Satisfaction rate						Total
		No comment	Poor	Fair	Good	Very good	Excellent	
Communication with local groups		1	3	23	54	39	8	128
	%	1%	2%	18%	42%	30%	6%	100%
Cooperation with local groups		1	3	13	53	42	16	128
	%	1%	2%	10%	41%	33%	13%	100%
Total		2	6	36	107	81	24	256
	%	1%	2%	14%	42%	32%	9%	100%

The key reason for rating the above satisfaction rate is indicated in the next Table 6-73. Details of the reason are further listed in Appendix I.

Table 6-73: List of key reasons for rating satisfaction with communication and cooperation between Afar communities and clans

	Categories of rationale	Frequency of response	%
1.	Tradition (*9 comments*)	9	24%
2.	Social relationships (7 comments)	7	19%
3.	Problem solving (3 comments)	3	8%
4.	Humanity (3 comments)	3	8%
5.	Information and awareness (2 comments)	2	5%
6.	Conflict (2 comments)	2	5%
7.	Personal behaviour (2 comments)	2	5%
8.	Language and religion (2 comments)	2	5%
9.	Work conditions: (1 comment)	1	3%
10.	Water supply (1 comment)	1	3%
11.	Respectfulness (1 comment)	1	3%
12.	Participation (1 comment)	1	3%
13.	Cooperation (1 comment)	1	3%
14.	Underdevelopment (1 comment)	1	3%
15.	Common natural resources (1com.)	1	3%
	Total	37	100%

6.9.6 Measuring NCC on Local Water Conflicts

Above (§6.1 to §6.9), the findings of NCC data have been discussed in detail. In Table 6-74 below, summaries of each component of NCC are presented together with assumptions about the categories of CNN (minor, moderate, major and critical).

Table 6-74: Assumptions and summary of NCC data analysis

NCC Variable Summary and Assumptions	Minor	Moderate	Major	Critical
	≤25%	**≤50%**	**≤75%**	**≤ 100%**
K: Constant (problem subject)			60% (major problem)	
f(x): Communication		41% (moderate communication)		
f(y): Networking	Negative (not adequate)			
f(z): Cooperation	Negative (not adequate)			
K*f(x,y,z):	**2* Negative**	**1* Moderate**	**Major problems**	

The region is highly exposed to problems affecting the local NCC. In addition to this, the data analysis indicates that there was a negative or inadequate level of networking and cooperation mainly with neighbouring communities of the region. The level of communication within the same tribe is moderately better as compared to the negative communication with neighbouring Issa tribes residing in the River Basin.

6.9.7 Data Analysis, Modelling, Forecasting and Validity Design (Data Mining)

The above preliminary information can help as preliminary information for local NCC observation data analysis. This preliminary analysis helps to develop further complex functions in identifying and validating the numerical values of the relationships between NCC sub variables.

6.9.8 Grouping and Measuring NCC Data Analysis on Local WC EWS

Table 6-75: Summary of local networking, communication and cooperation (NCC) data analysis

	NCC Variables	What to analyse?	Representation	Findings	Max. of respondent agreement
A.	**NCC problem Identification**		K= Mean(K_1/2,K_2/2)+(K_3)/2	Critical	=(38% +32%)/2 + 50%/2=60%
1.	GENERAL pressure on local communities in sharing local water supply resources in the basin	Measuring the internal and external pressure	K_1	High pressure	76%
2.	Intensity of pressure on resource sharing		K_2 = Max (K_{21}, K_{22})	High pressure	64%
	2.1. External pressure (Within the tribes)	External pressure	K_{21}		64%
	2.2. Internal pressure (Within the Afar clans)	Internal pressure	K_{22}		36%
3.	Problems related to communication and cooperation	Types and frequency of problems	K_3	Conflict over grazing, water and other resources	50%
B.	**Communication STAUS**		**X= Mean [X_{4i}]**		=42%+66%+45%+10%=41%
4.	Availability of communication	Availability of communication types and status	X_1	**INCREASING,** both traditional and modern ways (mainly traditional, it has a positive impact on development).	50%
5.	Communication preference/priority	Transfer and information use priority	X_2	Majorities preferred primary sources of information through traditional ways (, it has a positive impact on development).	66%
6.	Communication efficiency/style		X_3	Majority communication style was passive (It has an impact on resolving conflicts that require much critical thinking).	45%
7.	Satisfaction with the level of communication	Satisfaction (among inst. and com)	$X_4 = (\sum X_{4i})/ i$	POSITIVE by 10% but very poor.	=(Positive + Negative)/N =(76% - Zero-46%)/3 =10%
	7.1. Among institutions	Communication satisfaction among different institutions	X_{41}	Dissatisfied/highly dissatisfied (Communication based on WEC-related activities).	46% (Negative)
	7.2. Among a group of communities (different tribes in the river basin)	Availability of communication and networking tools	X_{42}	There is no common road, market and other tools that help groups to communicate with each other.	NEGATIVE/Zero (not available)
	7.3. Between different institutions and local communities working in the region	Between institutions and communities	X_{43}	Used both traditional and modern ways.	76% (Positive)
C.	**Networking STATUS**		Y		
8.	Social network availability		Y_1	Negative com. with neighbouring tribes	Inadequate communication
	8.1. Within the same tribe (Afar)		Y_{11}	Traditional ways available - *Dhaagu*	Fully available (Positive)
	8.2. With other neighbouring tribes in the basin		Y_{12}	Not available	Not available (Negative)
9.	Neighbouring com. language understanding/speaking		Y_2	Below average	37% only
10.	Key areas of relationships/networks in the basin		Y_3	NEGATIVE relationships	48% NEGATIVE
D.	**Cooperation STATUS**		Z	Z= Mean [Zi]	
11.	Communities coop. within themselves (clan level)		Z_1		Positive
12.	Communities cooperation with other tribes		Z_2		Negative
13.	Communities cooperation with Institutions		Z_3	Z_3= Mean [Z_{3i}] =52% + 41%=47	Moderate
	13.1. Feedback/Response evaluation	Response feedback	Z_{31}	Medium	52%
	13.2. Satisfaction rate or agreement	Satisfaction agreement	Z_{32}	Good	41%
14.	Institutions' cooperation with other institutions		Z_4		Negative

6.10 Transparency Data Analysis

Individual, traditional and institutional transparency (variable 7) is one of the major factors of the framework of the study (chapter 3). The status of transparency within a community has a major impact in the transfer of WEC information and is a key factor in the study of local water conflict pre-identification and preparedness.

6.10.1 Premises for the Local Level Transparency Data Analysis

Local-transparency-related information was collected from both members of the communities and representative institutions in the region working on water resources development and related activities in the Awash River basin of Ethiopia. The researcher has identified a list of nine main categories useful for measuring the status of transparency in the region both at institutional level and within members of the local communities.

6.10.2 Summary of the Findings on Transparency

Figure 6-13 below shows a summary of the findings on local transparency. The local communities in the region have a tradition and a system of transparency and accountability. Most local communities and institutions in the region are interacting on the works related to WRD and management in a partially transparent way. The local communities agreed that the performance of financial institutions in the region is non-transparent. The majority of the people in the region do not prefer frequent interaction based on emotions and plans. When it is required, they prefer to take sudden and immediate actions only.

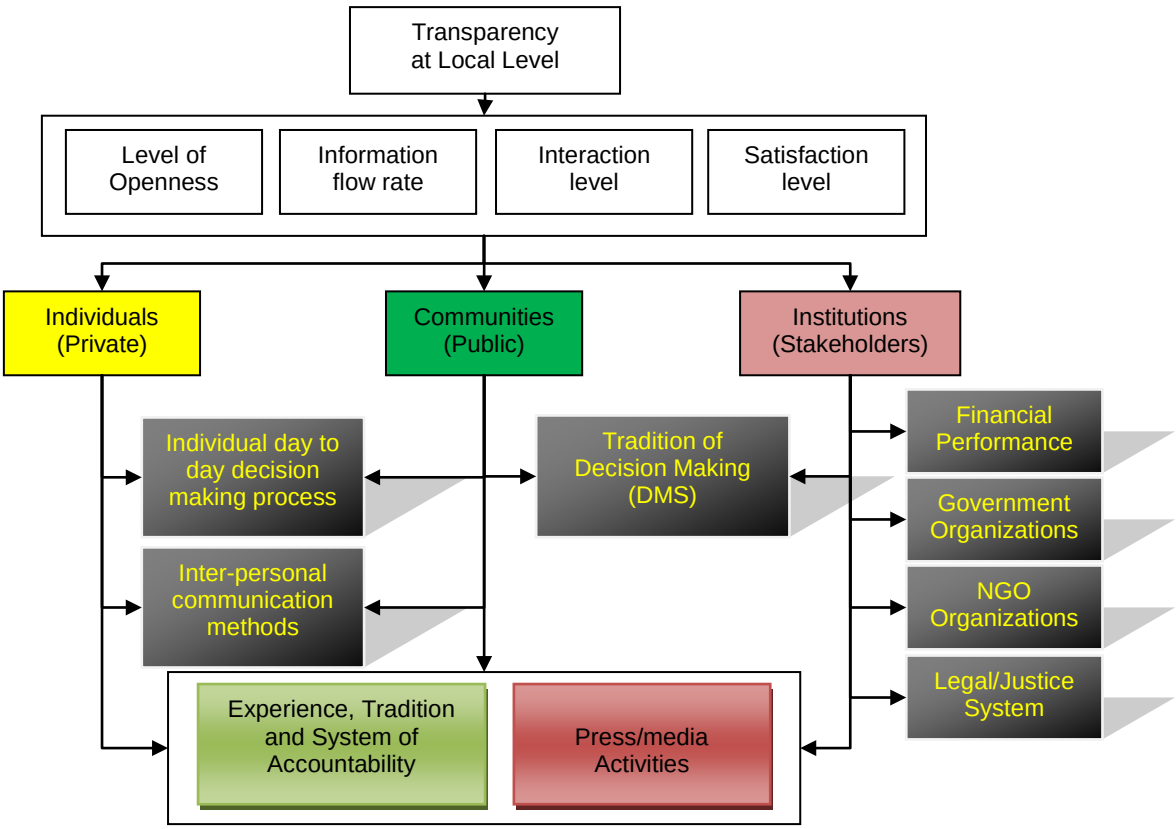


Figure 6-13: Data types and analysis variables for local transparency

6.10.3 Data Analysis on Local Communities' Transparency

6.10.3.1 Communities' View about Status of Transparency

Table 6-76: Communities view on local the availability of transparency at local level

No.	Factors used in measuring local transparency (Categories Openness)	Transparency Level					Total
		Transparent	Partially transparent	Not transparent	No comment	I do not know	
1	Individual day- to-day decision making process	3	67	47	10	1	128
2	Traditional decision making practice	65	50	11	2	0	128
3	Financial institutions performance	1	45	73	9	0	128
4	Gov. organizations functioning	5	51	67	5	0	128
5	NGOs service provision	10	65	46	7	0	128
6	Activities of the press	7	63	55	3	1	129
7	Legal related decision making	4	61	49	14	0	128
8	Individual experience on accountability	1	73	45	8	1	128
9	Availability of accountability system or tradition	69	36	18	6	0	129
	Total	165	511	411	64	3	1154
	Percent	14%	44%	36%	6%	0%	100%
	Maximum frequency	69	73	73	14		
	Raw heading for max. freq.	Availability of accountability system/ tradition	Individual experience on accountability	Financial institutions performance	Legal-related decision making		

The data analysis indicates that local communities agreed to activities related to traditional ways of decision-making were transparent. Communities' view on NGO's work varies between partially transparent and fully transparent. The tasks related to finance, press and government organisations functioning process were not transparent.

6.10.3.2 Level of Inter-Personal Communications within Communities

Table 6-77: Level of inter-personal communications (information sharing)

No.	How information flows within communities (Reason and method)	Frequency	%	Valid Percent	Cumulative Percent
1	*Dhaagu* with members of the tribe	104	70.3	71.2	71.2
2	Meetings (tribal, traditional, social, consultation and local)	15	10.1	10.3	81.5
3	Discussion with friends, family members, clan/tribe members, surrounding people, and sometimes with local administrative bodies	11	7.4	7.5	89.0
4	By gathering and exchanging latest information within the community	7	4.7	4.8	93.8
5	Radio	3	2.0	2.1	95.9
6	Telephone	2	1.4	1.4	97.3
7	By sharing water supply while the area is very hot	1	.7	.7	97.9
8	*Dhaagu* (making *Dhaagu* with people from another country/region)	1	.7	.7	98.6
9	In terms of natural resources, there is no trust among shared communities	1	.7	.7	99.3
10	Postal services	1	.7	.7	100.0
	Total-valid	146	98.6	100.0	
	Missing	2	1.4		
	Total	148	100.0		

Table 6-77 shows that almost all (93%) of the local communities in the region agreed that the existing inter-personal interaction on exchanging information is related to common natural resources. This is mainly communicated through traditional systems of *dhaagu*, meetings and discussions among themselves.

6.10.3.3 The Rate of Information Flow among People in the Region

54% of respondents expressed their feelings that the rate of interactivity among people is decreasing due to increasing tribal and religious conflicts.

Table 6-78: Information and flow rate within groups of communities in the region

No.	Amount and rate of information transfer	Rate of information flow					Total
		High	Medium	Low	Not available	No comment	
1	Interactivity	30	27	66	3	1	127
2	Vividness	31	31	60	2	3	127
3	Information-general amount	106	17	3	0	0	126
4	Specific-Direct information transfers	103	19	5	0	0	127
5	Specific-Indirect information transfers	18	57	50	2	0	127
	Total	288	151	184	7	4	634
	Percent	45%	24%	29%	1%	1%	100%

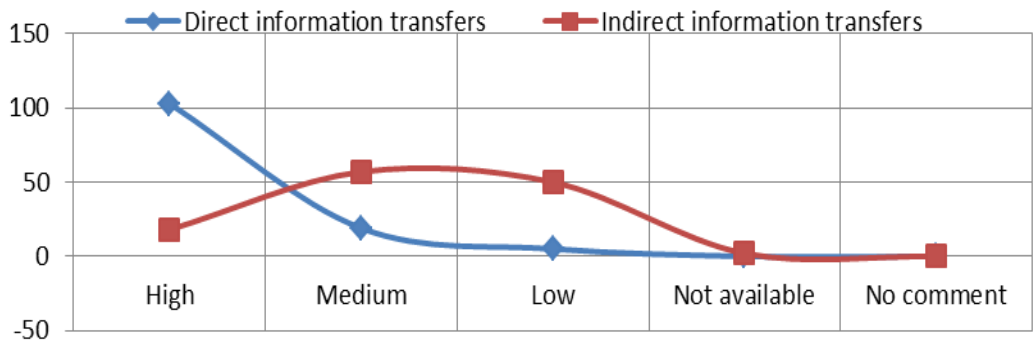


Figure 6-14: Direct and indirect information

6.10.3.4 Measuring the Level of Interaction within Communities

Table 6-79: Observed implications while interacting with other members of the communities

Observation of Interaction status		Interaction Status										Total	
		Frequently		Occasionally		Suddenly		None/not sure		No comment			
		N	%	N	%	N	%	N	%	N	%	N	%
Information flow status (IFS)	Actions	13	27%	23	13%	60	27%	29	17%	2	13%	127	20%
	Emotions	3	6%	34	19%	56	25%	32	19%	2	13%	127	20%
	IFS Total	**16**	**33%**	**57**	**32%**	**116**	**52%**	**61**	**36%**	**4**	**25%**	**254**	**40%**
Non information flow status(NIF)	Plans	2	4%	41	23%	38	17%	43	25%	3	19%	127	20%
	Intentions	11	23%	41	23%	39	18%	33	20%	3	19%	127	20%
	Beliefs	19	40%	41	23%	29	13%	32	19%	6	38%	127	20%
	NIF Total	**32**	**67%**	**123**	**68%**	**106**	**48%**	**108**	**64%**	**12**	**75%**	**381**	**60%**
TOTAL		**48**	100%	**180**	100%	**222**	100%	**169**	100%	**16**	100%	**635**	100%
PERCENT		**8%**		**28%**		**35%**		**27%**		**3%**		**100%**	
Maximum frequency of % Interaction type for max.		40%		23%		27%		25%		38%			
		Beliefs		Plans, Intentions		Actions		Plans		Beliefs			
Interaction category for max.		NIF		NIF		IFS		NIF		NIF			

6.10.3.5 Communities View on the Way the Local Legal System is Functioning

Table 6-80: Observation about how local legal systems are functioning independently

No.	Where Do You Go …	Satisfaction Rate						Total
		Strongly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dis-satisfied	Strongly dissatisfied	No comment	
1	Traditional leaders	13	31	17	5	4	1	71
2	Local elders	11	31	18	3	4	3	70
3	Religious leaders	2	16	4	2	1	1	26
4	Keble (local administration)	0	12	7	2	0	1	22
5	Court	1	0	7	4	2	0	14
6	Police	0	1	16	4	1	1	23
7	No comment	0	0	1	0	0	0	1
	Total	27	91	70	20	12	7	227
	Percent	12%	40%	31%	9%	5%	3%	100%
	Cumulative Percent	**52%**		**31%**		**14%**	**3%**	

Table 6-80 reflects that 52% of the communities are satisfied by the functions of local traditional/tribal/religious legal systems in the region. The other 48% of the respondents are not satisfied by the transparency of modern court systems in the region.

6.10.4 Data Analysis on Local Institutions' Transparency

6.10.4.1 Local Institutions' Status and View on Transparency

Table 6-81: Local institutions' transparency status

No.	Categories Openness	Transparency Level				Total
		Transparent	Partially transparent	Not transparent	No comment	
1	Institutions day-to-day decision making process	2	10	9	2	23
2	Traditional decision making practice	17	3	2	1	23
3	Financial institutions performance-Tax allocation	2	10	8	3	23
4	How Gov. organizations are functioning	1	14	6	2	23
5	NGOs service provision-see notes on local and international NGO comments	2	12	6	3	23
6	The way local, regional and national press/ media are working	0	10	8	5	23
7	Legal-related decision making processes	2	8	9	4	23
8	Individual experience on accountability	0	12	10	1	23
9	Availability of accountability system or tradition	12	3	7	1	23
	Total	**38**	**82**	**65**	**22**	**207**
	Percent	**18%**	**40%**	**31%**	**11%**	**100%**

In Table 6-81, the institutions' activities related to water resources development and management, 40% of institutions agreed that they are working in partially transparent ways, 31% not transparent, 18% transparent and 11% undecided. The Lower Awash Basin Office, Afar Water Works Construction Enterprise and Afar Water Resources Bureau were ranked among the top three institutions in terms of transparency status or views. This indicates the top three institutions working on water-related activity at regional level were transparent. In contrast, the regional institutions working on trade, industry, investment, urban water supply and pastoral development activity are not transparent.

6.10.4.2 Comparing Communities' and Institutions' Views on Transparency

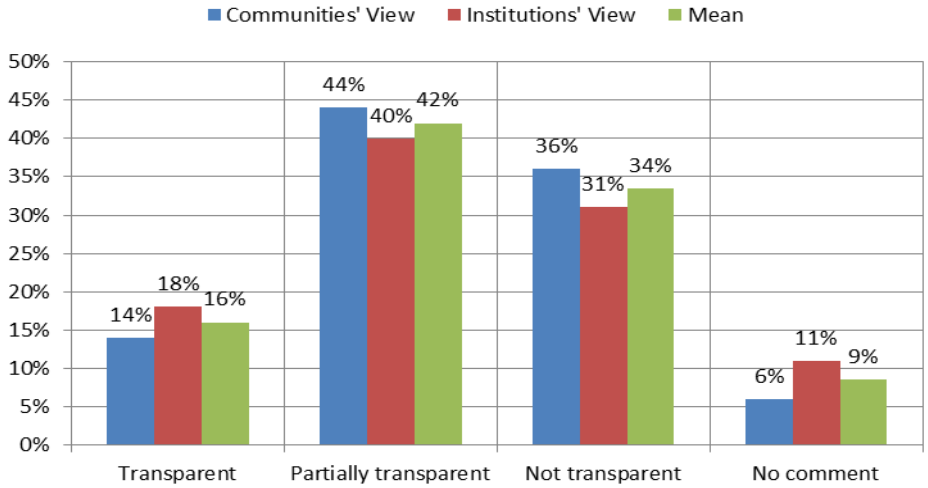


Figure 6-15: Comparing communities' and institutions' views

In Figure 6-15, survey information collected both from local people and institution representatives in the Afar region showed that the rates of satisfaction on the issue of transparency in relation to water resources development and management activities were relatively comparable. The percentages of communities who agreed on transparency and who do not want to comment were less than the percentage of institutional respondents. The percentage of communities who said 'partially transparent' and 'not transparent' exceeds that of the institutional respondents.

Table 6-82: Summary of communities and institutions views on transparency

No.	Transparency category	Transparency status (maximum feedback)				Summary [Conclusion]		Comparative Percent
		Communities view		Institutions view				
		Max. Status	%	Max. Status	%	Max. Status	Max. %	
1	Individual day-to-day decision making process	Partially transparent	52.3%	Partially transparent	43.5%	Partially transparent	47.9%	10.3%
2	Traditional decision making practice	Transparent	50.8%	Transparent	73.9%	Transparent	62.3%	13.4%
3	Financial institutions' performance	Not transparent	57.0%	Partially transparent	43.5%	Not transparent	50.3%	10.8%
4	How Gov. organizations are functioning	Not transparent	52.3%	Partially transparent	60.9%	Partially transparent	56.6%	12.2%
5	NGOs service provision-see notes on local and international NGO comments	Partially transparent	50.8%	Partially transparent	52.2%	Partially transparent	51.5%	11.1%
6	Activities of the press/media	Partially transparent	48.8%	Partially transparent	43.5%	Partially transparent	46.2%	9.9%
7	Legal-related decision making	Partially transparent	47.7%	Not transparent	39.1%	Partially transparent	43.4%	9.3%
8	Individual experience on accountability	Partially transparent	57.0%	Partially transparent	52.2%	Partially transparent	54.6%	11.7%
9	Availability of accountability system or tradition	Transparent	53.5%	Transparent	52.2%	Transparent	52.8%	11.3%
								100.0%

A majority of respondent local communities and institutions agreed that traditional ways of decision-making practice and a tradition of accountability-related activities are transparent. Most of the communities in the region agreed that government organisations are functioning in a non-transparent manner. In contrast to communities' view, government institution representatives believe that institutions are working in partially transparent ways (See the above Table 6-82 and the next Figure 6-16).

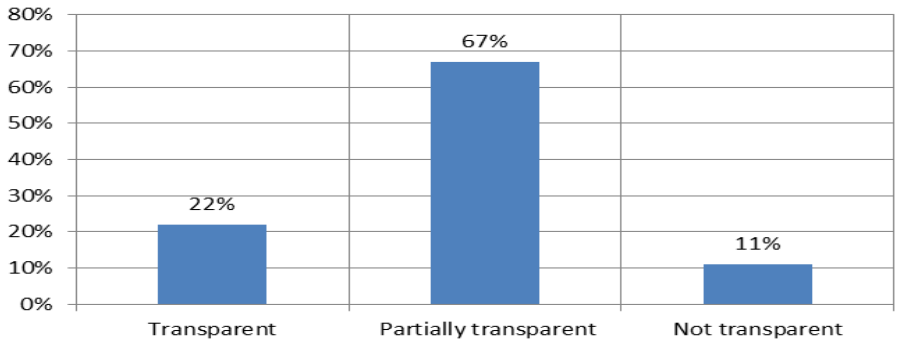


Figure 6-16: Percentage of communities and institutions transparency views

On activities related to modern ways of legal decision-making processes, the majority of the communities agreed that the process is partially transparent, though institutional respondents viewed this as not transparent. See Appendix J for more information on local transparency.

6.10.5 Grouping and Measuring Transparency Data Analysis

Transparency Variables	What to analyse?	Findings	Variables
A. Communities' view:			**X**
1. *Level of openness*: Rating local communities' satisfaction rate on basics of transparency.	Categories of openness (Level of openness)	Partially transparent [44%]	X1
B. Other factors:			X2
1.1. *Inter-personal communication methods*: Level of inter-personal. communications within communities	How information flows within communities (reason and method)	Traditional '*dhaagu*' [93%]	X21
1.2. *Information flow rate*: Amount and rate of information transfer.	Amount and rate of information transfer	High [45%]	X22
1.3. *Interaction level:* Measuring the level of interaction within communities.	Measuring the level of interaction status within communities	Suddenly [35%]	X23
1.4. *Justice system:* The way local legal system is functioning independently.	Communities satisfaction on independence of local legal system	Satisfied [52%]	X24
C. Institutions' view:			**Y**
2. *Level of openness:* Rating local institutions' satisfaction rate on basics of transparency.	Institutional transparency in relation to water resources development and management activities	Partially transparent [40%]	Y
CONCLUSION (Summary):			**Z**
Level of openness: Local communities and institutions.	Local communities and institutions transparency status	Partially transparent[67%]	Z

6.10.6 Data Analysis, Modelling, Forecasting and Validity Design

The findings on local transparency were further analysed, discussed and a framework model was developed in Chapter 7, the discussion of the findings.

6.11 Sustainability Data Analysis

In Chapter 3, the contribution to sustainable development (variable 8) is one of the key factors for understanding the status of local water-conflict-related problems. This section highlights local contributions towards sustainable development and resource utilization of the region. The survey information was collected in terms of rating the status of the community's views, activities, participation and satisfaction and the institutions' awareness and identification of the extent and the frequency of problems, which was labelled as the Sustainability of Resources and Conflict Diversity Factors (SRCDF). There was a negative correlation between the communities' and institutions' views on activities related to sustainable development of the region. Community respondents have a neutral opinion on the rate of their participation and satisfaction with sustainable development activities. The institution respondents believed that there is a high level of frequently occurring problems that hampers the development of the region.

6.11.1 Summary of the Findings on Sustainability

Communities' contribution: The list of **activities** indicated in the questionnaire for analysing communities' contribution on SRCDF shows that it has a very positive relationship with **satisfaction rate**, by having a positive correlation coefficient of 0.850. The local communities' respondents found it easier to explain ether they are satisfied or dissatisfied with a list of activities going on in the region instead of asking them about the status of their participation. The figure shows that activities list has a negative relationship with communities' **participation rate** (corr. value -0.036). It means communities were not engaged in activities related to SRCDF. In contrast, satisfaction and participation have a positive relationship (corr. value 0.437).

Table 6-83: Correlation among the status of communities' activity, participation and satisfaction rate

Correlations		Community Activity List	Status Participation	Satisfaction Rate
Community Activity List	Pearson Correlation	1	-.036	.006
	Sig. (2-tailed)		.227	.850
	N	1152	1152	1152
Status Participation	Pearson Correlation	-.036	1	.437**
	Sig. (2-tailed)	.227		.000
	N	1152	1152	1152
Satisfaction Rate	Pearson Correlation	.006	.437**	1
	Sig. (2-tailed)	.850	.000	
	N	1152	1152	1152

**. Correlation is significant at the 0.01 level (2-tailed).

Institutions' contribution: Local institutions agreed that a high degree of frequently occurring problems took place or were manifestly evident in the Awash River Basin affecting the sustainable development of water resources in the region. Among the respondents of the survey, 44% agreed on a high level of problems, 24% said there were moderate problems, 14% believed that problem levels are low and the remaining 18% were undecided. Problems related to drought (17%), natural resources and environment (13%) and the economic (13%) were among the top three major problems mentioned by institution respondents that highly affect the sustainable development of water resources. Problems associated with ethnicity or race, social issues and language contribute insignificant effects as compared to other problems.

6.11.2 Sustainability Data Types and Analysis Variables

Table 6-84: Sustainability data types and analysis variables

Sustainability Variables	What to analyse?	Description(findings)
Communities: Sustainability of Conflict Diversity Factors (SRCDF) for Communities	Communities' view, contribution, participation and satisfaction on sustainable development of water resources (SRCDF)	Neither satisfied nor dissatisfied (54%)
Institutions: Sustainability of resources and conflict diversity factors for institutions (SRCDF)	Institutions' view, contribution, participation and satisfaction on sustainable development of water resources (SRCDF) [Extent of problems]	High level of problems (44%)

6.11.3 Analysis on Contribution to Sustainable Development

6.11.3.1 Communities View on SRCDF

In Figure 6-17 and Table 6-85 below, nine categories were integrated to measure the local community's contribution towards sustainable development of the region, referred to as SRCDF. These sustainability diversity factors include, WRD and utilization, wetland protection, environmental protection, economic development, responsibility social relationships, drought reduction activities, health improvement, political stability and education improvement.

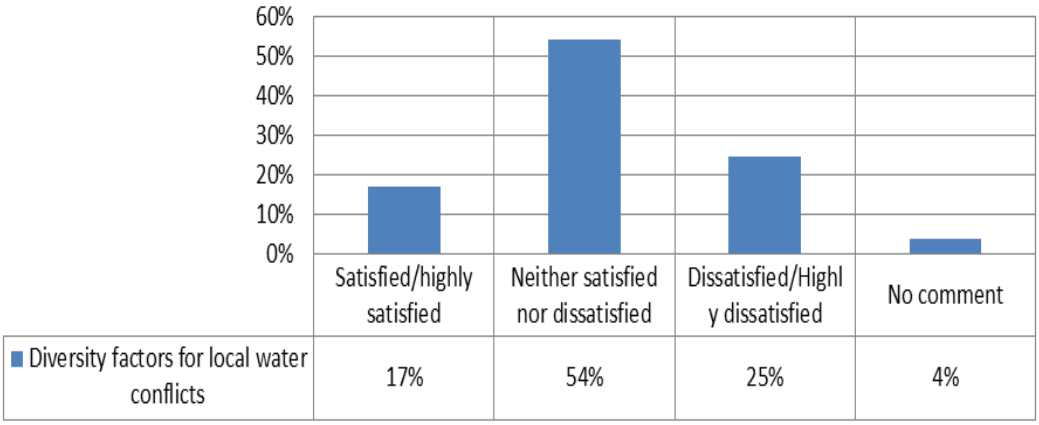


Figure 6-17: Summary of local communities view on SRCDF

Table 6-85: Local communities' view on factors that affect sustainable development

No.	List of SRCDF activity	Satisfaction Rate						Total
		Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied	No comment	
1	Effective WRD and utilization	2	9	89	20	4	4	128
2	Wetland protection	0	17	63	31	6	11	128
3	Environmental protection	1	33	60	24	7	3	128
4	Local economic development activity	7	25	75	16	3	2	128
5	Feel responsibility in improving social relationships in a community	7	12	82	17	5	5	128
6	Drought reduction activities	1	12	67	37	5	6	128
7	Local health related activities	7	15	60	35	5	6	128
8	Political stability activities-traditional or modern ways	2	21	78	20	7	0	128
9	Education improvement and diversification activities	4	21	52	38	6	7	128
	Total	31	165	626	238	48	44	1152
	Percent	3%	14%	54%	21%	4%	4%	100%
		17%		54%	25%		4%	
Maximum response area		Environmental protection		Effective WRD and utilization	Education improvement and diversification activities		Wetland protection	
Minimum response area		Effective WRD and utilization		Education improvement and diversification activities	Local economic development activity		Political stability	

The local people are exclusively happy by their participation in environmental protection activity mainly as a result of their participation in the nationwide campaign for planting tree seedlings. Also, there was no adequate knowledge on wetland protection at local level. At the same time, local people were quite reluctant to comment on areas related to politics.

Table 6-86: Relationships between participation and satisfaction feedback

No	Status Participation	Satisfaction Rate						Total
		Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied	No comment	
1	Actively participated	23	13	2	1	8	1	48
2	Participated	6	133	285	86	11	3	524
3	Neutral (do not have any interest)	2	12	250	50	1	14	329
4	Not participated	0	5	76	96	26	13	216
5	Not available	0	1	0	0	1	1	3
6	Do not know/no comment	0	1	13	5	1	12	32
	Total	31	165	626	238	48	44	1152
	Percent	3%	14%	54%	21%	4%	4%	100%

Table 6-87: Correlation between participation and satisfaction – minimum positive relationship of (0.437)

Status		Status Participation	Satisfaction Rate
Status Participation	Pearson Correlation	1	.437**
	Sig. (2-tailed)		.000
	N	1152	1152
Satisfaction Rate	Pearson Correlation	.437**	1
	Sig. (2-tailed)	.000	
	N	1152	1152

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6-88: Correlation between communities' activity list and satisfaction rate- very strong positive relationship of (0.850)

Status		Community Activity List	Satisfaction Rate
Community Activity List	Pearson Correlation	1	.006
	Sig. (2-tailed)		.850
	N	1152	1152
Satisfaction Rate	Pearson Correlation	.006	1
	Sig. (2-tailed)	.850	
	N	1152	1152

Table 6-89: Correlation between communities' activity list and participation rate - negative relationship of (-0.036)

Status		Community Activity List	Status Participation
Community Activity List	Pearson Correlation	1	-.036
	Sig. (2-tailed)		.227
	N	1152	1152
Status Participation	Pearson Correlation	-.036	1
	Sig. (2-tailed)	.227	
	N	1152	1152

6.11.3.2 Institutions View on SRCDF

Table 6-90: Local institutions' views on factors that affect sustainable development

No.	Problems Category	Extent of the Problems					Total
		High	Medium	Low	Not available	No comment	
1	Technical factors	12	6	1	1	3	23
2	Administrative factors	11	3	7	0	2	23
3	Natural/environmental factors	13	7	1	0	2	23
4	Social factors	4	9	4	1	2	20
5	Economic factors	13	4	1	0	2	20
6	Political factors	9	4	2	2	3	20
7	Geographical/territory factors	6	9	2	0	3	20
8	Health factors	9	6	2	0	3	20
9	Drought factors	17	1	0	0	2	20
10	Ethnicity/race factors	5	4	6	2	3	20
11	Language factors	2	3	5	7	3	20
	Total	101	56	31	13	28	229
	Percent	44%	24%	14%	6%	12%	100%
		44%	24%	14%	18%		100%

Table 6-91: Comparing the relationships between types and extents of the problems

Frequency Status Description		Problems Category	Extent of the Problem
Problems Category	Pearson Correlation	1	.275**
	Sig. (2-tailed)		.000
	N	229	229
Extent of Problem	Pearson Correlation	.275**	1
	Sig. (2-tailed)	.000	
	N	229	229

**. Correlation is significant at the 0.01 level (2-tailed).

6.11.4 Grouping Data Analysis on Local WC- Sustainability

SRCDF	Assumptions	Positive correlation with	Negative correlation with
Communities' satisfaction rate on activities that help for SRCDF	• Views based on current situation (decision) ***[sometimes difficult to express]***	Satisfaction rate[0.850]	
Communities' participation rate on activities that help for SRCDF	• Direct views on participation • Emotional views ***[Easy to judge]***		Participation rate [-0.036]

6.11.5 Measuring Sustainability of Local Water Conflicts

(Assumptions and Results)

Category	Sustainable [X_1]	Moderately sustainable [X_2]	Not sustainable [X_3]	Conclusion (Y= Max [X_i])
(a) Communities' contribution, views, participation and satisfaction	Highly satisfied or satisfied **17%**	Neither satisfied nor dissatisfied **54%**	Highly dissatisfied or Dissatisfied **25%**	Moderately sustainable Y_1=[54%]
(b) Institutions' views on extent of the problem	Less problems or no problems **32%**	Medium problems **24%**	High problems **44%**	Not sustainable Y_2=[44%]

Mean Yi=[48%], which is below average and it can be concluded that local activities related to water resources development during the last five years were not sustainable. The relationship between (a) communities' views and (b) institutions' views in the above table shows that there was a negative relationships (Corr. = [-0.66]) regarding activities related to local sustainability factors.

6.11.6 Data Analysis, Modelling, Forecasting and Validity Design

The framework model related to sustainability data of the findings will be shown in Chapter 7, the Discussion of the Findings.

6.12 Early Warning Services Data Analysis

In the framework of the study (Chapter 3), and literature review (Chapter 2) the importance of tradition and practice of early warning services (variable 9) in local communities and institutions and its link with the process of pre-identification and preparedness of local water conflicts was justified in detail. This section encompasses the availability of local awareness, participation, and identification of the status of timely warning services practised at low level

within the communities and institutions working in the region. Availability of effective, timely, warning traditions helps to avoid or reduce conflicts and human crises.

Availability/practice of EW services: There are affirmative ways of traditional early warning practices implemented by a male-predictor '*gignili'* and a female-predictor '*Kaluwale'* within the Afar community. However, there are inadequate numbers of forecasting tools available for immediate use within institutions in the region.

Awareness of and participation in EW services: There was a moderate level of local community and institutional awareness on water resources development practices, early warning services, understanding cost-effects of pre- and post-conflict-related problems. In contrast, there was a minimum rate of stakeholders' participation in the indicated activities.

Status (current and future) of EW services: Respondents representative of both communities and institutions agreed that local water supply and sanitation coverage in the region is increasing. However, the status is unsustainable due to potential conflicts and security concerns in the river basin.

6.12.1 Summary of the Findings on Early Warning Services

There was positive awareness of traditional early warning practices. The level of water supply and sanitation coverage is significantly increasing, though it remains inadequate. Specifically, inadequate awareness was observed on WRM, environmental protection and flood control development activities practices. Also, there are inadequate forecasting tools for local EW service prediction. Communities agreed that they have less participation in setting water supply services tariff-related activities.

Local institutions have a moderate level of awareness on of EW activities related to WRM and conflict. The result shows the people were afraid to comment on issues directly related to security situations and conflicts over water or any other natural resources in the region.

Table 6-92: Data types and summary of data analysis on local EW services

Early warning services Variables	What to analyse? [Maximum/the most frequently occurring]	Description (findings)	Variable representation
1. Communities feedback		$\sum X_i$	X
1.1. Local prediction acceptability.	Status of traditional practice on early warning.	High [74%].	X_1
1.2. Types of local early warning practices.	The most frequent types of local EWP Practice.	Conflict, war, arbitration and reconciliation and weather [50%].	X_2
1.3. Who participates in local early warning prediction practices?	Who participates on local early warning prediction practices?	Local/tribal elders [82%].	X_3
1.4. Awareness of the costs of conflcts for early warning prediction activities.	Awareness of the costs of conflicts.	Partially [44%].	X_4
1.5. Awareness of WRM, environmental protection and	Level of community participation.	No comment (Not available [54%].	X_5

Early warning services Variables	What to analyse? [Maximum/the most frequently occurring]	Description (findings)	Variable representation
flood control activities.			
1.6. Awareness of sponsor institutions in the region.	Activities sponsored by?	No comment/ Not available [55%].	X_6
1.7. Local communities' participation area.	Local community participation status.	Yes [65%].	X_7
1.8. List of local plans, intentions and threats forwarded by communities.	Water supply, irrigation dam, flood control, wetland protection and pastoral development.	Moderate [49%].	X_8 ++++
2. Institutions feedback		$\sum Y_i$	Y
2.1. Water resources utilization and identified problems:		$\sum Y_{1i}$	Y_1
2.1.1. Water Supply Status.	Water Supply Status.	<500 m^3/person [43%].	Y_{11}
2.1.2. Water Supply problems.	Water Supply problems.	General management problems [44%].	Y_{12}
2.2. Water and sanitation coverage:		$\sum Y_{2i}$ mean=71%.	Y_2
2.2.1. Water supply coverage.	Water supply coverage.	Increasing [96%].	Y_{21}
2.2.2. Sanitation coverage.	Sanitation coverage.	Increasing [46%].	Y_{22}
2.3. Awareness and consideration of timely warning [EWS-LT].	% of institutions expressed their practice on EWS.	Below average [46%].	Y_3
2.4. Status and acceptability of traditional knowledge and practices on EWS.	Status and acceptability of traditional knowledge and practices on EWS.	Stable [63%].	Y_4
2.5. Local security situations related to disputes over water or any other natural resources.	Local security situations related to disputes over water or any other natural resources.	Afraid to comment on this topic [39%].	Y_5
2.6. Awareness of the costs of deliverable services and conflicts.	Awareness Gap analysis.	Partially informed-medium [30%].	Y_6
2.7. Views on stakeholders' participation in setting water services tariffs.	Rate of agreement.	Disagree [57%].	Y_7
2.8. Institutions awareness of EW - projects related to water resources management, environmental protection: and flood control activities:			
2.8.1. Level of awareness.	Level of awareness.	High [32%].	Y_{81}
2.8.2. Activity sponsored by?	Activity sponsored by?	Government [51%].	Y_{82}
2.9. The aim that helps to avoid or reduce violence and human crises.	Availability of tools, plans or methods.	Not available [43%].	Y_9

6.12.2 Data Analysis of Communities' View on Local EW Services

A. Status of Traditional Practice on Early Warning

Table 6-93: Traditional/local prediction acceptability rate

Local Prediction Acceptability		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	108	74.0	82.4	82.4
	Moderate	16	11.0	12.2	94.7
	Minimum	5	3.4	3.8	98.5
	Not acceptable	2	1.4	1.5	100.0
	Total	131	89.7	100.0	
Missing	System	15	10.3		
	Total	146	100.0		

B. Traditional Ways of Early Warning Prediction: Drought-Specific

Table 6-94: Traditional drought predictions practices by Afar communities

No.	List of traditional EWS	Number (Percent)
A.	**Domestic animals**	6(27.2%)
1	When animals sleep collectively in the northern side/direction of the barn.	
2	When animals pass their urine and dung while sleeping.	
3	When the animals fall asleep immediately after drinking water from water sources.	
4	If camels stand by criss-crossing their back/hind leg.	
5	When animals move by themselves to the grazing area from their barn without a shepherd leading them.	
6	When a mother camel leaves her infant in search of water and does not returning quickly.	
B.	**Wild animals and birds**	5(22.7%)
7	When the sound of wild animals (lion and tiger) roaring and birds singing is not heard or is lessening.	
8	When monkeys do not, or decreasingly, roam around looking for food and if they do, they will not return to their usual shed.	
9	When hyenas stop attacking domestic animals.	
10	When wild pigs '*Kerkero'* come out from the forests and mix up with domestic animals for grazing.	
11	Unusually, when a wild hen '*Jigra'* enters a house.	
C.	**Wind and tornado**	3(13.6%)
12	When there is a strong and frequent tornado. e.g. strong wind stops rain, helps in the predication on regional and world stability.	
13	When a wind blowing from the North '*wereru'* and a wind from the East '*bedita'* collide with each other.	
14	When a wind from the North-east 'arimu' is blowing .	
D.	**Astronomy**	3(13.6%)
15	If there are many more stars in the sky than usual.	
16	If the stars in the sky are visible it will rain, otherwise no rain.	
17	When there exist long red lines across the sky during sunset and rise.	
E.	**Weather**	1(4.6%)
18	When the temperature is very hot during daytime and very cold in the evening.	
F.	**Trees**	1(4.6%)
19	When the leaves of natural trees like '*Gamroyta'* dry up and the '*Edayitu'* tree becomes evergreen.	
G.	**People**	1(4.6%)
20	When people are selfish and do not care for those living around.	
H.	**Food consumption**	1(4.6%)
21	When animals and human become hungry right after they consumed food.	
I.	**General Observation**	1(4.6%)
22	Decrease in price of goats, failure of rain and deterioration of pasture may act as an early warning indicator for drought.	
	Total	***22 (100%)***

C. Who Participates in Local Early Warning Prediction Practices?

The findings in Table 6-95 shows that 85% of local communities' respondents highly agreed on the availability and acceptability of traditional knowledge and practices used in pre-identification of conflict-related problems in the region related to water or any other natural resources. Hence, it appeared to be local prediction practice is highly acceptable among pastoral communities in the region.

Table 6-95: Sources of local EW predictions /who predicts?

No.	Who/how (Prediction sources)	Local Prediction Acceptability				Total	%
		High	Moderate	Minimum	Not acceptable		
TRADITIONAL (97%)							
1	Local/tribal elders	75	7	1	0	83	82%
2	Traditional observation (general)	5	2	0	0	7	7%
3	Traditional *Gignili* (male) or *Kaluwale* (female) predictor	4	0	0	2	6	6%
4	Observing the status of red star and moon (Specific)	0	0	1	0	1	1%
5	Dhaguu	1	0	0	0	1	1%
MODERN (3%)							
6	Radio and TV	1	2	0	0	3	3%
	Total	86	11	2	2	101	100%
	Percent	85%	11%	2%	2%	100 %	1%

D. Awareness on the Costs of Conflicts for Early Warning Prediction Activities

The researcher has discussed community awareness on the cost effects of conflict in § 5.6.3.1 of Table 6-18. According to this, 44% of the communities have agreed that they have partial awareness on the costs of conflicts. Some (33%) have full awareness and 22% have no awareness.

E. Awareness of WRM, Environmental Protection and Flood Control

Table 6-96: Local awareness on WRM, environmental protection and flood control

No.	Categories Awareness	Level of awareness				Total
		High	Moderate	Minimum	No comment (Not available)	
1	Water resources management	4	11	37	77	129
2	Water resources management regulation	4	15	24	84	127
3	Able to identify who can participate in WR development process	4	17	31	77	129
4	Environmental protection	6	23	66	34	129
5	Flood control activities	7	20	59	43	129
6	Political intervention	1	16	35	77	129
7	Military intervention	1	9	22	96	128
	Total	27	111	274	488	900
	%	**3%**	**12%**	**30%**	**55%**	**100%**

Table 6-96 shows 55% of the community respondents are undecided or do not participate in activities related to WRM, environmental protection and flood control. The level of community awareness on flood and environmental protection was better than for other areas.

Test Statistics		
	Level of Awareness	Level of Participation
Chi-Square	764.744[a]	550.089[b]
df	4	3
Asymp. Sig.	.000	.000

0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 180.0.

Correlations		Level of Awareness	Level of Participation
Level of Awareness	Pearson Correlation	1	.613**
	Sig. (2-tailed)		.000
	N	900	900
Level of Participation	Pearson Correlation	.613**	1
	Sig. (2-tailed)	.000	
	N	900	900

**. Correlation is significant at the 0.01 level (2-tailed).

F. Local Communities' Participation Area

Table 6-97: Local activities on WRD, environmental protection and flood control

No.	List of Activity	Local community participation status						Total
		Yes		No		No comment		
		N	%	N	%	N	%	
1	WRD and management activities	45	17%	85	64%	1	20%	131
2	Environmental activity	110	42%	23	17%	2	40%	135
3	Flood control activity	104	40%	25	19%	2	40%	131
	Total	259	100%	133	100%	5	100%	397
	Percent	65%		34%		1%		100%

The above table indicates that 65% of the respondents participate and 35% do not participate on local water resources development, environmental control and flood control activities. Main participation area was environmental protection followed by flood control activity.

G. Awareness on Sponsor Institutions in the Region

Table 6-98: Local people's awareness rate of sponsoring institutions on WRM, environmental protection and flood control activities

No	Activities Sponsored by	Participation Level				Total	%
		High	Moderate	Minimum	No comment/ Not available		
1	Government	8	57	164	220	449	50%
2	Private	1	7	8	18	34	4%
3	Public/Local communities	7	11	20	14	52	6%
4	NGO	2	7	6	6	21	2%
5	Government, NGO and Public	0	9	3	3	15	2%
6	Government, and NGO	1	5	18	2	26	3%
7	Government and Public	0	3	7	1	11	1%
8	Government, Public and Private	1	1	1	1	4	0%
9	All	3	2	4	0	9	1%
10	Do not know/No comment	2	4	40	223	269	30%
	Total	25	106	271	488	890	890
	Percent	3%	12%	30%	55%	100%	100%

The finding shows that 55% of the community do not have full awareness or they do not want to comment on sponsoring institutions in the local region.

H. List of Local Plans, Intentions and Threats Forwarded by Communities

Table 6-99: Summary of areas of concern forwarded by local communities

Categories for local views on plans, intentions and threats forwarded by local communities	Count	Percent	Summary
1) Water supply, irrigation dam, flood control, wetland protection and pastoral development	20	49%	49%
2) Politics and security	5	13%	
3) Public education	5	13%	26%
4) Health care	2	5%	
5) Sanitation	2	5%	
6) Good governance	2	5%	15%
7) Agriculture	1	2%	
8) Development projects	1	2%	
9) Community participation	1	2%	
10) Research and development	1	2%	
11) Livelihoods	1	2%	10%
Total	**41**	**100%**	**100%**

6.12.3 Data Analysis on Institutions' Views on Local EW Services

A. Water Resources Utilization and Identified Problems

Table 6-100: The average amount of water supply consumption and major problems, 2009

Yearly water supply status	Main problem areas				Total	%
	Chronic water scarcity	Water Stress	General management problems	Limited management problems		
Less than 500m^3/person	2	1	1	-	4	45%
1000-500m^3/person	-	1	1	-	2	22%
1,600-1000m^3/person	1	-	2	-	3	33%
10,000-1,600m^3/person	-	-	-	-	-	
Above 10,000m^3/person	-	-	-	-	-	
Total	3	2	4	-	9	100%
Percent	33%	22%	45%		100%	

B. Trends of Water Supply and Sanitation Coverage in 2009

The data in Table 6-101 shows 96% of respondents agreed that both urban and rural water supply coverage is increasing. However, the opinion of the respondents on sanitation coverage separated into two. Half of the respondents agreed that sanitation coverage of the region is increasing; and the other half agreed that the coverage is decreasing or stable.

Table 6-101: Trends of water supply and sanitation coverage in Ethiopia, 2009

Coverage category	Water supply coverage trends				Sanitation coverage trends			
	Decreasing	Stable	Increasing	Total	Decreasing	Stable	Increasing	Total
1. Rural	-	1	9	10	2	3	4	9
2. Urban	-	0	9	9	2	3	4	9
3. Overall	-	0	9	9	2	2	4	8
Total	-	1	27	28	6	8	12	26
Percent	-	4%	96%	100%	23%	31%	46%	100%

C. Awareness and Consideration of Timely Warning [EWS-LT]

Among 26 institutions 12, (46%) only indicated their participation in and awareness of, activities related to avoiding or reducing violence and human crises at local level and during the last 5 years. These activities are related to water resources development, conflict reduction and early warning awareness services, which are listed below. More than 50% of institutions do not have adequate awareness with respect to these situations.

Table 6-102: Major activities performed by institutions on reducing human crises

No	Institutions' activities category	Major activities performed in reducing human crises
1	Water Supply	- Provided plastic water tankers for those people who were displaced from their location due to the newly established sugarcane plantation projects owned by government
2	Flood control activity	- Studying flood controlling or reducing mechanism - Support the community during flooding season by providing food, shelter and maintaining the security of people
3	WR construction design	- Preparing compatible water resources development designs for the area and community
4	Infrastructure	- Construction of different infrastructure in different 'Weredas' of the region

No	Institutions' activities category	Major activities performed in reducing human crises
5	Operation and maintenance	- Provided maintenance support when canal cut problems occurred so that the water flow can reach the river course properly
6	Agricultural, irrigation and increase in domestic productivity	- Expansion of agricultural extension services in rural and pastoral areas - Development of sustainable small-scale irrigation constructions - Development and implementation of market-lead production - Increase in domestic productivity
7	Environmental conservation	- Performing environmental impact assessment
8	NGO participation	- Invited NGOs in order to improve the quality of water and to reduce the problem gap
9	On reducing conflicts	- Provision of pre-warning information to neighbouring communities of people living in Amhara, Tigray and Oromiya region regarding Afar pastoralist's periodic transhumant grazing movements. This type of information provision has been mutually supported since 1992.

D. Status and Acceptability of Traditional Knowledge and Practices on EWS

Table 6-103: Trends of the acceptability level of traditional knowledge

Current Status	Level of acceptability		Total	Percent
	High	Moderate		
Increasing	-	-	-	-
Decreasing	2	0	2	37%
Stable	4	1	5	63%
Total	7	1	8	100%
Percent	**88%**	**12%**	100%	

Respondent institutions (88%) agreed that the level of knowledge related to traditional prediction practice for EWS was highly acceptable; 37% of them indicated the trend of this tradition is on deceasing situations.

E. Local Security Situations Related to Disputes over Water or Any Other Natural Resources

Table 6-104: Trends of the security situations in the local area

No	Description	Rating police or security-related information 2005-2009 (1997-2001 EC)						Total
		Highly increasing	Increasing	Stable (Normal)	Decreasing	highly decreasing	No comment	
1	Number of arrests	1	2	1	1	1	8	14
2	Number of people affected by the violence	0	6	1	1	1	5	14
3	Damage occurred	0	5	1	3	0	5	14
4	Estimated damage in local currency (Birr)	0	5	2	2	0	5	14
5	Parties involved in conflicts	0	5	2	2	1	4	14
	Total	1	23	7	9	3	27	70
		24		**7**	**12**		**27**	
	Percent	**34%**		**10%**	**17%**		**39%**	100%

Table 6-104 indicates 39% of respondents are afraid to comment on topics related to security. The other 34% believed that the problem was increasing, 17% of them decided it was decreasing and 10% felt that it was stable.

F. Awareness on Costs of Deliverable Services and Conflicts

Table 6-105: Institutions' view on different stakeholder's awareness

Local stakeholders	Institutions view on listed stakeholders
Local communities	Not informed-Ignorant
Traditional leaders	Less informed
Local administrators	Fully informed
Local politicians	Partially informed-medium
Local professionals	Not informed-Ignorant
Students	Not informed-Ignorant

G. Views on Stakeholders' Participation in Setting Water Services Tariffs

Table 6-106: Institutions' view on local community's participation in water tariff settings

Rate of agreement	Frequency	Percent	Summary percent
Highly agree	4	28.6	
Agree	1	7.1	35.7
Disagree	4	28.6	
Highly disagree	4	28.6	57.2
No comment	1	7.1	7.1
Total	14	100	100

H. Institutions Awareness on Early Warning

Table 6-107: Level of institutions' awareness on EW

No.	Categories Awareness	Level of awareness				Total
		High	Moderate	Minimum	Do not know/no response	
1	Water resources management	9	7	3	3	22
2	Participants of WR development process	6	7	3	6	22
3	Water resources management regulation	7	5	4	6	22
4	Environmental protection	6	8	4	3	21
5	Flood control related activities	6	8	2	5	21
6	Political intervention	7	5	4	5	21
7	Military intervention	5	3	4	5	17
	Total	46	43	24	33	146
	Percent	32%	29%	16%	23%	100%

Table 6-108: Institutions' awareness level of activities sponsored in the region

No.	Categories Awareness	Activities Sponsored by					Total
		Local community	Government	NGO	All	I do not know	
1	Water resources management	0	5	1	2	1	9
2	Participants of WR development process	0	2	0	5	2	9
3	Water resources management regulation	0	7	0	1	1	9
4	Environmental protection	3	1	1	2	1	8
5	Flood control related activities	0	6	0	1	1	8
6	Political intervention	0	5	0	0	3	8
7	Military intervention	0	2	0	0	2	4
	Total	3	28	2	11	11	55
	Percent	**5%**	**51%**	**4%**	**20%**	**20%**	**100%**

I. The Aim that Helps to Avoid or Reduce Violence and Human Crises

Table 6-109: The aim that helps to avoid or reduce violence and human crises

Tools, Plans and Methods		Availability Check				Total
		Available	Partially available	Not available	Not sure	
1	Forecasting Plan	2	1	5	2	10
2	Forecasting tools	1	1	5	2	9
3	Forecasting methods	1	3	3	1	8
4	Preparedness action-plan	2	3	2	1	8
	Total	**6**	**8**	**15**	**6**	**35**
	Percent	**17%**	**23%**	**43%**	**17%**	**100%**

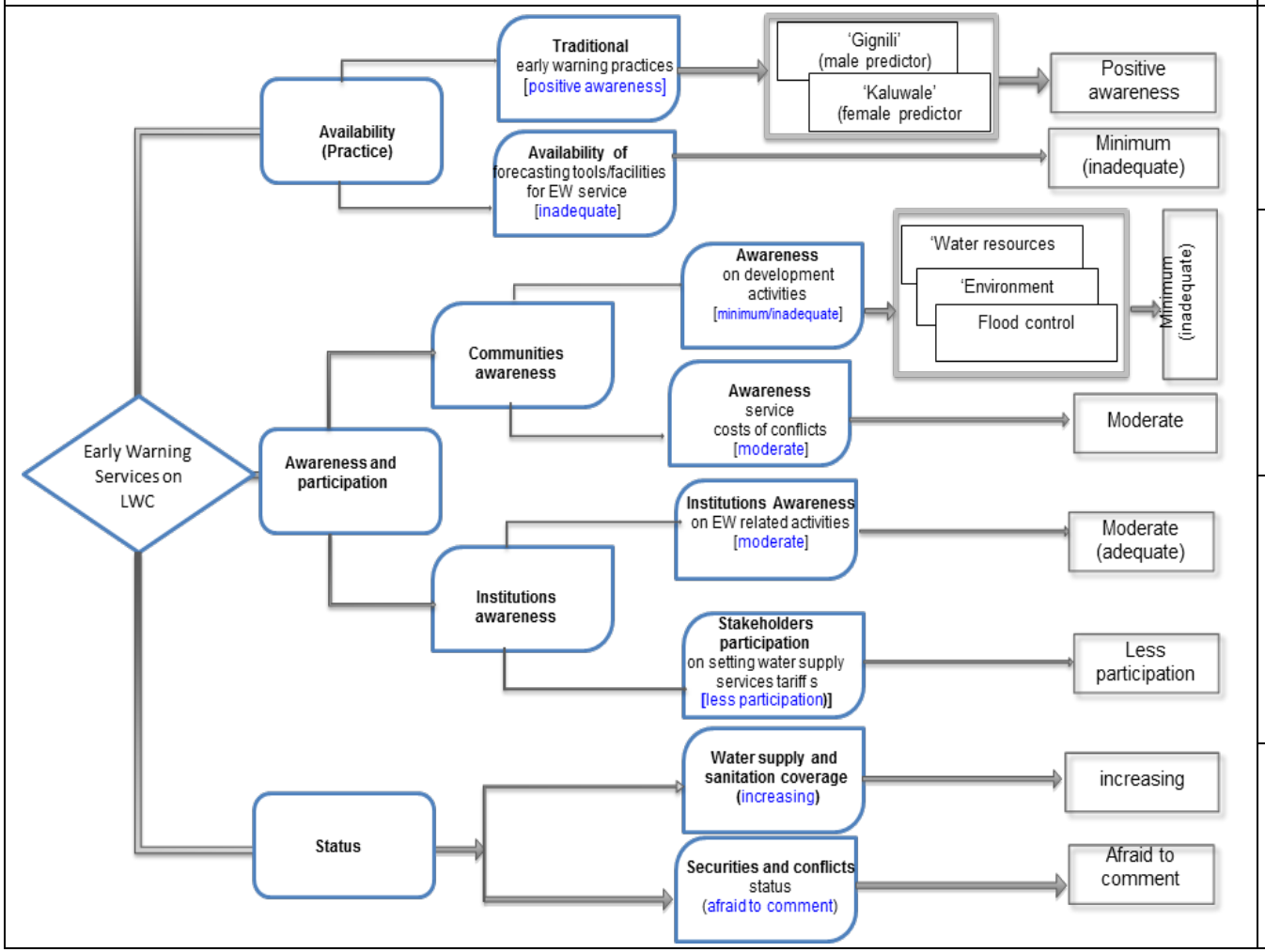
Survey data shows 43% of respondent institutions agreed that there were no forecasting tools, plans and methods useful in the process of avoiding or reducing violence and human crises at local level and during the last 5 years. More information on the findings of the early warning is presented at Appendix L.

6.12.4 EWS Data Analysis Measuring, Forecasting, Validating, Modelling and Deployment

In Chapter 7, the researcher has developed a framework modelling of local early warning practices in combination with other relevant variables useful for testing the validity and related future work.

6.12.5 Grouping Data on Local WC Early Warning Service Data Analysis

Figure 6-18: Mapping community activity, participation and awareness correlation with early warning services



Group-1	Group-2	Group-3 (Summary)
Positive but inadequate [Availability of traditional EW practices and forecasting tools]		• Positive but inadequate local EWS practices and traditions • Less participation but moderate level of awareness within local communities and institutions • Local water supply and sanitation coverage is increasing but unsustainable due to due local conflict and security situations
Moderate but inadequate [Communities' awareness on development activities and costs of conflicts]	Moderate and inadequate/less participation [communities' and institutions' awareness on WSD, EW practices, effects of conflicts, and stakeholders participation	
Moderate but less participation [Institutions' awareness on EW activities and the rate of stakeholders participation]		
Increase WSS coverage but unsustainable due to security and conflicts [Status of water supply and sanitation coverage; securities/conflicts]		

6.13 Availability of Preparedness Data Analysis

In Chapter 3, the framework of the study, the researcher has indicated the importance of local preparedness (variable 10) in reducing the momentum of local water-conflict-related problems. The major research question re-stated below clearly enquires about the status of preparedness at local level:

"How can we pre-identify and prepare for local water conflicts in low-income developing countries?"

Together with other variables, this section analyses data that are important in answering the research question. This section reflects the analysis of research variables that help to identify the preparedness of local people and institutions' capacity and awareness in reducing local water conflict events. The next flow chart indicates a map for grouping the findings on the local communities' and institutions' activities, participation and satisfaction correlated with the availability of preparedness and main data types for analysis. The flow chart helps to visualise the results of the findings and it helped to design a framework model illustrated in Chapter 7.

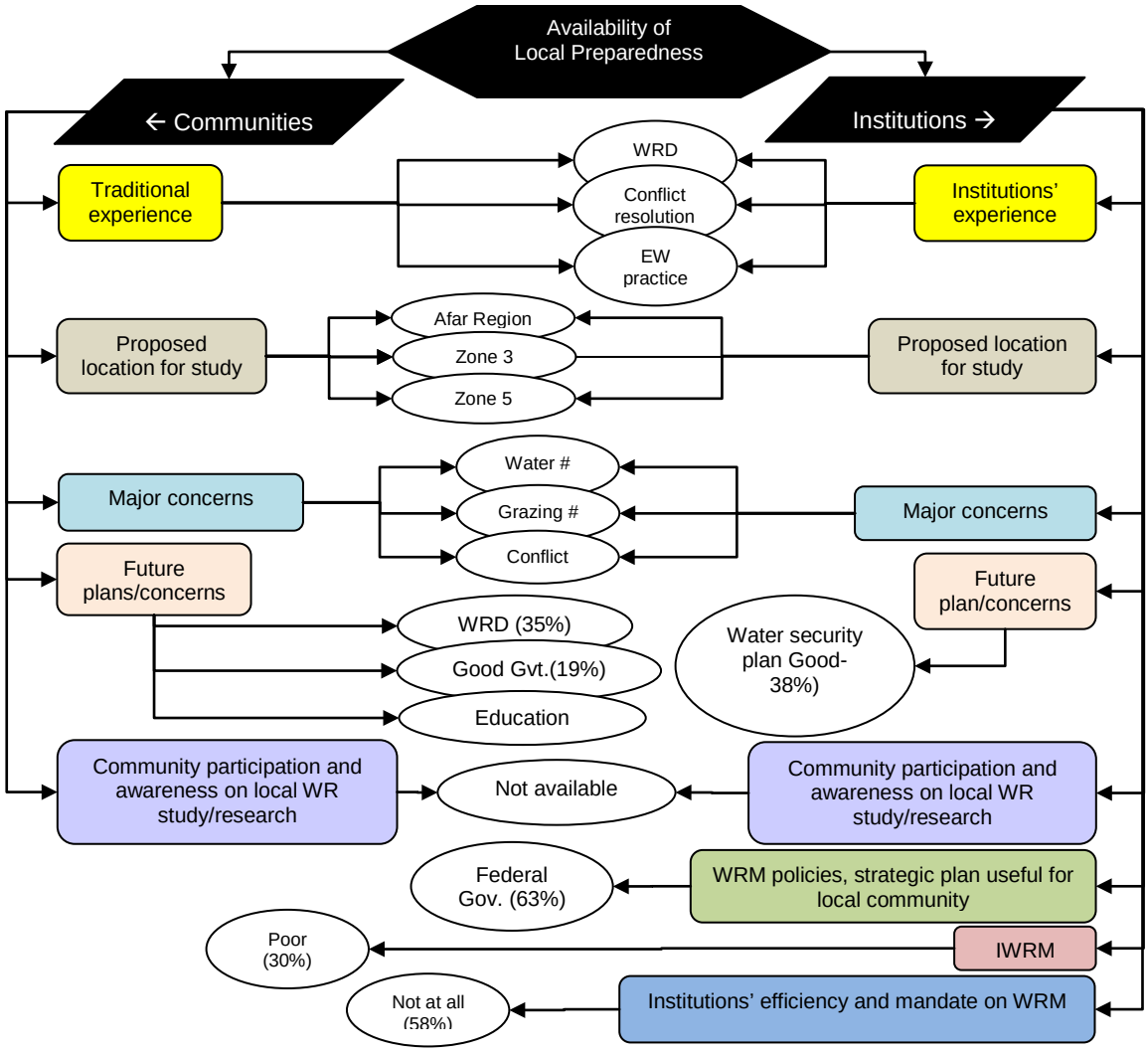


Figure 6-19: Flow chart for summaries of local preparedness variable in the Afar region

6.13.1 Summary of the Findings on Availability of Preparedness

The process of identification of local communities and stakeholder institutions preparedness on local conflict management is the major research question (see §6.13) and the major focus of the study. The finding indicates the availability of a moderate level of preparedness within the region, which is encouraging as it plays a significant role in reducing conflict-related problems.

Observation 1: *Minimum experience on WRD, EW services and conflict resolution practices*:
In the last 5 years, there have been moderate levels of awareness, ranging from 45 to 54%, among the local communities and institutions of modern or traditional preparedness on WRD in the areas of experience that include education and training on local water resources development, operation and maintenance practices, respectively. There are minimum practices of a conflict resolution process as compared to WRD activities, ranging from 23 - 38%, within local communities and institutions. The figure suggests 23% of institution respondents agreed that there was adequate awareness of local preparedness on early warning, communication and emergency response practices.

Observation 2: *The entire Afar region, Zone 3 and Zone 5 were recommended for WRD and conflict-related study/research in the region:*
The opinions collected show that the entire Afar region (33%) and in particular Zone 3 (27%) and Zone 5 (16%) of the region, were among the most frequently recommended locations by local community and institutional respondents as locations that are useful when studying water resources development and conflict-related aspects in the Awash River Basins of Ethiopia. The main reason for the proposal was based on improvements of clean water supply, WRD and potential conflict areas over water and grazing mainly with neighbouring Issa/Somali tribes.

Observation 3: *Moderate level of preparedness on future plans/concerns/ water security plans:*
Regarding future preparedness and plans on activities directly or indirectly related to the sustainability of local WRD, most of the respondents from local communities showed their concerns about the continuity of problems associated with water supplies. These concerns include water shortage, saving, harvesting, distribution and quality problems (40%); good government, security and political instability (19%) and lack of adequate education (12%). However, 38% of local institution respondents agreed that they have agreed on the availability of short-term, medium-term and long-term water security plans specifically designed for the communities. Some 34% of institutions agreed that the water security plan was poor or very poor. The remaining 27% do not have awareness or were not interested enough to comment.

Observation 4: *Lack of community's participation and awareness of local WR study/research:*
Opinion collected from 74% of respondents' shows that they do not have any awareness of, and participation in, activities related to studies and research being undertaken in the region;

26% of them have only a low or medium level of awareness. Similarly, 74% of institution respondents agreed that there was no community participation or that they do not know about communities' involvement in related field studies.

Observation 5: *Availability of WRM policies and strategic plan useful for local communities at Federal level:*

The data shows 63% of the respondent institutions agreed that there were water resources management policies, strategic planning, rules and regulations prepared at federal government level; 20% agreed that they were prepared at regional government level; 9% only believed that they were designed at basin authority level. The other 5% of the respondents agreed that local government had little participation in this activity while 4% of the respondents had no awareness of the issue.

Observation 6: *Lack of satisfactory activities on integrated water resources management (IWRM) in the region:*

The analysis indicates 30% of institutions' respondents agreed that the status of activities related to integrated water resources management implemented in the region were not satisfactory. However, 28% agreed that they were adequate; 19% agreed that they were good.

Observation 7: *Inadequate institutional efficiency and mandate on WRM:*

The analysis indicates 58% of institutions agreed that they do not have the required authorization to implement water resources management activities at regional level. About 25% agreed that they have such a mandate occasionally. The other 17% only believed they had appropriate authority to implement water resources management related activities at regional and local community level.

6.13.2 Communities' View - Data Analysis on Preparedness

The main research question "*How can we pre-identify and prepare for local water conflicts in low-income developing countries*" together with the third research question, enquires in measuring the status of preparedness-related activities within local communities and institutions. In this section, community-related data collection will be analysed.

A. Traditional Experience and Education on WRD and Conflict Resolution

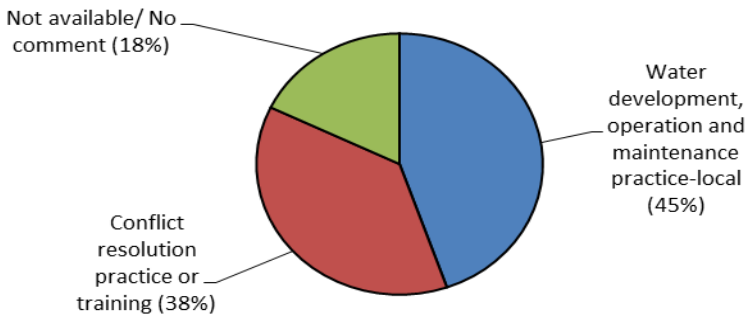


Figure 6-20: Percentage of opinions on availabilities of local experience, education or training on preparedness

Figure 6-20 shows that 45% of the local community respondents agreed that there was moderate level of awareness for preparedness in the areas of experience, education and training on local WRD, operation and maintenance. Correspondingly, 38% agreed on the presence of conflict resolution practices together with 18 % of the people who believed that there was no such preparedness in the region.

B. Conflict-related Study/Research Locations of Public Recommendations

Table 6-110 indicates that eight categories of locations were recommended by local communities that are useful to study WRD and conflict-related aspects. The three most frequently recommended locations were the Afar region (56%), Zone 3 (18%) and Zone 5 (8%). Zone 3 borders Oromiya, Amhara, Arguba special *woreda* and Somali regions. Zone 3 also borders Zone 1 and Zone 5 of the Afar region. Zone 5 is also divided in to 5 *woreda* sub districts, shares a border with Amhara region on the west side, and internally bordered with Zone 1 and Zone 3 of the Afar region.

Table 6-110: Frequencies of public opinion on identification of conflict areas in the region

Proposed location for study (Research Locations)	Frequency	%	Cumulative %
1. Afar region	103	55.7	55.7
2. Zone 3	34	18.4	74.1
3. Zone 5	15	8.1	82.2
4. Zone 1	13	7.0	89.2
5. Grazing land in the region	7	3.8	93.0
6. Awash River Basin	6	3.2	96.2
7. Zone 4	4	2.2	98.4
8. Zone 2	3	1.6	100.0
Total	***185***	***100.0***	

C. Publics Reasons for Study/Research Locations Recommendations

The figure shows that a majority of respondents (55%) agreed that the main study and research areas in the region should focus on WRD in order to improve clean water supply, and 29% agreed on studying potential conflict areas that occur between the Afar and neighbouring tribes over the use and control of water resources and grazing lands.

Table 6-111: Public reasons for recommendation of locations for further study/research

No	Summary of recommendation (Areas of Study)	Frequency	Percent
1	Water	101	54.6
2	Conflict	54	29.2
3	Water supply and grazing	18	9.7
4	Displacement and settlement	3	1.6
5	Grazing	3	1.6
6	Livelihood and population	3	1.6
7	Ethnic boundaries areas	2	1.1
8	Central location for many tribes	1	.5
	Total	**185**	**100.0**

D. Communities' Comments on Proposing Areas of Future Preparedness

Figure 6-23 below is drawn from data on major problems identified by institutions towards SRCDF (see Appendix K3). As a result, fourteen issues were recommended by communities for future preparedness on activities related to sustainable local water resources planning and development. The communities three most frequently recommended areas include (1st) water shortage, water saving, water harvesting, water distribution and quality (40%); (2nd) good governance, security and political stability (19%) and (3rd) education (12%).

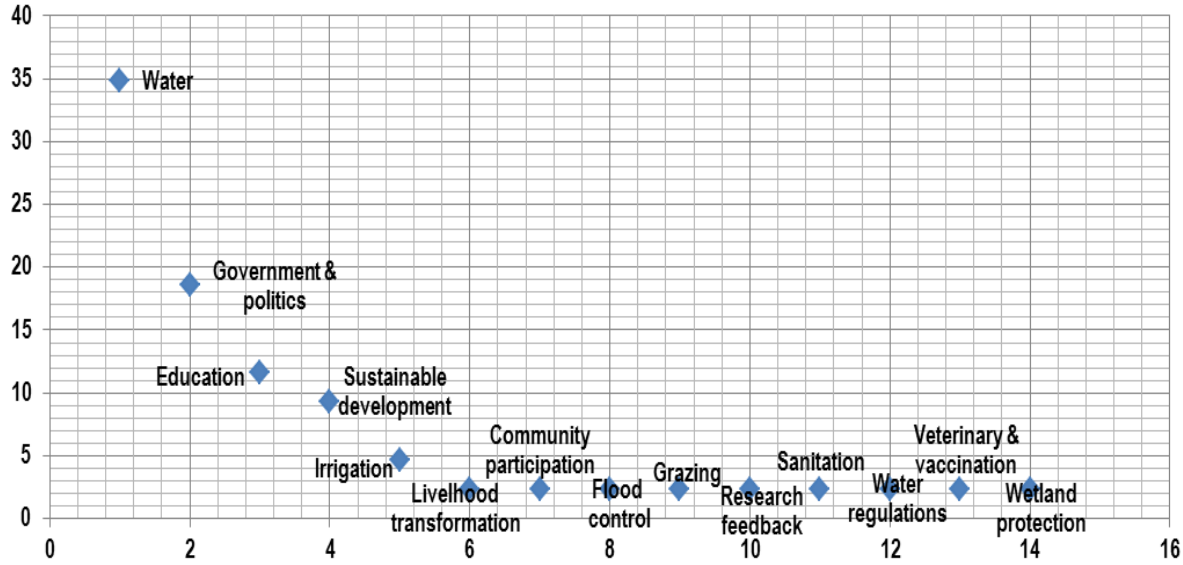


Figure 6-21: Public recommendation on the future preparedness activities related to sustainability of WRD

E. Communities' Participation and Awareness of Local Research Activities

The findings show that 74% of the communities do not have sufficiently developed or acquired awareness and do not participate in studies and research being undertaken in the region. The 26% of them only have low or medium level of awareness.

Table 6-112: Local people's participation and awareness of local research activities

No.	Research Categories	Participation Level					Total
		Medium	Low	Not available	I do not know	No comment	
1	Water pollution control related research.	4	29	54	30	11	128
2	Water recycling related research.	4	29	53	30	11	127
3	Study on searching for more extra water (desalination, rain water harvesting, and others).	3	27	54	32	12	128
4	Study of local water saving technologies.	7	31	49	29	12	128
5	Any new water resource development-related studies.	1	28	55	32	11	127
	Total	19	144	265	153	57	638
	Percent	3.0%	22.6%	41.5%	24.0%	8.9%	100%
		26%			74%		

6.13.3 Institutions' View: Data Analysis on Preparedness

In continuation to the previous section (§6.13.2), in addressing the main research question "*How can we pre-identifyand prepare for local water conflicts in low-income developing countries*" together with the third research question, the preparedness data collected with respect to local institutions will be analysed.

A. Institutions' Experience of WRD, EW and Conflict Resolution Practices

Table 6-113: Activities performed by institutions related to WRD, EWS and conflict management

	List of Local Activity/Category	Frequency	Percent	Valid Percent	Cumulative Percent
2.	**Water resources** development , operation and maintenance	12	54.5	54.5	54.5
3.	**Early warning**, communication and emergency response practices	5	22.7	22.7	77.3
4.	**Conflict resolution**, management and training related practices	5	22.7	22.7	100.0
	Total	22	100.0	100.0	

Table 6-113 shows that 54% of institutions agreed that they have adequate experience on WRD, operation and maintenance activities as compared to EW and conflict resolution practices. There were minimum levels (23%) of conflict resolution practices; and 23% of early warning, communication and emergency response practice preparedness within communities in the region.

B. Institutions' Recommendations on Conflict Related Study/Research Locations

Table 6-114 shows, institutions suggestions for studying WEC related researches. Later it will be compared with community's views in the Table 6-115.

Table 6-114: Frequencies of institutions opinions on identification of conflict areas

Institutions proposal					
Proposed area in the region		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Zone-3	20	34.5	35.7	35.7
	Zone-5	13	22.4	23.2	58.9
	Zone-1	9	15.5	16.1	75.0
	Afar Region	6	10.3	10.7	85.7
	Zone-2	3	5.2	5.4	91.1
	Zone-4	3	5.2	5.4	96.4
	Afar and Amhara Border	1	1.7	1.8	98.2
	Afar and Oromiya Border	1	1.7	1.8	100.0
	Total	56	96.6	100.0	
Missing		2	3.4		
Total		58	100.0		

***Comparison*:** Table 6-115 compares the suggested WEC study location by local communities (Table 6-110) and the institutions' proposal (Table 6-114). The data in the tables show that

communities recommend the whole region for study and institutions recommend Zone 3 as a primary WEC study location.

Table 6-115: Comparing communities' and institutions' view (Table 6-110 vs. Table 6-114)

Top three ranked locations	Communities' proposal in %	Institutions' proposal in %	Mean (%)	Rank
Afar Region	55.7	10.7	33.2	1st
Zone 3	18.4	35.7	27.05	2nd
Zone 5	8.1	23.2	15.65	3rd
Zone-1	7.0	16.1	11.55	

C. Institutions View on the Listing and Reasoning of Conflicting Parties

In Table 6-110, 44% communities agreed that water could be considered as the main factor for the future identification of a local study area. In contrast, institutions believed that conflict (98%) is the main cause for such study location identification.

Table 6-116: Institutions' recommendation on locations for further study/research

Conflicting Parties	Frequency	Percent	Valid Percent
Conflict between Afar and Issa tribes.	24	41.4	43.6
Conflict between Afar and Kereyu/Oromo tribes.	9	15.5	16.4
Conflict between Afar and Arguba/Amhara tribes.	7	12.1	12.7
Conflict between Afar and other tribes Oromo and Amhara).	3	5.2	5.5
Conflict between Investors and local communities (farmers/pastoralists/clans).	3	5.2	5.5
Conflict between Afar and Wajirat (Tigirigna speaker) tribes.	2	3.4	3.6
Conflict area.	1	1.7	1.8
Conflict between Afar and other tribes (Kereyu, Amhara, and Issa).	1	1.7	1.8
Conflict between Amhara and Oromo tribes.	1	1.7	1.8
Conflict between Government and local community.	1	1.7	1.8
Conflict between local community and small-scale private business people.	1	1.7	1.8
Conflict over water supply shortages.	1	1.7	1.8
Ethiopia vs. Eritrea conflict.	1	1.7	1.8
Total	55	94.8	100.0
Missing	3	5.2	
Total	58	100.0	

D. Local Institutions' Views on Availability of Short-term, Medium-term or Long-term Plans Related to Water Security in the Region

Table 6-117 gives 38% of the respondent institutions only agreed on the availability of short-term, medium-term or long-term plans related to water security activities. The 34% of institutions agreed that the water security plan was poor or very poor. The remaining 27% do not have any idea about this and failed to comment.

Table 6-117: Availability of short, medium or long-term plans related to water security in local institutions

No.	Main components of water security plan	Status of water security plan					Total
		Good	Adequate	Poor	Very poor	No comment	
1	Availability of a plan for water supply systems or infrastructure security from threats (Source, treatment, distribution).	5	2	3	1	3	14
2	Availability of a plan for protecting drinking water from contamination.	4	3	2	1	4	14
3	Availability of a method for improving and monitoring of drinking water	2	5	1	2	4	14
4	Availability of a plan on wastewater treatment and collection system protection.	1	0	6	2	5	14
5	Availability of a plan on information assessment, communication and emergency response on water security, risk and resources information.	2	3	5	1	3	14
6	Availability of water security training programme and capacity building.	3	4	3	1	3	14
7	Availability of a general local water supply planning and security model.	3	1	4	2	4	14
	Total	20	18	24	10	26	98
	Percent	20%	18%	24%	10%	27%	100%
	Percent group	38%		34%		27%	
	Status summary	Good/adequate		Poor/very poor		No comment	

E. Availability of Policies, Strategic Plans, Rules and Regulations Required for Local WRM

Table 6-118: Availabilities policies, strategic plans, rules and regulations on local WRM

No.	Policy, strategic plan and regulations	Coverage of the plan					Total
		Federal Gov.	Regional Gov.	Local Gov.	Basin Authority	No comment	
1	Water resources policy	16	4	1	3	0	24
2	Strategic plan on WRD	12	11	0	2	1	26
3	Regulation on ground water extraction and monitoring	12	2	0	1	1	16
4	Regulation on surface water flow monitoring	14	1	2	2	1	20
5	Regulation on protecting water resources from pollution	13	3	2	2	1	21
	Total	**67**	**21**	**5**	**10**	**4**	**107**
	Percent	**63%**	**20%**	**5%**	**9%**	**4%**	**100%**

F. Institutions' View on IWRM-related Activities at Local Level

Table 6-119 gives 30% of institution respondents agreed that the status of activities related to integrated water resources management implemented in the region were not satisfactory. However, 28% agreed that they were adequate; 19% agreed that they were good.

Table 6-119: Evaluating the approaches IWRM related activities at local level

Tasks of IWRM	Functionality Status					Total
	Good	Adequate	Poor	Not comment	Not available	
1. Availability of favourable conditions (polices legal frameworks, finance, etc.)	5	3	5	2	1	16
2. Availability of institutions useful for implementing IWRM (flood control, dam management, drought control, health and safety, soil management, etc.)	3	4	6	2	1	16
3. Enabling environment (planning, training)	3	8	3	1	1	16
4. Ensuring the continuity of the process (IWRM audit body)	1	3	5	6	1	16
Total	12	18	19	11	4	64
Percent	19%	28%	30%	17%	6%	100%

G. Institutions' Efficiency and Mandate on WRM

Table 6-120: Status and opinions on institutions' efficiency and mandate on WRM

Rating the adequacy of institutions efficiency and mandate on WRM	Frequency	Percent
Yes, always available and adequate	2	17%
Yes, occasionally available and adequate	3	25%
Not at all	7	58%
Total respondents	12	100%

The 58% of institutions agreed that they do not have adequate authorisation to implement water resources management activities at the regional level. The 25% agreed that they have mandates, occasionally. Only 17% believe they have the required authority to implement water resources management related activities at regional and local community levels.

H. Institutions' Awareness on Publics Participation in Research Activities

Table 6-121: Institutions awareness on communities' participation on research activities

Research Categories	Local Communities Participation				Total
	Medium	Low	Not available	I do not know	
1 Water pollution control	0	4	10	2	16
2 Water recycling related	0	2	12	2	16
3 Extra water search related (eg. rain water harvesting)	1	5	9	1	16
4 Technologies on water saving related	1	3	11	1	16
5 Any new concept on WSD related	1	2	12	1	16
6 Soil erosion related	2	4	9	1	16
Total	**5**	**20**	**63**	**8**	**96**
Percent	**5%**	**21%**	**66%**	**8%**	**100%**

6.14 Application of the Model (Deployment)

This data analysis chapter helps to interpret and validate the frameworks and variables of the research designed at the beginning of Chapter 3 (Framework of the Study). In addition, in the next Chapter, the researcher will further discuss each of the WEC variables and integrate

them in enhanced framework models, which we call the DIPTI framework model. In indicating the road map for the process of development of a framework model and in citing its future application/deployment to support scientific reasoning, the researcher has used the nine useful checklists during the process of data analysis.

Table 6-122: Check list for the application of the framework model on LWC

Check list	Explanation
Definition	The validity and the importance of each of the above ten major variables including over ***116 sub variables for local WEC system was explained in Chapter 3 of the framework of the study and Appendix E***. The researcher has classified variables for data analysis. Further definition of terminologies also introduced at the beginning of this thesis.
Interpretation	The ***variables are interpreted*** with respect to local areas with special focus on the Afar region in Ethiopia.
Evaluation	The researcher has used descriptive statistics to ***evaluate the findings*** of the survey. Also, the researcher has formulated equations helpful for further analysis of the findings.
Illustration	In this research, ***graphs, flow charts and tables*** are used to visualise data in the process of data analysis, discussion and literature gap identification as well as in the formulation of appropriate links between the variables. The process of data visualization helps to identify the trends and relationships of the information.
Discussion	The study has ***accommodated limited start-up discussions in each chapter*** in addition to the main Chapter 7 on Discussion of the Research Findings.
Explanation	The author has used ***qualitative and quantitative explanations*** in order to address the problem and the findings in the area of local water conflict identification and neutralization process.
Clarification	The researcher has prepared a framework and a used simple level descriptive analysis for the purpose of objective ***simplification*** as well as to maximize the understanding of the user about the status of local water conflicts.
Comparison	In most cases, the researcher has compared ***local communities' and institutions' views*** in order to check the validity or the compatibility of the data collected and the output of the analysis.
Contrasting	The researcher has compared and contrasted some of qualitative and quantitative findings of the survey in the process of ***optimizing the input and output*** of the data analysis.

6.15 Chapter Summary

The data analysis chapter provides extensive data related to local water conflicts, in addition to validating the feasibilities of variables identified in Chapter 2. The information in this chapter is adequate for achieving the four research objectives stated in the framework. It presents the primary process and the patterns of data for each of the ten major WEC variables: vulnerability, WEC awareness, local WEC Information availability, risks and hazards, networking, communication and cooperation (NCC), transparency, sustainability, early warning services status and local availability of preparedness. The analysis was supported by tabulation, cross-tabulation, figures and flowcharts together with the formulation of equations. The designed flowchart shows the process of data analysis. The researcher has also introduced a data evaluation process based on location, unit of analysis, representative population and data compatibility tests. It explains the necessary operation rules, definitions and justification of the variables for local water conflict identification and early warning services. The qualitative and quantitative justification data analysis includes over 116 variables and sub-variables in comparison to the ten operation rules for the interpretation and evaluation of the findings.

Chapter Seven
DISCUSSION OF RESEARCH FINDINGS

"Wars may never cease, but we must continue to strive to eliminate them."
(Charles Frank Bolden, Administrator of NASA, 2011)

This chapter compares, discuses and interprets the results of the data analysis described in the previous chapters based on the previous work, existing theories and traditional practices in the context of the research questions. Accordingly, it introduces the most important parts of the findings of the research.

7.1 Introduction

In this chapter, the researcher discusses and interprets the research findings in the preceding chapters based on the research aim and questions. It assesses, discusses, critiques and evaluates the main substantive findings from the previous work stated in Chapters 3 to 6 related to research design and frameworks, the presentation of the results and the process of data analysis. The investigation includes the potential strengths and weaknesses of the findings. The study was framed out in the areas of the key research questions in order to reflect the main goal of the research direction. The objective is to investigate, validate and predict the necessary parameters useful in the identification, preparation and neutralization of local water conflicts' impact that might hinder the sustainable development of low-income developing countries. This chapter is made-up of 12 sections including the introduction.

Section 7.2 indicates the ***trends, patterns and fundamental observations*** of local water conflicts that comprise exceptional and chronological variations, the relationships, trends and organization of the result as well as a generalization of the presented design. Trends of local water conflicts, conflicting parties and the magnitude of effects of local conflicts as well as the new findings of the '**sparkling effects of conflict'** are discussed in comparison to the theoretical and practical findings of the study. In addition, the process and the importance of including non-conflicting parties in the study will be investigated.

Section 7.3 Introduces and discusses the construction, classification and formulation of ***the major variables*** of local water conflict identification and preparedness ***parameters***. This section discusses the parameters useful for answering *the major and first research question on the pre-identification and preparedness models for local water conflicts*. Fundamental variables that could be useful for water conflict identification and preparedness were discussed and mapped in detail into five major categories: information, interaction, tolerance capacity to cope with the problem, early warning preparedness availability, and the availabilities of opportunities for the sustainable development of the local area.

Section 7.4 examines the fundamental components and significant importance of the ***WEC information pyramid***. Transparency, awareness, WEC information availability, the framework, and the foundations of the structure that links the information sub-components will be discussed from the viewpoint of a local approach. It is a section that addresses the second key research question, on the availability of relevant data, theories, literature and information concerning the identification and management of local water-related conflicts and subsequently escalated to full-scale wars. Moreover, it relates to the continuity aspects of the main research question.

Section 7.5 examines the level of ***networking, communication and cooperation*** structures of local communities and institutions' level of openness about their role, linkages and collaboration in the process of local water-conflict-related activities based on the questions about ***who, where, why, when, and how*** local stakeholders are interacting. Moreover, the section identifies frames and interprets the various types of relationships, collaboration and links among different stakeholders in the region that are participating in the process of local water resources and conflict management as a contribution to answering the main and the third research questions.

Section 7.6 investigates the challenges and exposures of local communities towards natural and manmade ***vulnerability and risk factors*** in comparison to the awareness of locally available ***capacity and public tolerance*** in mitigating the local water-conflict-related problems as ways of answering the main and the fourth research questions of the study.

Section 7.7 focuses on answering parts of the main and the fifth research questions concerning the awareness and practices of local people and institutions concerning the availability of ***specific early warning services*** and the ***general capacity of local preparedness and preparation.*** It also helps to maximize the better understanding of the core point of the problems on local water conflicts in the region.

Section 7.8 explains and maps the **contributions** of the local communities and stakeholder institutions towards the **sustainable development** of the region. It includes the public's rate of involvement and indicates the key problems affecting sustainable development and local water conflict diversity factors. It is a part of the major processes involved in answering the main research questions concerning the identification and preparedness for local water-conflict-related problems.

Section 7.9 discusses the framework of the process of approaches for ***prediction and preparedness frameworks*** *of local* water *conflict patterns* with the possible causes of primary conflict-initiating factors and it is compared to previous work.

Section 7.10 explains and critiques *the* ***hypothesis and results*** of the evidence concerning local water-conflict EWS research variables and discusses the significance of the present results.

Section 7.11 reflects the feasible frameworks for the application of the research results. It compares and indicates the relationships among participant stakeholders and the size of their contribution and the major beneficiaries of the study in the process of sustainable development through pre-identification of, and preparedness for, local water conflicts in low-income developing countries.

Section 7.12 presents a summary of the discussion on the core findings of the research described in this chapter.

A local water conflict pre-identification, early warning and neutralization framework model was designed based on ten fundamental modules that comprise five major parameters and over 116 variables. The researcher has collected adequate survey data from the local community and institutions to validate the practicability of the design by analysing and comparing it with the developed framework.

The status of the livelihood of the pastoral Afar communities, which comprise 90% of the population in the region, is at a low level being graded 'D', which is below the normal expectation of grade 'A'. This shows that these people live in a highly fragile situation, exposed to violent local conflicts in comparison to many stakeholders in the river basin, especially with the neighbouring Issa tribes.

The communities in the region are highly exposed to many complex problems starting with an inadequate clean water supply and shortage of grazing land. The minimum level of awareness of information related to resources, conflicts and early warning situations is another key problem in the region. The people are involuntarily open to risks associated with exposure to a high-level of natural and manmade hazards in the immediate area of the basin. In advancing activities related to the sustainable development of water resources in the river basin, there was a minimum level of participation and satisfaction related to Networking, Communication and Cooperation with neighbouring communities and tribes.

7.2 Patterns and Trends of Worldwide Water Conflicts

This section discusses and compares international and local water conflict trends. It also highlights the significance of why the study focuses on local water conflict problems in the low-income developing countries. It helps as a ***fundamental component prior to answering the main research questions (RQ):***

> **RQ: "How can we pre-identify and prepare for local water conflicts in low-income developing countries?"**

Gleick's (2009) preliminary water conflict data, which is a foundation for this section, was analysed, reorganized and examined in different forms in terms of local and international conflicts for the foundation of this research. The local Afar region critiques are fully based on survey data. Moreover, this section discusses the patterns, trends and considerable

observations on issues related to local and international water conflicts. It is the preliminary criticism of parts of an investigation aimed at validating the local water conflict research area. Trends of local water conflicts, conflicting parties and the sparkling effects of local conflicts are discussed in detail. The discussion also emphasizes the vital requirement of including non-conflicting parties who directly or indirectly understand the occurrence of conflicts in the region, in the process of conflict resolution.

In most inter-sectoral, inter-regional and inter-national strategic alliances in developing countries, issues related to local-level conflicts were not given significant and prior importance in strategic partnerships. Most international and regional partnerships' business programmes were unattainable; and many global negotiations failed as a result of a lack of awareness or consideration of local level conflicts, mainly over water and other natural resources that are directly related to the sustainable development of low-income developing countries.

7.2.1 Trends of Water Conflicts at Local and International Levels

7.2.1.1 World Water Conflict Trends

The findings of the research, as indicated in Figure 1-3 of Chapter 1, show that international water conflicts were increasing in the 20th century and have started decreasing since the beginning of the 21st century. However, local water conflicts have been significantly increasing since the mid-20th century and continue to increase to date.

The figure indicates a high and significant decrease in international water conflicts after the end of the Cold War (1991), which was characterized by high levels of political conflict and military tensions. The growing concern about this is that, in contrast, there has been a high, significant growth in local water conflicts since the Cold War. One can also say that there is a highly significant increase in the proliferation of local water conflicts. There was no clear investigative information that indicates the alteration of international water conflict problems into local conflicts. It requires detailed investigatory studies to identify those factors that fuel and contribute to the increase in local, as compared to international, conflicts.

There is much concern that unsustainable ways of development exposed to international or macro-level conflicts may lead to immediate and conventional wars that are critical catastrophes. On the other hand, the dramatic increases in local or micro-level water conflicts have a continuous negative impact on the low-income communities. The aggregate impact of the local conflicts causes deep-rooted insecurity problems among the neighbouring communities in the region which makes it difficult for the situation to revert to normal. The local conflict between the Afar and Issa tribes in the Awash River Basin could be a good example for such deep-rooted conflicts.

Much research in recent years has focused on transboundary-related water conflict studies. Unfortunately, it is not clear why many researchers did not give close attention to researching micro-level local water-conflict-related problems as an alternative approach. Whether the lack

of adequate information about local conflicts or its inconvenience in the internal affairs of a country's local study acted as a major barrier to a study needs more clarification. In the years 2000 to 2009, 68% of water conflicts occurring in the world were local and only 32% international. There are some countries, like Australia, that do not have any significant history of international water conflicts.

7.2.1.2 Africa Water Conflict Trends

Among the low-income developing countries, Africa is the only continent that has a maximum of 75% local water conflicts and a minimum of 25% international water conflicts. The historical background of conflict information shows that among the water conflict problems in Africa, most (45%) of them have occurred in Eastern parts of the continent as displayed in Table 7.1.

Table 7-1: Percentage of worldwide water conflicts by continent (2000-9)

(a) Worldwide water conflicts by continent

Region	Conflict Category (2000-9)	
	Local (%)	International (%)
North America	10	-
Latin America	100	-
Australia	100	-
Africa	**75**	**25**
Asia	63	38
Middle East	50	50
Europe	33	67
% Worldwide mean	68	32

(b) Water conflicts in Africa

Region	Frequency of Water Conflict in Africa (2000-9)	
	Percent	Valid Percent
Eastern Africa	37.9	44.9
Southern Africa	24.1	28.6
Middle Africa	10.3	12.2
Northern Africa	6.9	8.2
Western Africa	5.2	6.1
Total-valid	84.5	100.0
Missing	15.5	
Total	100.0	

There is strong evidence of problems related to political instability, drought, poverty and socio-economic insecurities together with a significant increase in the number of water conflicts in parts of Eastern Africa. As a result, many parts of the region are extensively volatile and require further attention as compared to other parts of Africa.

7.2.1.3 Ethiopia Water Conflict Trends

The chronological trend of local and international water conflicts in East Africa indicates that more (36%) of the conflicts occur in Ethiopia as compared to Sudan, Kenya, Zambia, Zimbabwe, Mozambique, Eritrea, and Somalia. The fewest (5%) water conflicts were recorded in Somalia even though little evidence was available about the country because of internal and external conflict factors that have been causing the long-standing war and the political instability of the country. Table 7-2, below, helps to compare the frequency and percentage of water conflicts occurring in Eastern parts of Africa.

Table 7-2: Percentage of major water conflicts in Eastern Africa

Eastern Africa	Frequency	Percent
Ethiopia	8	36
Sudan	3	14
Kenya	3	14
Zambia	3	14
Zimbabwe	2	9
Mozambique	1	5
Eritrea	1	5
Somalia	1	5
Total	22	100

There are no rivers flowing into Ethiopia. The country is considered as the water tower of Africa and the source for many transboundary rivers for neighbouring countries. In Chapter 1, Fig 1.2, the researcher has displayed the list of 12 basins, which encompasses eight River Basins, one Lake Basin and three Dry Basins.

Ethiopia has a population of over 90 million people, which is dynamically increasing at an average rate of 3.2% per year. The country's strategic, hostile, geo-political locations and problems related to internal political instability have a great effect on the sustainable socio-economic development of the country. In Africa, the country's water supply coverage (38%) and sanitation coverage (12%) are amongst the lowest, which is a serious problem for local communities. Because of this, the people are exposed to drought and water supply shortage problems both in urban and rural areas.

Figure 7-1: Trends of major water conflicts in Ethiopia

The conflict trend displayed in Figure 7-1 above demonstrates that local water conflicts in the country are greatly increasing which is contrary to international conflicts since the end of the Cold War era. The historical and the major transboundary-related conflicts in Ethiopia were with Egypt and based on the utilization and resource control over the Nile River ('Abbay' River).

7.2.2 Trends of Local Conflict/Water Conflicts in the Afar Region

As the majority of the people in the region live in pastoral communities, their day-to-day life depends on the main Awash River and its tributaries. The findings show that the people are highly exposed and affected by unexpected flooding problems, transfer of pastoral lands to high-level state farms, mainly for sugarcane, and frequent conflicts with Issa tribes over the control and utilization of water resources, wetlands and grazing areas. The survey respondents agreed that the level of hostilities and conflicting stakeholders with the indigenous people have been increasing over time.

7.2.2.1 Awash River Basin

The Awash River located in the Awash River Basin stretches about 1,200km. It rises in the central parts of the Ethiopian highlands, the high plateau to the West of Addis Ababa, at an elevation of 3,000m. This river basin is the fourth largest catchment area in Ethiopia and has a total area of about 116,000km^2. It flows to the North Eastern parts of the country and ends in Lake Abe, near the Djibouti border, in the Afar region at an elevation of 250m.

(a)Afar region Land features

Land features	Description
Maximum altitude:	1000-1500m above sea level
Minimum altitude:	120m below sea level
49% of land:	500-1000m above sea level
38% of land:	0-700m above sea level
8% of land:	Below sea level

Source: Afar Economic Development and Finance Bureau

(b) Awash River Basin

Source: MoWR reports

Figure 7-2: Map of Awash river basin (b) and Afar region (a) land features

The Awash River Basin map and the land features of the region are displayed in Figure 7-2 above. Additionally, the basin is divided into seven categories as displayed in Figure 5-1 (Chapter 5). The wetlands, grazing areas and the riverbank areas of the lower and middle valley are the most conflict-prone areas in the basin.

7.2.2.2 Population and Administrative Boundaries

The Afar regional state is mainly located in the basin and it is one of ethnic division-based administrative regions in Ethiopia. The region is known for its ancient archaeological findings of hominid fossils. The region shares two international borders with Eritrea to the North and Djibouti to the west. Afar region also shares four local borders with Tigray, Amhara, Oromiya, Somali regions to the North, West, South and East, respectively. The state is divided into five Zones and twenty-nine Weredas. Among these Weredas, twenty-four (83%) share borders

with neighbouring regions and countries. This means that the people living in 83% of the region have great opportunities to share resources with other neighbouring communities. The 2008 population estimate of the Ethiopian Central Statistical Authority (CSA) shows that over 1.5 million people are living in the region where 57% of them are male and 43% of them are female. The rapid increase of the population in the basin has created a high pressure on the utilization of common property natural resources such as land, water, grazing and forests. Amhara, Oromo, Afar and Issa are the major tribes in the basin. The highlanders (Amhara and Oromo) in the basin practise agriculture and the lowlanders (Afar and Issa) are predominantly pastoralists.

7.2.2.3 Exposure to Vulnerability and Conflicts

The 2008 data collected from Ethiopian Central Statistical Authority (ECSA) displayed in Table 7-3 below indicates 70% of the population in Afar region are vulnerable, based on demographic information related to age and gender.

Table 7-3: Population size of Afar region by age distribution

Age category (in years)	% of population (2008)	Vulnerability discussion based on age and gender
Below 15	46%	Highly vulnerable
15-64	52%	Male-30% Not vulnerable; Female (22%)-Highly Vulnerable
Above 64	2%	Highly vulnerable
Total	100%	Percentage of highly vulnerable communities in the region (46+22+2 =70%)

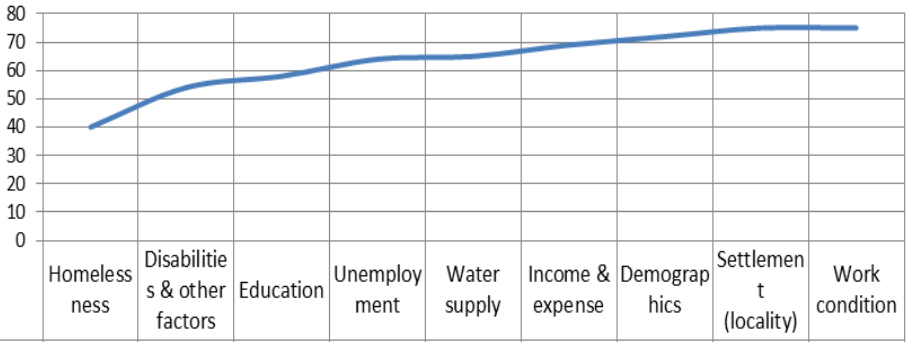
The 2010-survey data analysis shows 72% of the people are vulnerable with respect to age, gender and people with special needs and disabilities as seen in Tables 7-4 and Figure 7-3 below. In both cases, the region is highly exposed to critical problems. The analysis of survey data on vulnerability is categorized into five major categories based on work condition, water supply, demography, housing and shelter and literacy status. All these major variables are interpreted into 9 (nine) sub categories to evaluate the local vulnerability status of each household.

Table 7-4: Categories of vulnerability of people in the Afar region by percent

Categories of vulnerability	% of exposure
Work condition (related to type of work, rate of unemployment, income and expenses)	64%
Water supply (related to clean, adequate and affordable water supply)	60%
Demography (related to age, gender and people with special needs and disabilities)	72%
Housing and Shelter (related to settlement and homelessness)	74%
Literacy (related to level of education and illiteracy)	67%
Mean	67%

The study suggests two out of every three households have a vulnerable family member. Most of the people are vulnerable mainly because of poor work conditions and unemployment;

displacement from their settlement due to conflicts and economic-related problems; and problems related to disabilities and people with special needs, as indicated in Figure 7-3 below. The high number of vulnerable conditions increases people's exposure to hazards and risks. High levels of risk exposure speed up or fuel the level of local conflict in the region.



	Homelessness	Disabilities & other factors	Education	Unemployment	Water supply	Income & expense	Demographics	Settlement (locality)	Work condition
Level of vulnerability in %	40	54	58	64	65	69	72	75	75

Figure 7-3: Level of vulnerability in Afar region by percent

In the Afar region, frequent human death (36%), cattle raiding (18%), property loss (7%) and other problems (39%) mainly occur due to conflicts between Afar and Issa pastoralists. Shortage of grazing land and water supply problems are the major causes of conflicts in the basin. The intensity of the problem is very high during dry seasons. The local people's exposure to dislocation, disability, insecurity, fear, injuries and torture are some of the identified problems affecting them frequently.

Another great concern of 69% of the respondents is critical conflict-related problems affecting their day-to-day activities and hampering the socio-economic development of the local people in the region. These include inflation of local currency (the 'Birr'), land grabbing, health problems and poor water supply situations, as indicated in Figure 7-4 below. Within the region, though all listed problems are critical, the exposure to vulnerability problems related to water was rated lower than the immediate health situations and economic problems that include finance and land grabbing.

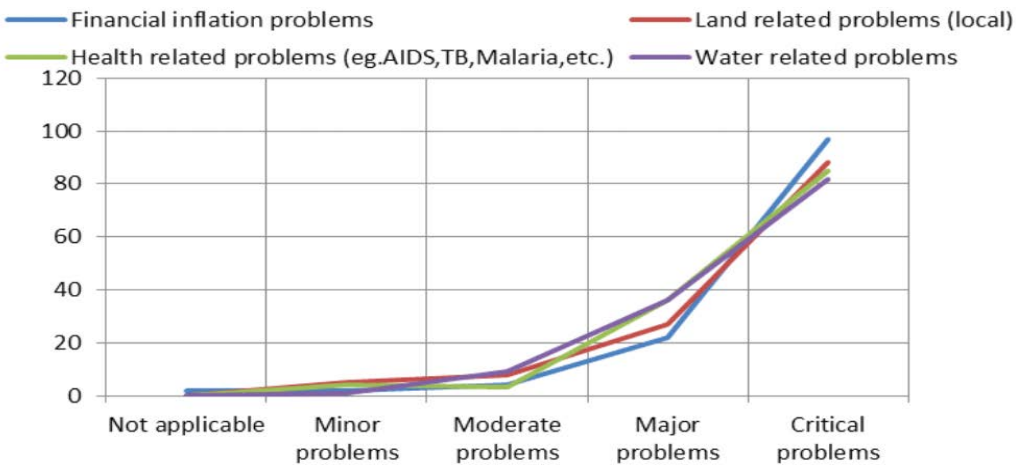


Figure 7-4: Categories of intensities of problems that affect the local people

Within the members of pastoral communities of the Afar tribe, excluding women, there is a tradition of carrying a handgun, saber ('*Gile'*) and stick by anyone above 12 years. The main purposes are for decoration as a traditional custom and for herding and slaughtering animals, as well as to defend themselves from attacks by wild animals and other enemies. Figure 7-5 below, displays details of the use of these tools.

The pastoral communities in the region are not allowed to use these tools randomly and also fighting is not allowed due to the existence of sophisticated and very important traditional laws. However, the situation provokes fear, anger and conflicts for those persons outside the Afar community due to their lack of understanding of this tradition.

Half of the respondents agreed that conflicts occur in the region frequently. Pastoralists and politicians are those who frequently carry and use handguns. Over 95% of the respondents agreed that the handgun movement is illegal. Most survey respondents (77%) believed that the sources are from the local area. On trends in the carrying of handguns, 44% agreed that it is decreasing, 35% increasing, 20% neither increasing nor decreasing and 1% decided not to comment on the question. The underlining issues of the findings are that one third of the respondents agreed that there is an increase in the handgun movement. Though modern handgun restriction regulations are implemented forcefully, the findings indicated that they have not gained full acceptance from certain sections of the communities. The next flow chart and figures clearly show the extent of the disagreement between the government and local communities on the recognition of handgun use. This gap appears to be very high, as shown in Figures 7-5, 7-6 and 7-7 below.

Figure 7-5: Handgun recognition gap between communities and government in Afar region

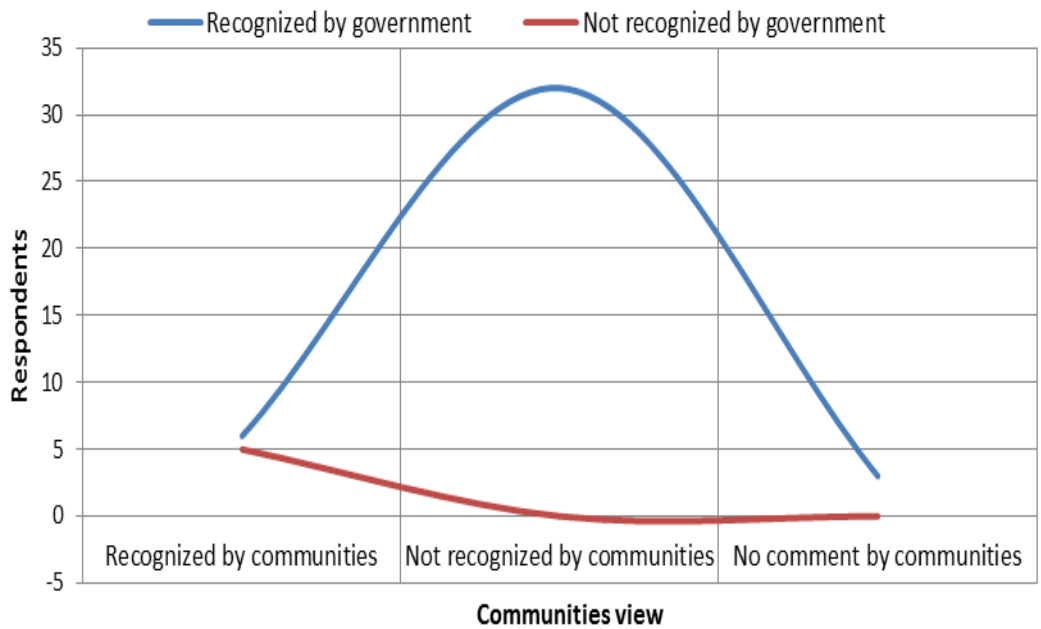
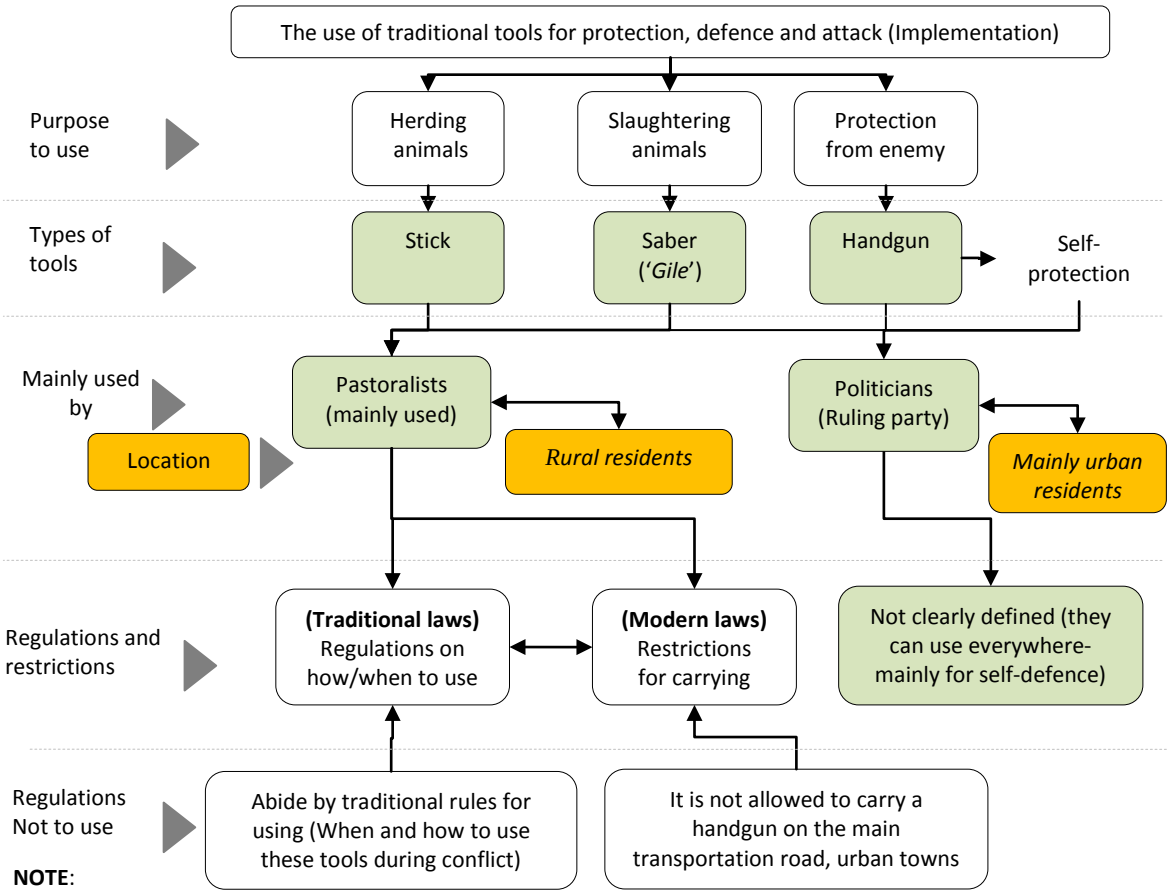


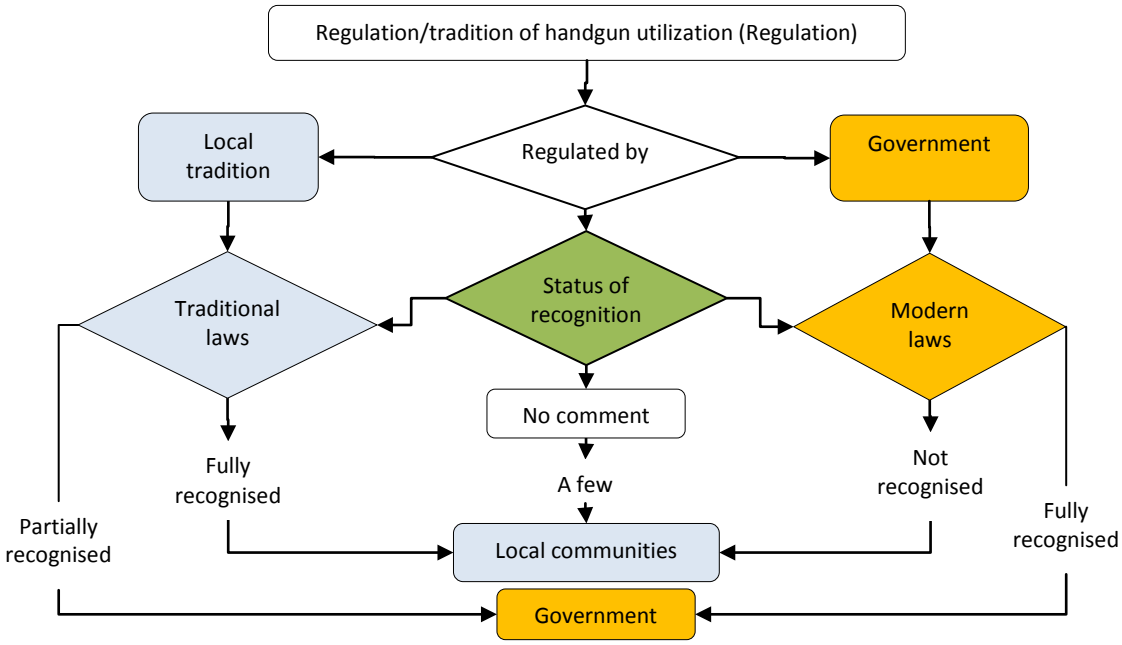
Figure 7-6: The main users and purposes of handgun in Afar region



NOTE:

1. There is a contradiction on the use of handguns rules and utilization areas (where to use among the two main users)
2. 77% of the respondents indicated that the sources of gun movements are from local sources
3. This study does not include formal handgun holders such as military, security and police forces

Figure 7-7: Status of regulation and recognition of the use of handguns in Afar region



7.2.2.4 Trends and Status of Local Water Conflicts in Afar Region

Lack of prepared, transparently-ready information on conflict is another major problem in the region. There has been much formal and informal news on frequently-occurring conflicts in the Afar region, especially between the Afar and Issa tribes disputing mainly over natural resources related to water, grass and land. However, there was no formally-registered statistical data on such conflicts but there are indications of more conflicts during the dry season and relatively fewer conflicts during the wet season. Sometimes, unexpected and unpredictable conflicts occur within Afar and Issa tribes in any of season. The survey data indicate that one in ten persons is directly involved in conflict; one in five persons has family members affected by conflicts; one in two persons believes that there are unresolved conflicts; nine in ten know the conflicting parties and seven in ten agree that they are conflicting with Issa tribes. Table 7-5 sums up the above points on the occurrence of conflicts mainly with neighbouring Issa tribes coming from the Somali region.

Table 7-5: Summary of discussion on the availability of local water conflicts

Conflict features	Respondents agreement in percent	Remarks
Households directly involved in conflicts	10.2%	90% are not involved in conflicts
Households that have family members affected by conflicts	21.1%	78.9% agreed not to comment or do not have family members affected by conflicts
Households that agreed on the existence of unresolved conflicts	55.8%	11.7% agreed that the conflict was resolved and 32.5% agreed not to comment
Households agreed on major effects of conflicts	36% (human death)	21% cattle looting, 11% war with Issa, and 32% miscellaneous problems
Major conflicting parties with Afar tribe in the region	91% tribal conflicts (72% with Issa/Somali tribes)	4% conflict with government, 3% with Afar clans, and 2% with farmers and international conflicts

Figure 7-8, below, reflects the root causes of local conflicts in the region. Most respondents agree that conflicts in the region occasionally occur because of water, grazing land, food and energy. Moreover, the figure indicates water supply scarcity problems are one of the major causes of local conflicts in the region.

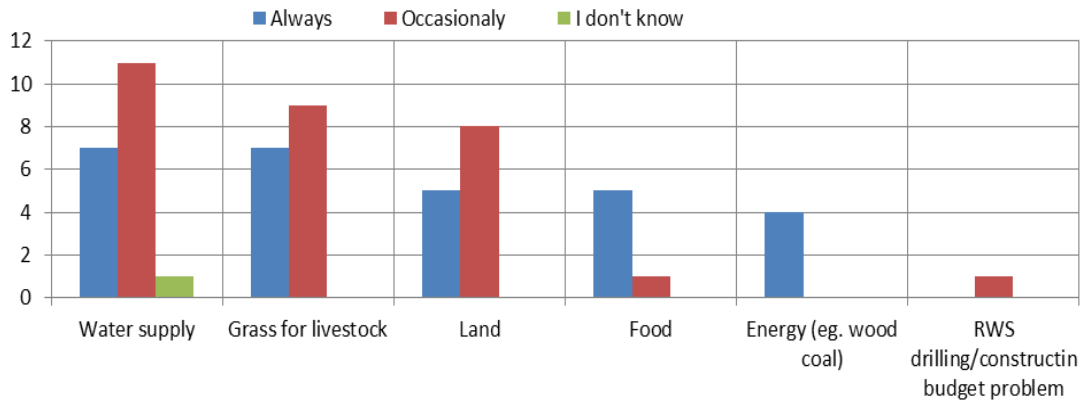


Figure 7-8: The root causes of local conflict in Afar region of Awash river basin

Table 7-5 and Figure 7-8 show that the pastoral communities are exposed to different types of internal pressures (mainly health and socio-economic problems) and external pressures (mainly problems over natural resources). The results of the survey identify water as the major problem that causes conflicts in the region. The details show that conflict over limited resources, control over distribution and construction of large government infrastructure projects are the three most frequently occurring problems and a root cause for the high level of conflicts in the region. In addition to this, the region is exposed to many complex problems that have a negative impact in terms of its future prosperity and stability.

7.2.2.5 Conflicting Parties

The researcher has identified a list of over one hundred and eighty complex problems in the region indicated in the previous chapters as directly related to conflicts or playing a major role in fuelling local conflicts. In addition to the main conflicts with Issa pastoralists, there is a slowly growing conflict with government institutions due to disagreement on the implementation of development projects in the region. Problems related to the construction of a big irrigation dam on the Awash River and the use of pastoral lands for agricultural purposes are some of the identified problems. Figure 7-9 displays communities' opinions of the lists of the conflicting parties in the region.

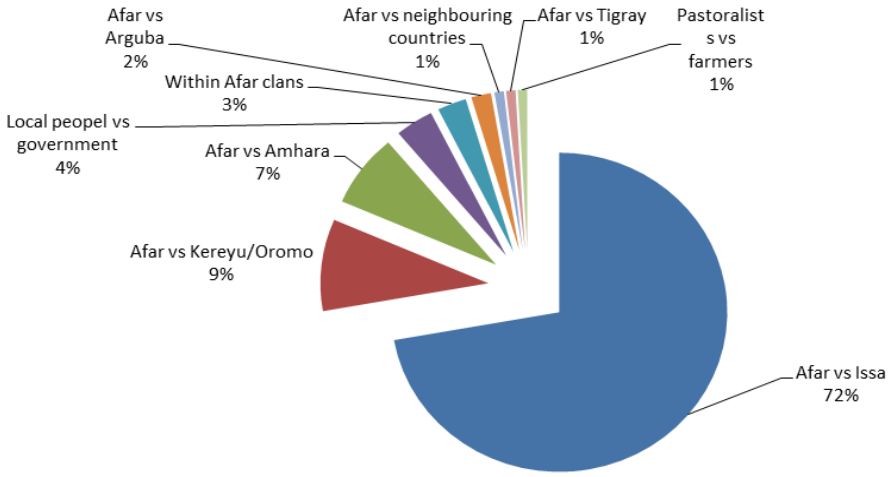


Figure 7-9: List of conflicting parties in the Afar region of the Awash river basin

7.2.3 The Level and Sequences of Conflicts (Boundaries of Conflict)

The result shows that the region is highly exposed to occasionally-occurring conflicts and violent crises where 72% of this problem is between Afar and Issa tribes. The problem in the region already exceeds the boundaries of simple disagreements and disputes. On the rate of the occurrences, simple disagreement and disputes occurs less frequently compared to serious conflict and violence that occurs more frequently and mainly depends on the season. The survey data indicate that the situation in the region was volatile. Vast numbers of the communities knew the causes of conflict, as well as the conflicting parties, in the region. Not all communities are ambiguous about conflicts in the region because of long-standing, deep-rooted and ever-growing competition over resources.

Table 7-6: Conflict boundaries and rate of occurrence in Afar region

Boundaries of conflict	Rate of Conflict Occurrence					Total
	No comment	Slowly	Occasionally	Frequently	Not sure	
Simple disagreement	4	47	33	22	22	128
Dispute	5	48	45	13	17	128
Conflict	2	42	60	17	7	128
Violence	6	27	58	21	16	128
Total	17	164	196	73	62	512

Table 7-7: Comparing the trends of maximum number of opinions on local conflict

Trends of maximum number of respondents opinion on local conflict							
Categories of Boundary	Lower Maximum Bound⬅						Upper ➡Maximum Bound
Frequencies of maximum observation:	47	≤	48	≤	58	≤	60
Types of conflict:	Simple disagreement		Dispute		Violence		Conflict
Trends of occurrence:	Slowly		Slowly		Occasionally		Occasionally

Table 7-7 shows the trends of maximum number of respondent opinions on local conflicts in the region. The bottom line of the findings of the survey confirms that the region is exposed to occasionally-occurring deep-rooted conflicts caused because of unpredictable violent conflicts. Generally, respondents expressed their views that conflicts frequently occur in the region. However, the specific survey query summarised in Table 7-7 indicates that conflicts occur occasionally and violence occurring in the region is at a critical stage.

7.2.4 Sparkling Effects of Conflict (Availability Support)

This section discusses, formulates and validates the theoretical findings of the concept of the Sparkling Effects of Conflict (SEC) with practical findings from the study. This new and vital finding contributes an additional tool for conflict resolution processes. In this survey, the percentage of people involved in conflicts (10.2%) is nearly identical to the 11.7% of respondents who agreed that the conflicts were resolved, as indicated in Table 7-8 below. In contrast to this, the study suggests that out of two people who were not involved in conflicts, one person thinks that the problem was not resolved.

Table 7-8: Conflict involvement and resolution comparison table

Conflict involvement	Agreement (respondents in %)	Disagreement (respondents in %)	No comment (respondents in %)
Involved in conflicts	10.2%	89.8%	-
Conflicts resolved	11.7%	55.8% (unresolved conflicts)	32.5%

The reason why 50% of those who were not involved in the conflict think that there were unresolved conflicts in the region is contrary to those involved in both conflict and the conflict resolution process is vital in understanding the effects of conflicts. It is beyond the boundary line of stakeholder participation in the process of conflict resolution. The cause for this could be seen in four scenarios linked to the findings related to those stakeholders who did not have a chance to play any role in the situations:

- *Scenario one*, the situation could be acceptable as it is from the neutral point of view of those who did not participate in conflicts, including the availability of reliable ways of traditional information communication systems among the people.
- *Scenario two*, the conflict might have affected other groups of people or stakeholders indirectly.
- *Scenario three*, the conflict would be directly resolved between the conflicting parties only without reconsidering its effects on the community or missing other concerned stakeholders.
- *Scenario four*, the conflict resolution process might have specific problems such as the dictation of traditional over the modern or *vice versa*. In fact, finding some kind of equilibrium resolution process that goes well with all parties requires further challenging work and will be quite difficult.

A local conflict resolution process should be based on the anticipation of the widely spreading boundary map of conflicts at different levels of communities and institutions at local, regional, federal and international levels. The effects of conflict might regenerate the same or another conflict depending on the way it will be resolved. If external stakeholders are those conflict negotiators who have an efficient understanding of the problems of the conflicting parties, they might play a great role in confidence-building for the negotiators.

It was witnessed that people are migrating worldwide due to local conflicts, as in the case in Somalia. Thus, the causes of local conflicts and the tolerances of conflicting parties were highly manoeuvred and influenced by external factors targeted on the basic pillars of conflicts. This makes the resolution process very difficult if the focus is only on the main factors of the conflict.

The intensity and complex magnitude of the effects of conflict were determined by (1) the depth, width and how fast it was spreading within the boundaries of internal and external stakeholder communities and (2) the level of full or limited awareness of what is going on in the areas of conflicts. These are the reasons why the conflict resolution process is difficult if it does not include all key stakeholders rather than the main conflicting parties only.

These stakeholders were not directly or indirectly involved in the conflict but have significant levels of awareness about the existence of the conflict due to the sparkling effects of conflicts.

The exclusion of the SEC stakeholders will lead to the problem becoming unending, continuous and circular. They ought to speak and write continuously about the conflict in the local area and influence the resolution process which acts as a counter effect by provoking conflicts. In conclusion, this finding shows its compatibility with the concept of the sparkling effects of conflicts, which ignites the whole process by creating uncertainty, as the researcher has discussed in the literature review (theoretical framework).

7.3 The Process of Local Water Conflicts Pre-Identification and Preparedness

This section discusses the process, importance, link and validity of the five key water-conflict pre-identification, preparedness and early-warning parameters. These include information, interaction, tolerance, preparedness and sustainable development (known as the **DIPTI** parameters). They are useful in answering the major and the initial research questions on local water conflicts, which are restated as follows:

RQ: "How can we pre-identify and prepare for local water conflicts in low income developing countries?" together with the next and first secondary research questions.

RQ1: "What type of framework, models or theories could be applied to pre-identify and prepare for local water-conflict-related problems?"

Local water conflicts in the Awash River Basin occur and escalate because of unfair combinations of three factors related to water and other natural resources; the user communities or institutions and regulation or traditional regulations or a binding rule as displayed in Table 7-9 and Figure 7-10 below. In any on-going local development activities, these pillars make pyramids of conflict identification only identified through the process-based development parameters indicated in the next figures.

The simplest way that might be easy to identify and reduce the effects of local water conflict is to focus on the three pillars: the users, the resource and rules and regulation for resource utilization. However, these pillars are heavily influenced by unbalanced external forces that have a great impact on the conflict. Hence, the approach of focusing on each pillar makes the study unsustainable and far more complicated. The complexities of the effects of external factors that have a direct effect on local conflict require enhanced approaches together with the WEC pillars.

Table 7-9: Primary approaches in pre-identification of local water conflicts in the region

Categories of LWC factors	*Description*	*Major factors that ignite conflicts (affecting the game plan)*	*The boundary line for pre-identification of LWCs*		*Effects of External factors*	
			Lower bound	*Upper bound*		
The users (the players)	Communities in the river basin - mainly pastoralists, stakeholder institutions, and all conflicting and non-conflicting parties (e.g. Afar and Issa tribes, government.)	Migration, dislocation and normal increase of the size of population in the basin	Minimum (limited) users	Maximum (unlimited) users	OTHER EXTERNAL AND INTERNAL FACTORS (EFFECTS OF CONFLICT DIVERSITY FACTORS)	
Resources (the playing field/object)	Awash River and its tributaries (mainly water, grazing, land and other natural resources)	Reduced resources due to scarcity, environmental problems, over-utilization, and improper management and other factors	Adequate resources	Inadequate resources		
Rules and regulations (Rules of the game)	Modern regulations and traditional practices on resources utilization, management and control	Lack of recognition in abiding regulations; unfair regulatory practices and other internal and external factors	Fair practice of rules and regulation	Unfair practice of rules and regulation		
Conflict Identification Boundary/Zone			Insignificant Conflict Boundary (ICB)	High Conflict Boundary (HCB)	-ve HCB	+ve ICB

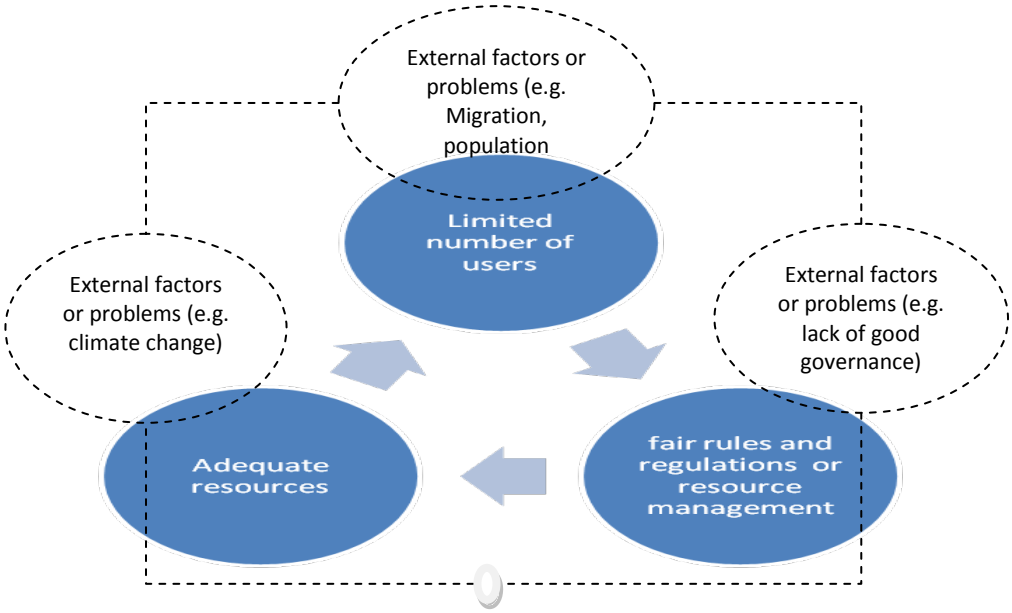


Figure 7-10: Minimum local conflict prediction pillars and major external factors affecting the process

These simple ways of approaching the pillars of conflict indicated in Figure 7-10 above, which are based on (1) adequacy of resources, (2) number of users, and (3) rules and regulations for resource management, are useful for understanding the extent of the problems but unachievable due to effects of the multiple external problems. However, the lessons learned from the above pillars are that local water conflicts could occur, triggered or fuelled depending upon the type of existing links, relationships, beliefs and traditional or regulatory frameworks. Moreover, there are necessary rules existing among the people and institutions participating at

the local level in sharing, managing or controlling the resources. It also depends on external factors related to local issues such as the involvement of stakeholders from other parts of the country. The initial attempt helped the researcher to develop an alternative approach that incorporates the concepts of the internal and external factors of local water conflicts.

Alternatively, the researcher has designed the useful, integrated and achievable five-step process-based approach called the **DIPTI** parameters and displayed in Figure 7-11 below. The hierarchy, relations and effective resource utilization practices of communities, institutions and the local, regional, national or international stakeholders concerned depend on the optimistic DIPTI model. The conflict pre-identification process parameters have a total of 11 major variables, as seen in the next diagram. The parameters help to identify and evaluate the level of preparedness based on bottom-up, direct, positive directions and top-down, integrated links approaches.

Figure 7-11 shows a model for effective local contributions towards sustainable water resources' management and development. This approach can be accomplished as a result of adequate awareness, transparency and the availability of information; efficient interactions among the stakeholders in the region; availability of a high level of tolerance and capacity in resolving crises that occur as a result of conflicts and other related phenomena. An adequate level of preparedness and early warning systems should also be available.

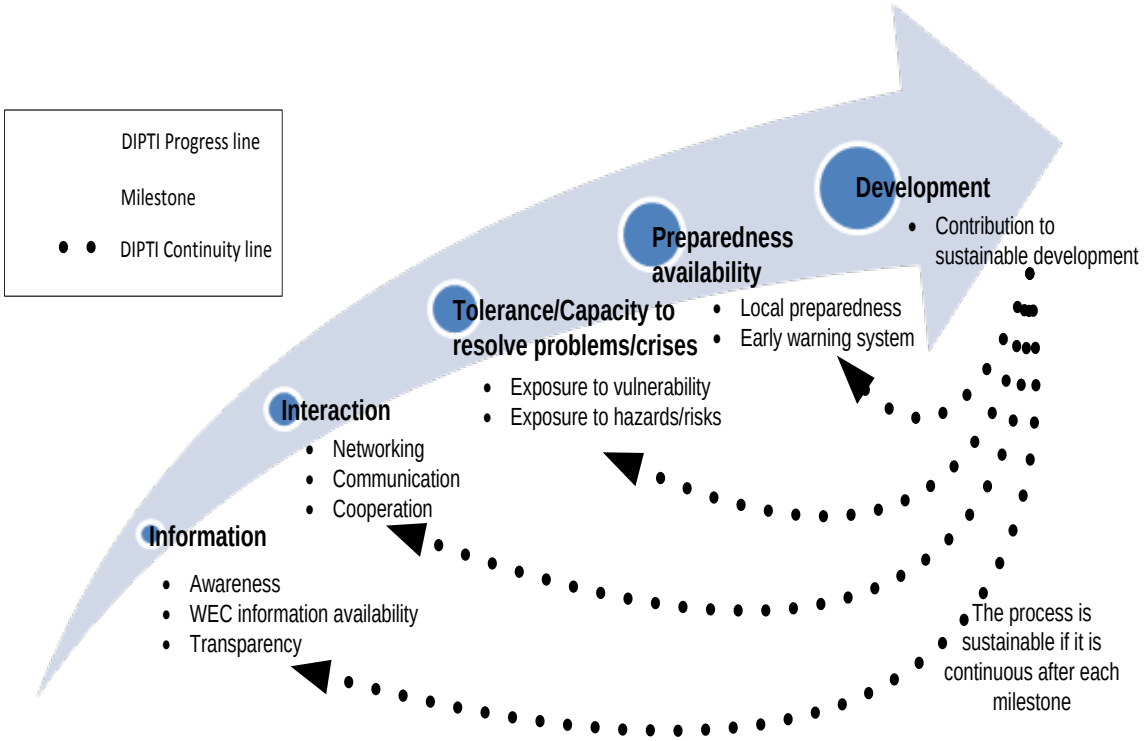


Figure 7-11: DIPTI directional framework model: A hierarchy, progression trend and milestone framework model for local water conflict pre-identification, early warning and preparedness

In order to speed up sustainable development by avoiding local water-related conflicts, one should properly address and prioritise the awareness and implementation of conflict identification, reduction and neutralization parameters in the process of preparing sustainable and integrated water resources management policies (high level) and practices (local level).

The findings of the survey data as compared to the previous theory show that there was a low level of tolerance and capacity in resolving the local risks that can harm the livelihood of the local communities due to an increasing number of natural and manmade hazards in the river basin. The effect of this is clearly observed in the inadequate number of community contributions to sustainable socio-economic development. Considering the DIPTI information parameters as a start-up tool for progress, there is a positive link between information and the other two factors, namely, interaction and tolerance.

Table 7-10: Scores of conflict pre-identification based on DIPTI process-based parameters

Parameters	Findings (grades)	N	Total	Mean	Positivity of mean
Information	DDC	3	4	1.3	Baseline
Interaction	DC	2	3	1.5	+
Tolerance/capacity	D	2	2	1.0	-
Preparedness	CC	2	6	3.0	+
Development	D	1	1	1.0	-
Mean Grade				1.6 (C)-moderate	

N= number of sub variables

Denotation for grades and scores: A=4, B= 3, C=2, D=1

The analyses of survey data with respect to the DIPTI parameters indicate a ‘C’ (1.6) grading, which means the region is moderately exposed to volatile conflict situations though there was a better level of preparedness. Table 7-10 and Figure 7-12 display the findings of the survey where each parameter is affected by problems more specific to the variables, such as the level of community awareness being better than the existing capacity or tolerance in resolving the problems.

The hypothetical line in Figure 7-12, as compared to the findings, shows that the local communities in the Afar region are better in information, interaction and preparedness as compared to tolerance and development activity. Although the basis for the developments in the region is very strong and encouraging, there was a serious problem in the area of tolerance capacity that makes the process unsustainable. Next, each parameter will be further discussed and compared with theoretical frameworks.

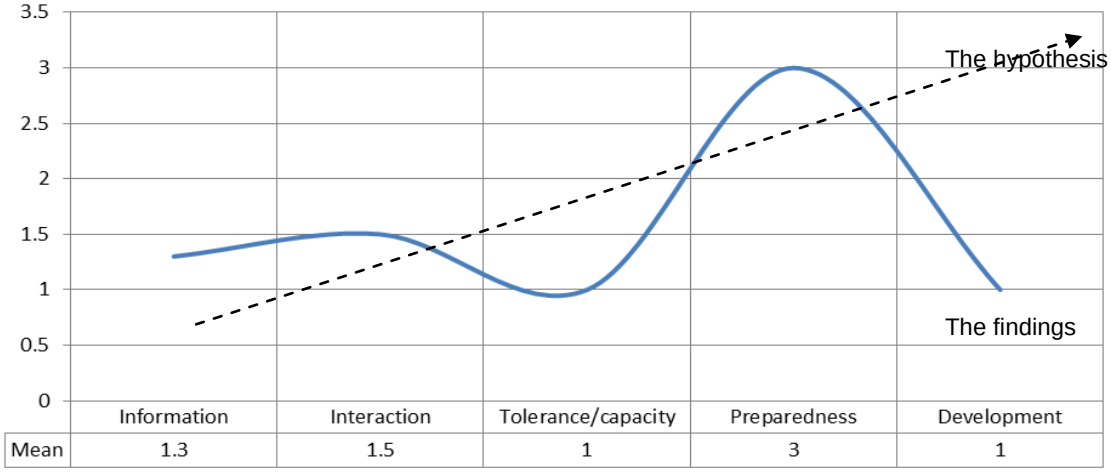


Figure 7-12: The findings of conflict identification process parameters

7.4 Fundamentals of Local WEC Information-Identification and Management

[INFORMATION]- DIPTI PARAMETER-I

This section discusses the WEC information, which is the first and primary DIPTI parameter useful in answering parts of the main research questions and the second key research question, on the availability of relevant data, theories, literature and information as well as on the identification or management of local water-related conflicts.

RQ: "How can we pre-identify and prepare for local water conflicts in low income developing countries?"

***RQ2**: "What are the available and relevant data, theories, literature and information on pre-identification or management of local water-related conflicts or war?"*

The water, early warning and conflict (WEC) information parameter is the cornerstone and the central point for identification, preparedness and management of local water conflicts. The parameter is supported and processed by a pyramid comprising four components, three of which are supportive components and one core central fact component. Awareness of the theoretical and practical foundations of the modern and traditional practices and transparency are the supportive and fundamental bases of the component. Also, the WEC data serves as the core central component for the local WEC information process. Figure 7-13 shows the major components of the design of the WEC Information Pyramid, which leads to the framework design of Figure 7-14 that indicates the local WEC information identification and management process.

Figure 7-13: The WEC information pyramid

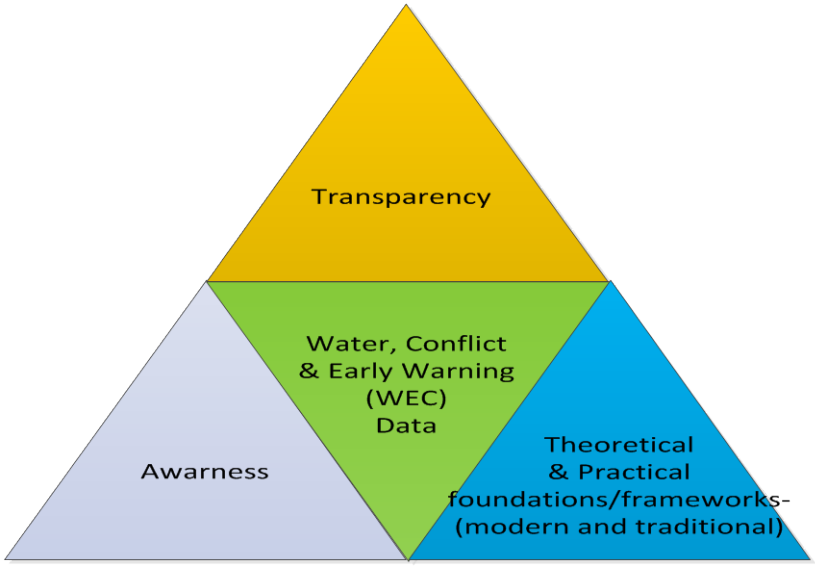
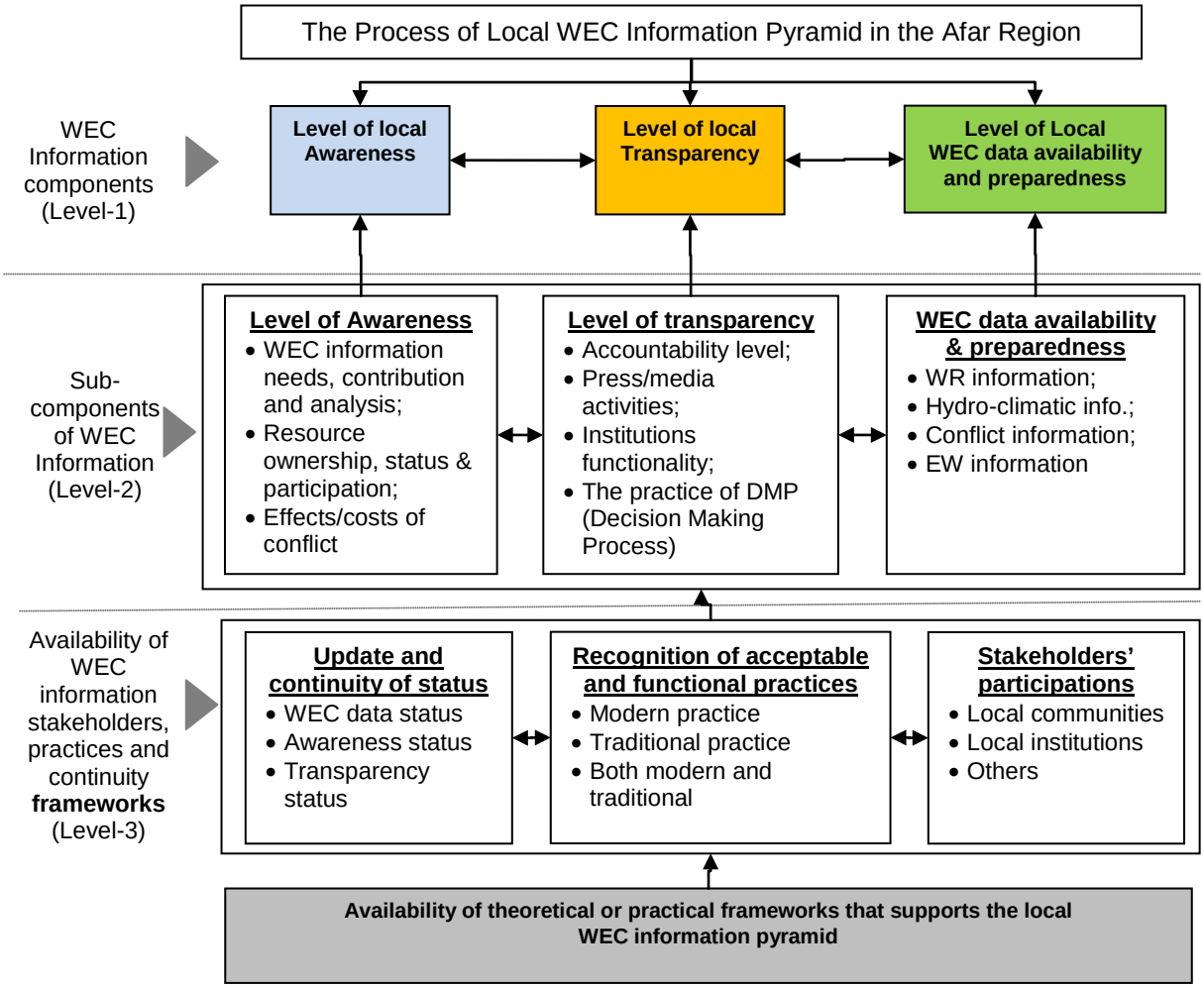


Figure 7-14: The process of local WEC information pyramid identification and management



7.4.1 Awareness

Local communities and stakeholder institutions' awareness are two of the major and primary processes in having and identifying information related to water, conflict and early warning predictions and preparedness. The problem of the lack of adequate and proper awareness on local issues is a great concern in many parts of conflict-prone, low-income, developing countries worldwide. The development activities in the region are frequently hampered because of lack of awareness of adequate consideration and integration practices related to useful modern and traditional practices at the local level. The voices of vulnerable people in these areas have not been heard due to a lack of balanced communication systems between concerned stakeholders or as consequences of the top down pressure from the media and government on local communities. The issue of who should set those balances requires further work.

Useful traditional knowledge and practices were not protected sufficiently as compared to modern practices because of lack of social awareness. The vulnerable members of local communities that include women, children and people with special needs were not well protected from harmful traditional and modern practices.

Lack of adequate awareness leads to ignorance and it could instigate conflicts, which would be difficult to resolve. The level of awareness varies from simple to complex depending upon the level of understanding and types of information perceived. The researcher has focused on simple and common-sense local levels of awareness that help to query, collect, refine, analyse and properly transfer shared information within the communities that play a great role in **supporting the** sustainable development of human resources in the region.

The life of pastoral communities heavily depends on their natural habitat and less so on the stability of the surrounding wider environment. Indeed, it is easily hampered because of competition and instability due to inefficient management and limited water supply resources, grazing land, livestock, wild animals and natural forests. Any activity involving natural resources in the region directly and immediately affects the life of pastoral communities.

The pastoral communities see activities related to deforestation for farming or for any reason and consider such activities as being 'against nature'. Local farmers, state farm **developers** and investors in private **mechanized farms** were not seen positively by pastoral communities, as one respondent said, “If the result of education leads to deforestation and against nature, why should I send my children to school?” The respondent’s opinion on education is compatible with the concept of vulnerability and education described in section 6.5.2.2 (see page 164, paragraph 2) of the data analysis.

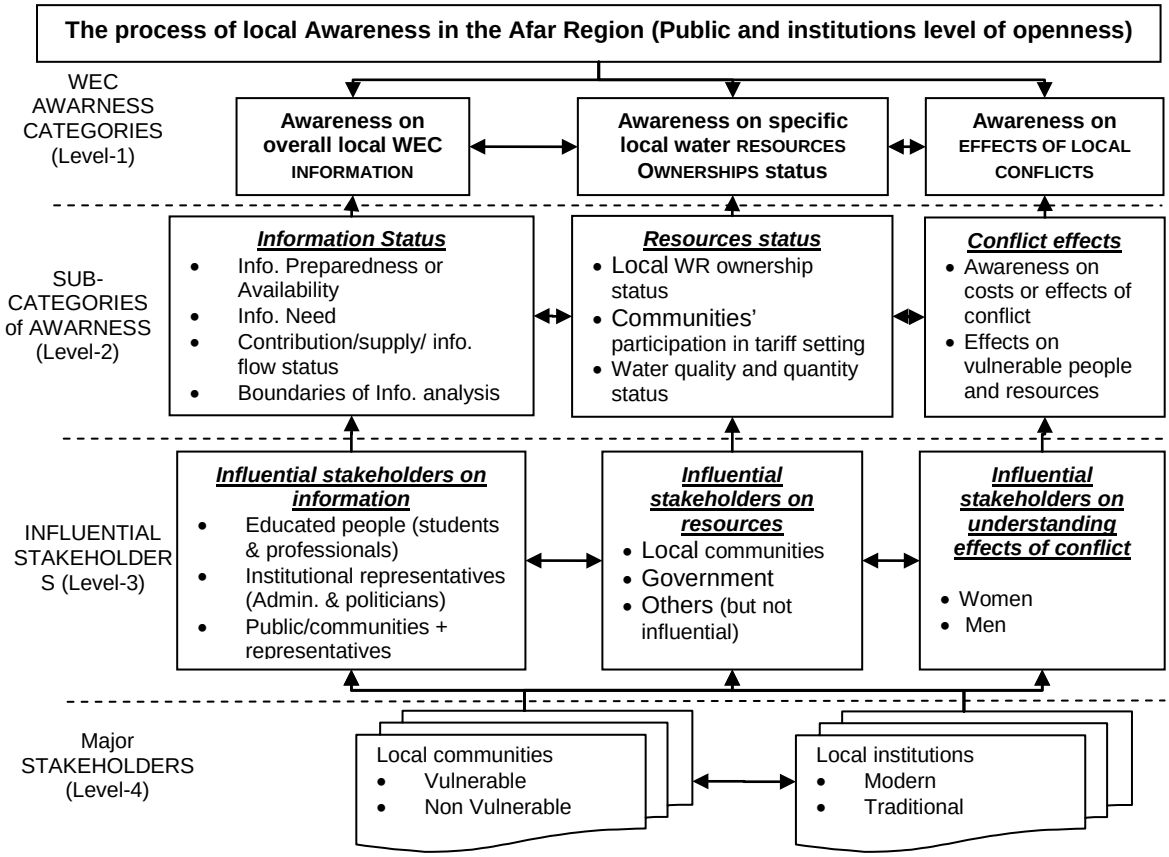


Figure 7-15: The process of the local awareness model in the Afar region

Low level of awareness leads to exposure to disagreements. High levels of awareness increase the level of understanding among the conflicting parties and help to overcome all setbacks affecting the sustainable socio-economic development. Awareness of modernization and tradition helps us in identifying and keeping the sustainable development balance of the highly increasing manmade factors (artificial life/behaviour) with the significantly reducing natural factors (natural life/behaviour).

On political issues, for instance in the UK, traditional and modern administrative activities or developments have co-existed and are balanced through the representation of the Monarch and the Office of Prime Minister. In the US Congress, members of the House of Representatives who are elected every two years, stand for the voice of the grassroots, local communities, which could be said to be a traditional representation in a modernized way. In the Afar region of Ethiopia and in most parts of Africa, there are unsustainable and fragile governing structures that directly hamper the socio-economic development of the people.

In order to detect the awareness level of local communities' and institutions' identification and preparedness for problems related to local water conflicts, the survey data collection and analysis were focused on mapping the process of awareness. This awareness at a local level consists of three major components: WEC information, resource ownership management and effects of conflicts, as indicated in Figure 7-15 above.

7.4.1.1 Awareness of WEC Information

A. Local Communities

This part compares overall local community awareness limitations and correlations based on demographic data mainly from men and women residents. The data collected show there was a moderate level of awareness of information related to water, conflict and early warning preparedness among members of the local communities in general. The pastoralist men felt they had a full awareness about their region and the women thought they had partial awareness. The local women thought that they were concerned in the same way with both the health and social relationships that they have within their community. Men were primarily concerned about their health/fitness and the issues related to social relationships in the community were seen as a secondary issue. Similar to the case of general awareness, both women and men in the community equally gave attention to, and were concerned about, the time spent because of local conflicts, which ranked third.

In order to re-examine the local survey findings and take a broader view, the researcher held informal discussions with two Loughborough University MSc. students, a young man from China and a girl of mixed race from Britain and Hong Kong. The young woman showed her inclination towards the agreement with giving equal emphases to both relationships and health. The young man firmly believes in the priority of health and he said, ‘All relationships come after having good health only’.

In rural pastoral areas of the Afar region, men are those who participate in hunting to feed their family, which requires physical fitness. Women have a natural responsibility for feeding their children and traditional responsibilities for having very close relationships with neighbours and other social responsibilities. The finding poses several questions on the natural role and contribution of women and men in a community, such as who would be best suitable for social or political leadership of a community or a country; and who would be the best fitted for leadership in the areas of health, foodstuff production and physical fitness-related activities? Did the world miss something for centuries in tapping and utilizing the natural talents of leadership of the different genders? Is this approach acceptable and compatible with the beliefs and traditions of different societies? Could this be one of the causes for the main problem in today’s war and pro-conflict areas? Haynes *et al*. (2011) state that women were held to be in need of strong moral guidance from their male counterpart. In view of this, Haynes *et al*. also noted that women have made great progresses in overcoming such prejudices and now enjoy rights of citizenship in most parts of the world.

B. Institutions and Other Stakeholder’s Awareness

Similar to communities’ awareness, it is also generally accepted that local institutional stakeholders have moderate levels of awareness of WEC information. However, the

government representatives believe that traditional leaders, students and other professionals have less awareness as compared to politicians and administrators. In other words, it means that the respondents who are representatives of an institution consider themselves to have a better awareness about WEC information.

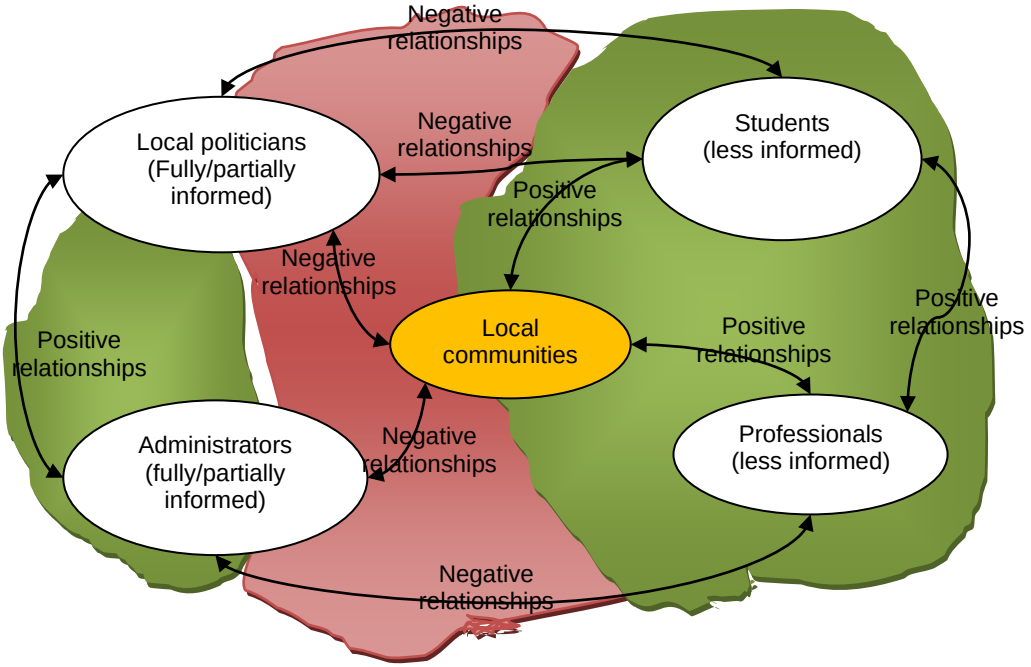


Figure 7-16: Local water, conflict and early warning information awareness gap

The communities and traditional leaders are considered to be the stakeholders with the lowest level of awareness on issues related to the effects and costs of conflicts. The research data show that those stakeholders considered by institutions as a group with least awareness have better relationships with communities but exceptionally unsatisfactory relationships with government institutions.

Figures 7-16 above, shows the information awareness gap that depends on the strength and type of relationship or difference between the local communities, educated people (students and professionals) and institutional representatives (administrators and politicians). The Figures based on the survey findings show that the local communities are pulled from two opposing directions. Does this create favourable or unfavourable conditions for sustainable development of the region? Does this create conflicting information within the community? Could this problem be fuelling local conflicts? The findings indicate that communities' view on awareness varies from that of local stakeholder institutions.

(1) Information Need (Professionals)

Local professionals in the institutions have less awareness of retaining the necessary information for their work. The study shows that most of the institutions are in need of water quantity and quality information, primarily for planning activities. Information requested

mainly reflected the profession of the respondent, not the objective and activities of the organization.

(2) Information Preparedness (Institutions)

The most astonishing point was that those institutions requesting the availability of more information mentioned in the study were fully or partially responsible for collecting the information for themselves. That poses questions about whether there is a lack of coordination among professionals and institutions both within and outside of the same institutions and, if so, why.

(3) Boundaries of WEC Information (Analysis)

Among survey respondents, 54% of institutions primarily believe in boundaries of WEC information analysis based on political boundaries and 11% do not know the boundaries of analysis. This indicates that 65% of the users practise unsustainable methods of information analysis. The feasible ways of information analysis awareness are about 12.2% for the river basin analysis approach. Incorporating traditional ways of analysing boundaries is limited to 13%, which is encouraging but less emphasis was given to information related to an early warning system. A major emphasis was given to other categories of information analysis different from water or natural resources. Could this practice be one of the reasons why there was inadequate information on water resources in the region? See Table 7-11 on ranking local practice on information analysis.

Table 7-11: Summary of awareness on types of information and boundary of analysis

Categories of analysis	Observed rank	expected rank	Remarks on observed status
Political administrative boundary	1st	3rd	Up
Traditional	2nd	2nd	No Change
River basin boundary	3rd	1st	Down
I do not know	4th		

7.4.1.2 Awareness on Resources Ownership and Tariff Settings

A. Water Resources Ownership Status

There are diametrically opposite views on the ownership of land, water and other natural resources. Institutions believe, communities are secondary and government should be the primary resource owner. Local communities have a tradition of private land ownership and still believe in private or tribal natural resource ownership. This might create a big information gap and a conflict between the government and the pastoral communities who believes that they

should be the owners of the local resources. The researcher observed that the communities are highly dissatisfied with the government's control of the resources.

B. Communities' Participation in Water Tariff

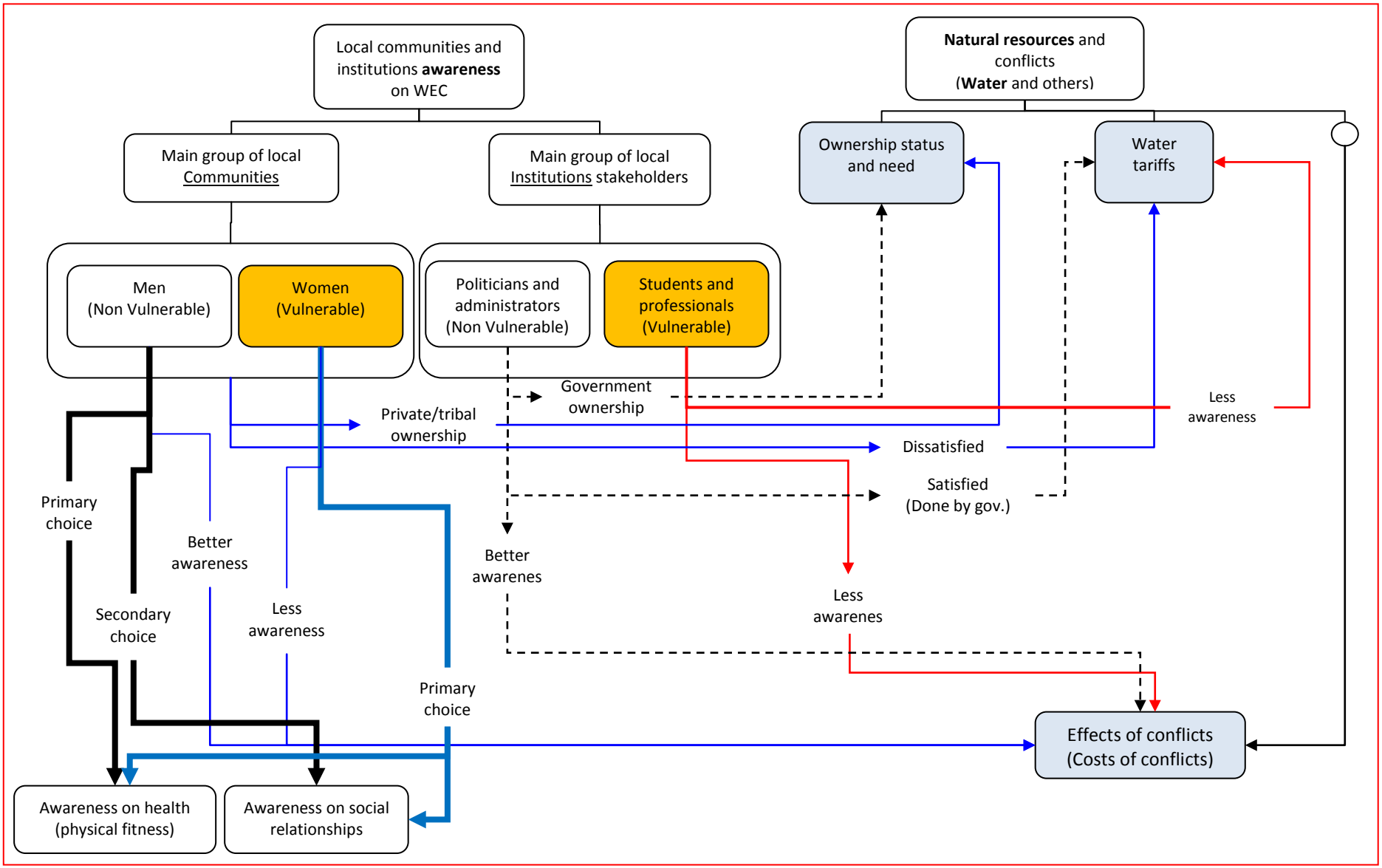
On local communities' participation in water tariff setting, 57% of respondent institutions disagreed with, and were concerned about, inadequate information and decreased participation. The other 36% agreed with the current situation and 7% were undecided or unaware of stakeholders' participation. Approximately, 2 out of 3 people show their disagreement with their non-participation in the process. The UNESCO report (2006) shows that one of the historical causes of water conflicts in Europe was related to disagreement on water tariff setting in urban areas. One of the problems in the Afar region could be mainly because water resources, including the tariff setting tasks, are controlled by government bodies and representatives. A community's lack of awareness and inadequate knowledge of tariff setting could be alternative reasons for the problem.

7.4.1.3 Awareness on Cost Effects of Conflict

Many survey respondents (77%) from the local communities have partial or full awareness of the costs of the effects of conflicts, which is very good. In terms of gender, men have relatively better awareness of the costs of conflicts as compared to women. The fact that men have better awareness of these aspects, in a place where the most affected vulnerable group of people are women and children, requires further investigation. However, men are the ones who are usually involved in major conflict and war situations. The traditional '*Dhaagu*' information communication system provides higher priority for men than women.

The findings show that government institutions believe that local professionals and students are less informed and less concerned about the effects of conflict or the service costs of conflicts. Whereas they believe local administrators and politicians, who are members of their organization, have full awareness on the effects. Local communities' and traditional leaders' awareness fluctuates and falls in between those who are either partially or not informed.

Figure 7-17: Summary views of the status of local awareness in the Afar Region



7.4.2 Transparency

Miller and Holmes (2010) and other independent international transparency institutions reported that Ethiopia's level of accountability, corruption and transparency related to economic, political, institutional and legal background is ranked among the lower levels as compared to 183 countries. It is possible to agree on basic factors of transparency at all levels but the width and depth of transparency of the developed and least developing countries are quite different. This is mainly due to people's experience and exposure to vulnerability and insecurity. Transparency is facilitated or impacted by stakeholders who are benefiting through traditional or modern practices concerning the level of openness in the region. In addition, it improves and creates sustainable links among the people and speeds up information communication as well as playing a major role in achieving sustainable development.

Moreover, transparency is one of the fundamental components for the identification and management of information on local water conflicts and early-warning-related activities. It is an essential element of the information in the context of understanding and resolving conflicts and is used as a tool for identifying the extent of interaction as well as for building confidence among conflicting parties. Transparency is a pivotal tool used as a means to increase trust and confidence among communities and stakeholder institutions. In this research, the local transparency variable is focused on the identification of the existence of a modern or traditional practice that helps to enhance the public's confidence in relation to the level of accountability and freedom from corruption.

Where the level of transparency is high (modern and complex level), it is mainly focused on the rate of the public's freedom in relation to service delivery together with the functionality of institutions in terms of economic, financial, political and legal systems in each country. These would not be the main factors at the low level due to the fact that there are no adequate institutions that were suitably equipped for the task in hand. There were no efficient systems of modern institutions at local level. Most activities at this level depend on individual and traditional experiences. The activities of each organization at this level mainly depend on the links between, and the level of openness of, individuals instead of organizational efficiencies.

In low-income developing countries, modern ways of measuring the level of transparency mainly depend on institutions having the freedom to function; and it is highly influenced by modern regulations or constitutions. Local-based transparency depends on the freedom of individuals restricted and influenced by traditional rules and practices. In both cases, the availability of transparency was initiated or appreciated; however, the impact could be overruled and diminished as a result of corruption that had taken place within a group with special interests.

The study shows that the Afar community's tradition was relatively transparent as compared to the function of governmental and nongovernmental stakeholder institutions in the region. The

local communities have a tradition of transparency in decision-making and accountability. In most cases, the availability of such transparency within a tradition of community has a constructive impact on the existence of transparent institutions.

However, the findings show that activities in the region are performed in partially transparent ways. In contrast, government and non-governmental institutions in the region work in partially transparent or non-transparent ways in the areas of finance, justice, media/press and decision-making. This incompatibility with local tradition is one of the factors that fuel conflicts, which is the key problem for the sustainable development of the region.

A model with three stairs displayed in Figure 7-21 shows the local transparency category (playing field), key stakeholders of the transparency (the players) and the level of openness practice and services (the playing ball/tools), which indicate the process of local transparency in the region. The model has four major categories that incorporate communities' and institutions' views on the status of accountability, the media, institutions functionality and the practices involved in the decision-making process as indicated in Figure 7-21 displayed before the start of section 7.4.3.

7.4.2.1 Local Accountability

The survey of members of local communities and institutions in the Afar region produced quite similar results for the identification of the existence of a system of accountability within the communities and individuals in general, as displayed in Table 7-12. All respondents agreed that, though the tradition has a system of transparency, people are partially transparent when it comes down to the individual level. The reasons why local respondents view their traditional practice in optimistic ways and particular individual accountability practices in pessimistic ways require further investigation. However, it is true that the public follows the most general principles whilst individuals follow and look at the immediate facts of the day-to-day specifics. Another reason could be the fact that most components of a tradition are transparently followed by many people, as compared to partially-transparent individual daily practices.

Table 7-12: Communities' and institutions' views on accountability

Accountability	Local Stakeholders	Status of transparency (communities and institutions view)
Individual experience of accountability	Individuals (a particular person)	Partially transparent
Availability of accountability system or tradition	Public (general, as a tradition)	Transparent

The most acceptable reason for the availability of a system of accountability should be due to the existence of unwritten traditional laws like '*Fima'*. It is a type of system that incorporates established communal laws, together with strong rules and regulations, which help to administer and control the use of water supply, grazing, land use and other resources. It is also used during conflict and wartime. Fima is a shared traditional common law for all Afar

clans. It has also many branches depending on different circumstances occurring in the region. Report data shows, 71% of respondents believe that they share information through traditional '*Dhaagu*'. During the communication practice of *Dhaagu* each member of the tribe follows the rule to share and transfer information between people (see Figures 7-19 and 7-20).

There are many international organizations working on accountability and transparency. At the local level, there are no adequate and efficient organizations working on these issues. Availability of such institutions at the local level would play a major role in decreasing the risks related to conflicts in the region.

7.4.2.2 Activities of the Press/Media

In the Afar region, there are a few government controlled radio and TV channels transmitted in local and national languages from Addis Ababa. There are also a few government and privately owned press publications. Some people with a satellite dish have access to internationally transmitted TV programmes like the BBC, CNN and Aljazeera. The VOA and DW radio programmes are alternative sources for the local communities but not fully listened to by pastoral communities due to language problems.

However, a majority of respondents believe that the activities of the domestic press/media are partially transparent. The controversial issue is that one third of local people are using these media channels as their main sources of information. If people think it is partially transparent, the participation would have been more than one third of the respondents. The remaining two thirds of the respondents agreed that their main source of information was traditional *dhaagu*.

7.4.2.3 The Ways in which Institutions are Functioning

Local Institutions and public views were collected and analysed to address the way in which government and non-governmental organizations are functioning; financial institutions' performance and public satisfaction with the justice system. Both institutional and community representatives agreed that NGOs are working in partially transparent ways. Local public respondents are not satisfied with the degree of transparency of financial and government institutions' activities. The local communities believe that the activities of financial institutions in the region are non-transparent. A summary of the details is displayed in Table 7-13.

Table 7-13: The way in which institutions are functioning

Description	Public view	Institutions' view
Financial institutions' performance	Not transparent	Partially transparent
How Government organizations are functioning	Not transparent	Partially transparent
NGOs service provision	Partially transparent	Partially transparent

The local communities have five alternative options for services for justice-related issues: the court service, the police service, '*kebele'* (local government) practice, traditional practice and religious practices. Figure 7-18 shows that the public are highly satisfied by traditional practices and dissatisfied by the modern court system and local police services. The main

reason for this could be due to a lack of adequate transparency in the modern court system. The other reason could be the incompatibility of the modern judiciary system with the traditional one. Another observation was that in the modern judiciary system, the decision mainly affects the individuals concerned and concentrates more on punishment than on its educational effect on the community, which was more theoretical. In the traditional ruling system, the decision affects all the members of the tribes including clansmen and is more educational in practical ways.

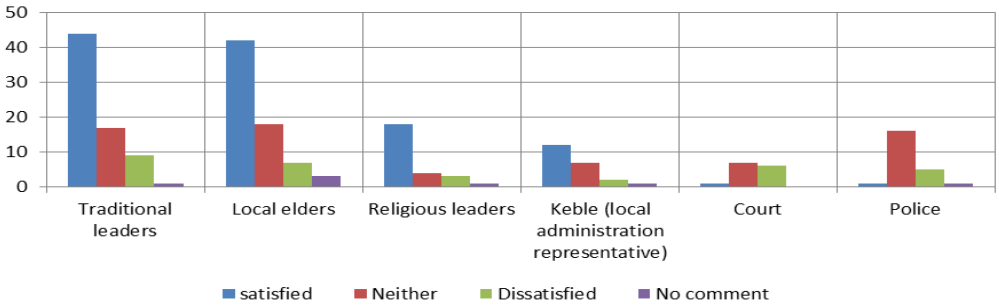


Figure 7-18: Public satisfaction with traditional and modern local legal systems

In general, the lack of transparency about the way institutions are functioning affects local people's confidence and creates a lack of public trust about working together with local institutions. The research has found that the three institutions working on water: The Lower Awash Basin Office, the Afar Water Works Construction Enterprise and the Afar Water Resources Bureau were ranked among the top three institutions who are working in relatively transparent ways. In contrast, some of the major regional institutions working on trade, industry, investment, urban water supply and pastoral development-related activities are not transparent. Institutions working at the federal level are labelled as partially transparent.

7.4.2.4 The Practice of the Decision-Making Process

The public and institutional views of the individual and traditional ways in which decision-making was practised were both the same. Both believe traditional practice is more transparent than the day-to-day practice of individuals in the decision-making process.

Table 7-14: Local practice of the decision-making process

Description	Public view	Institutions view
Individual, day-to-day, decision-making process	Partially transparent	Partially transparent
Traditional decision-making practice	Transparent	Transparent
Legal related decision making (modern practice)	Partially transparent	Not transparent

The survey shows communities do not prefer the practice of modern ways of legal-related decision-making activities. Table 7-14 indicates that a public view on the system was more optimistic as compared to respondents from government's institution. If the public is not frequently using the modern system, they might have less awareness as compared to those working in the institutions. In this aspect, the views of institutional representatives could reflect the existing reality though the department of legal services is available in almost all institutions.

Most of the public do not feel sufficiently satisfied by the transparency of the modern justice system. Survey data shows 93% of the local communities agreed that the existing inter-personal interaction on exchanging information was facilitated by traditional '*dhaagu*' and other tribal ways. Some members of the communities also expressed their concerns that the rate of interactivity among the people is decreasing due to the growing incidents of tribal and religious conflicts.

Figure 7-19: Key components of the Afar tribe traditional justice system structure

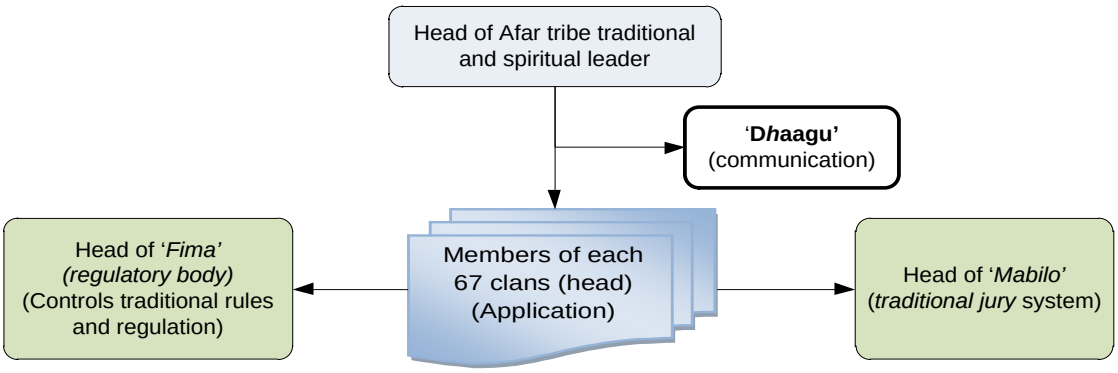
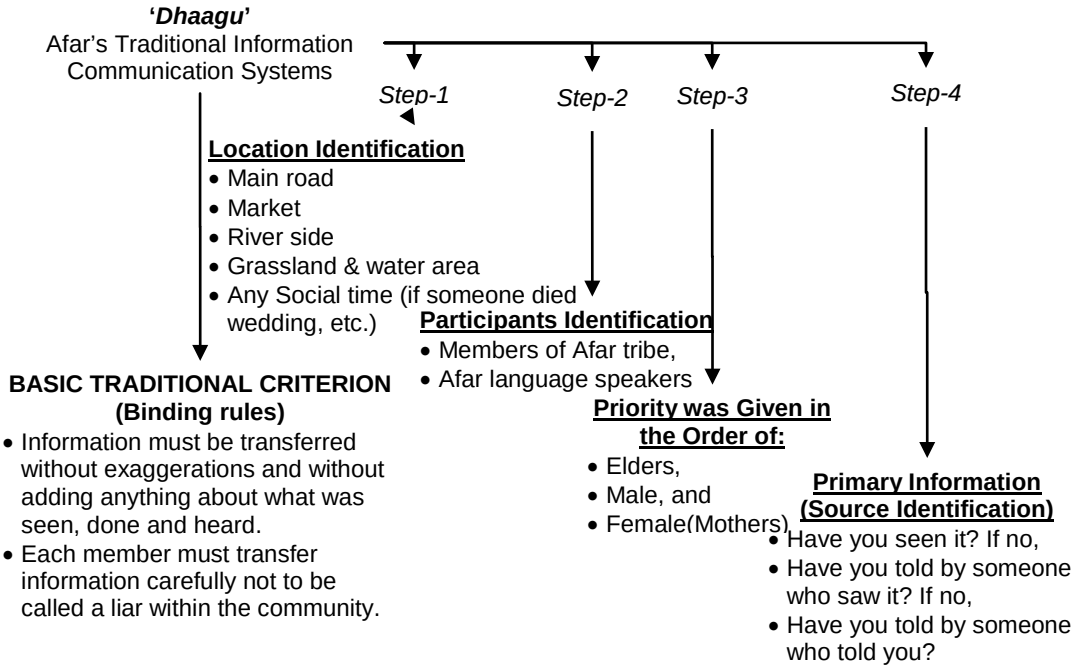
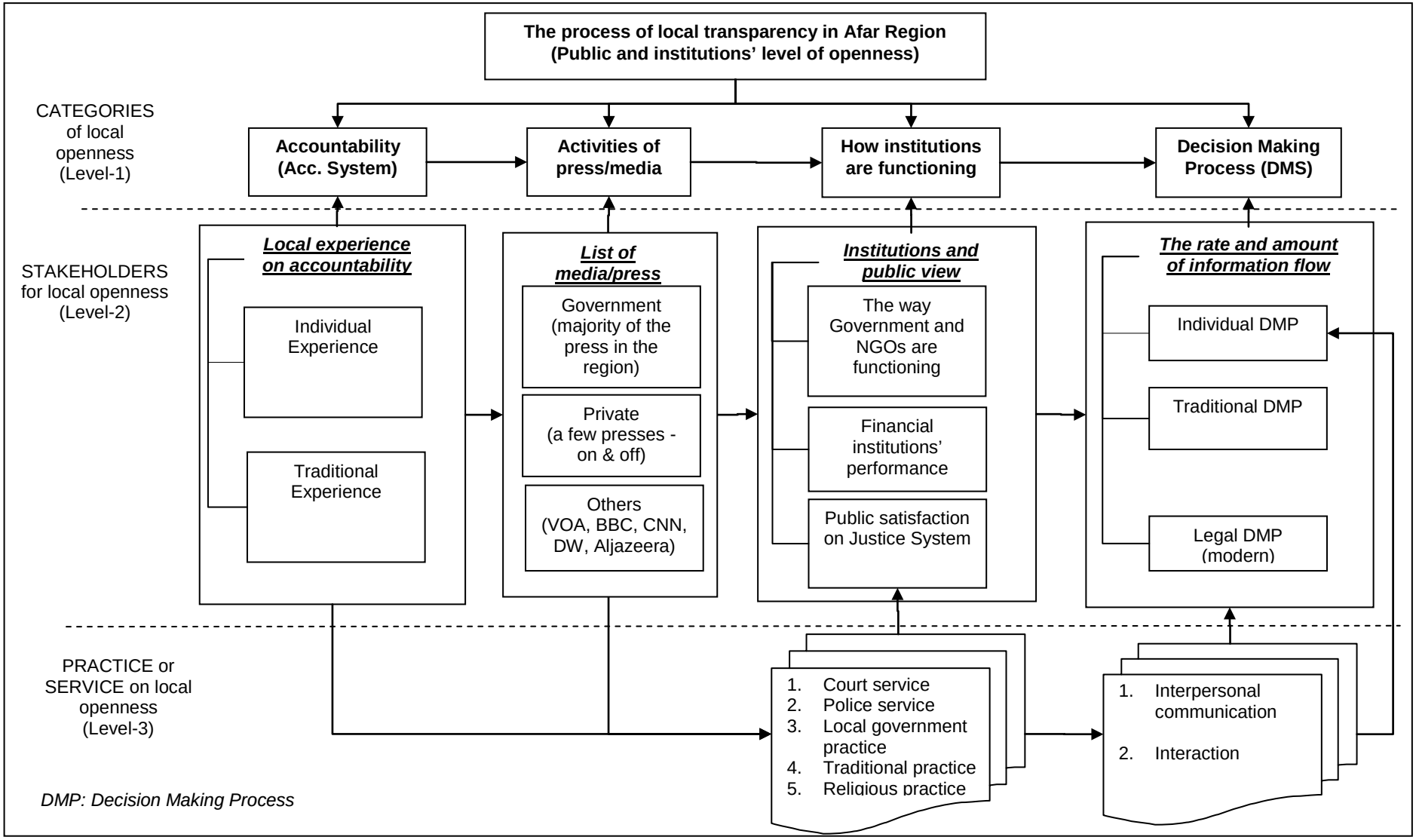


Figure 7-20: Traditional structure for the *dhaagu* information communication system



Local communities and institutions in the region are interacting and working on water resources development and management-related activities in a partially transparent way. Areas of partial transparency include: individual decision-making process and accountability; government and NGO activities; local press/media activities and the modern justice system. In addition, the findings show that most of the local communities interact suddenly and take actions based on their traditional beliefs without consideration of modern regulations. The majority of people in the region do not show a preference for frequent interaction based on emotion and plans. When it is required, they show a preference for sudden reactions exclusively.

Figure 7-21: The process of local transparency model



7.4.3 Local WEC Information Availability and Preparedness Analysis

In connection with awareness and transparency variables discussed in the previous sections, the local information availability and preparedness variable is an additional core component that makes up the WEC information pyramid framework. Figure 7-22, below, displays the process map of local WEC information availability, preparedness and analysis framework model, which is made by the integration of three data levels: overall practices of the modern and traditional approaches, criteria for data availability and analysis and the categories of major WEC information at the local level.

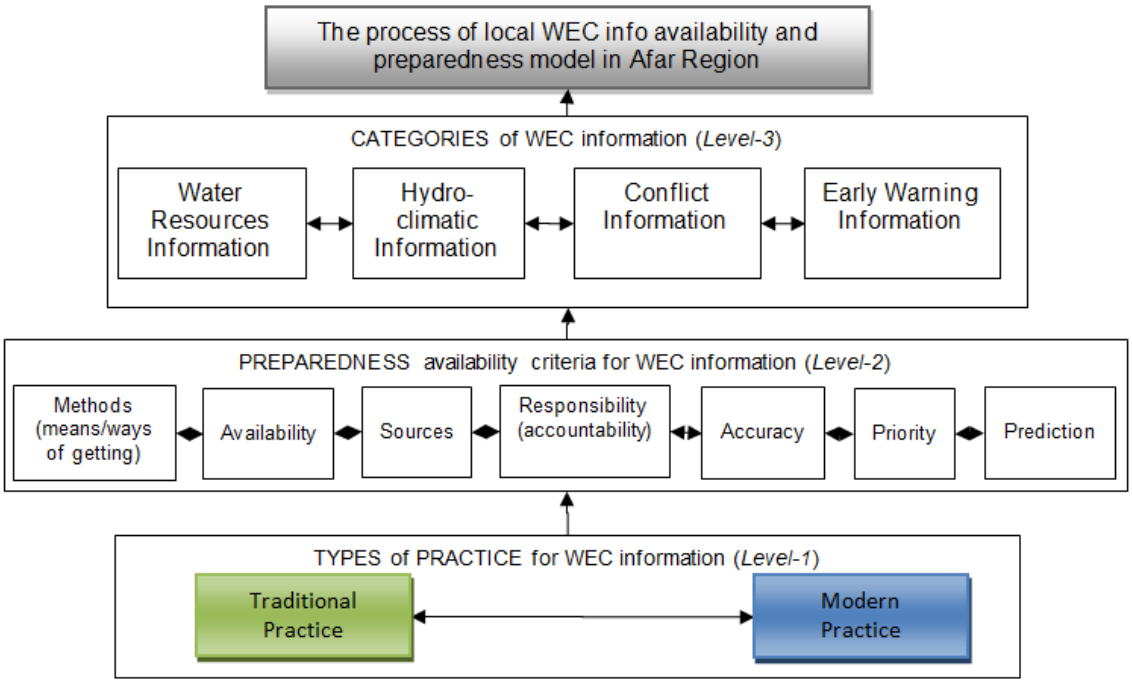


Figure 7-22: Local WEC information availability and preparedness analysis framework

7.4.3.1 Traditional and Modern Practices on WEC Information (Level 1)

This section aims at understanding the existing approaches of awareness of WEC information in the Afar region. Local communities have a practice of getting WEC information mainly (59%) through traditional ways such as *Dhaagu*, *Gignili* and observation from their daily lives. Among these, 35% only get information through modern ways such as the media, governmental extension programmes, radio and TV. A few members of the public (7%) of the communities are not aware of the sources of WEC information in the region.

The findings show people prefer or have easy access to information coming through traditional *Dhaagu* ways. They prefer the process of getting information that flows within the tribal communities. In most cases, modern ways of information transfer within the communities are limited by time, language and means of transferring information. Traditional ways of information communication, which includes body language and better connections as compared to the modern ones that involve radio and other means of communication and

transmission. However, in today's fast-moving and interlinked world, the use of traditional ways of communication as a major option should have a negative impact on the amount, flow and the time-line of the information. Traditional ways of information communication are more static in comparison to dynamically changing and improving systems using modern methods and means of communication. The reason why the people in the region preferred traditional ways of communication might be because their way of life is not comparatively improving.

7.4.3.2 Criteria for WEC Data Availability and Analysis (Level 2)

The researcher has identified seven useful criteria in the process of availability, analysis and getting WEC information in the region. These are methods (means/ways of getting), availability, sources, responsibility (accountability), accuracy, priority and prediction practices.

In all cases, the traditional process of acquiring and analysing local water, conflict and early warning-related information has gained primary acceptance in comparison to the modern approach. Public approaches toward customary ways of data acquisition were based on the historical observation and practical interpretation of local information.

7.4.3.3 Major Categories of Local WEC Information (Level 3)

At the local level, the basic WEC information availability is measured in terms of the plan, availability and accessibility of four major components related to water resources, early warning, conflict and information on the effects of hydro-climatic situations as shown in Figure 7-23, below.

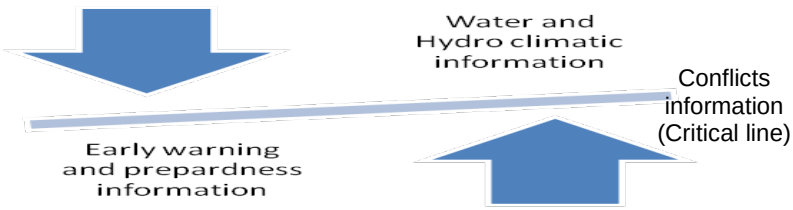


Figure 7-23: WEC information and conflict critical line

On overall WEC information, the opinion of institutional respondents indicated that they have 54% partially available, 40% available and 6% planned information. It is hard to investigate why the percentage of planned information was so much lower than that which was said to be available or partially available. Is it due to a lack of workforce or a lack of awareness of having adequate information? The figure shows the amount of the planned or available EW and conflict-related information (14%) was insignificant as compared to 86% of water resources information.

Sustainability of WEC information depends on locally-acceptable traditional and modern practices, the amount of information and the analysis capacity of the predictability of information as exemplified in the WEC pendulum. The power of predictability of information

(Road Strength) is gained through education and training. The increase in angle of amplitude increases the size and magnitude of conflicts in either direction.

Equation (7.1) of predictive function for measuring the magnitude of conflict intensity and Figure 7-24, the researcher has justified and mapped a guiding equation for a function (f) defined as follows.

$$f(\Theta) = f\ (\varepsilon,\ \omega,\ t) \tag{7.1}$$

where,

(f)	Predictive function for measuring the MAGNITUDE of conflict intensity
(**Θ**)	The intensity of conflict or conflict amplitude .It indicates the size of the pressure/intensity of conflict. No conflict means the pendulum is at the equilibrium situation.
(**ω**),	The amount and weight of information in terms of water, hydro-climatic and conflict related information.
(**ε**)	The length of pre-preparedness or early warning and preparedness information rod, which mainly goes with length of prediction and preparedness duration
(t_1)	Types of traditional practice (trajectory).
(t_2)	Types of modern practice (trajectory).

Pictorial illustration of the components of the function $f(\Theta)$:

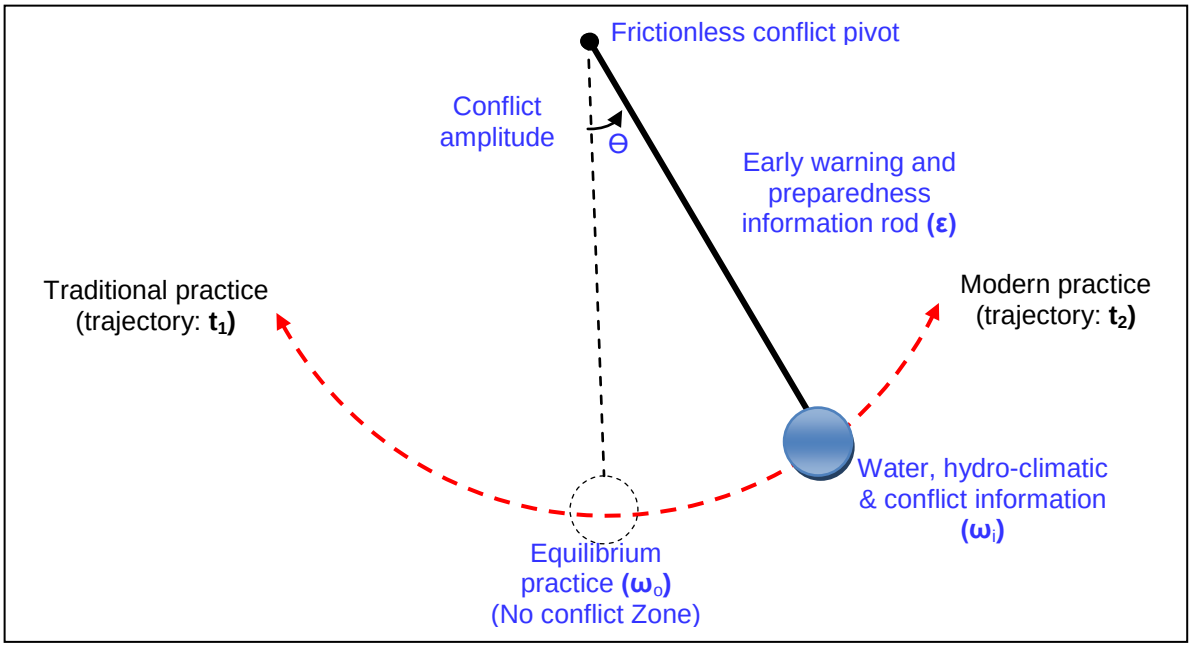


Figure 7-24: The WEC information pendulum to visualize and measure the magnitude of local conflicts

A. Water Resources Information

The amount of WRs information in the region was inadequate. The opinion of 72% of the respondents shows the amount of overall ground water and surface water resources in the region varies from inadequate to sufficiently available. The remaining 28% agreed that there was no such information or did not want to comment. Table 7-15, below, indicates institutions' feedback on the availability of water resources information. The reason why water

consumption information was not available in the region was due to the inefficiencies of water supply utilities. The researcher has found that water supply utilities in urban areas were less cooperative on providing information. Several reasons could be put forward as to why these utilities are not cooperating sufficiently. One reason may be due to lack of motivation for cooperation because of the minimum salaries the workers are getting. Another reason for this could possibly be fear that the state of corruption in urban water supply utilities related to water bill charges may be exposed. The efficiency of the River Basin Authority in the region on collecting and disseminating water-related information is better than other organizations dealing with water, as indicated in the table.

Table 7-15: Water resources information status

Availability of Water related information	Number of respondents	
	Majority of respondents	Minorities of respondents
Water resources	Partially available	Not available/no comment
River basin	Available	Not available/no comment
Water consumption	Not available/no comment	Partially available
Water pollution	Inadequate	Partially available
Ground water	Inadequate	Not available/no comment
Hydro-climatic information	Inadequate	Partially available
Others-Hygiene and sanitation	Inadequate	Partially available

B. Hydro-climatic Information

As the life of pastoral communities in the region heavily depends on the surrounding natural resources, information on the effects of climate change indicates that 85% of the respondents believe that they have been highly affected by climate change causing drought, death of humans and animals, change in temperature, water shortage and flooding problems. A few respondents (15%) believe there are no climate change effects. The effects of much of the problem in the region have been well known by local and international communities for many years. However, there was no significant improvement towards resolving the problem.

Three quarters of the community believe that the number of livestock in the region is decreasing due to the effects of climate change in the order of sheep, goat and camel respectively. Contrary to decreasing number of livestock products, agricultural products are increasing in the region by 64% due to sugarcane plantations. Most of the pastoral lands have been converted into sugarcane state farms, a cash crop plantation. The local community does not like the sugarcane farms, as its leaves are not useful for livestock feed. The pastoralists prefer cotton plantation while the camels and other livestock use the leaf for pasturing after harvesting cotton. The communities are highly dissatisfied with a significant increase in the number of problems.

C. Conflict Information

There was very little information on conflicts. The respondents strongly confirmed the existence of recognizable conflicts, with the neighbouring tribes and other stakeholders in the region including the government institutions, based on water, grazing, land and natural

resources. Most people agreed on the existence of frequent volatile conflicts between Afar and Issa tribes. Members of the Afar tribe pointed out that the Issa are an unpredictable fighting group supported by some neighbouring countries. Issas fight mainly during the dry season due to shortage of water and grazing problems in the river basin. Other times, they also fight during the rainy season to expand their territory and show their strength if they have water and grazing problems during this season. The main conflict with the government is on the expansion of state farms for sugarcane plantations. As mentioned above, the sugarcane plantation leads to deforestation and overtakes many pastoral lands. Moreover, the sugarcane plant residuals are no help for feeding livestock, unlike cotton plantations, which pastoralists are prepared to tolerate.

D. Early Warning Information

Most respondents (63%) of the community believe in having climate prediction practices. They also believe in the accuracy of traditional practices in comparison to the modern ones. Almost two fifths of them (37%) do not believe in climate and related prediction practices for religious reasons. Some even explained that they lost their old ways of traditional prediction practices due to the increasing influence of religion. The community is almost polarized in two opposite schools of thought, those who believe and who do not believe in prediction practices even though both groups follow the same religion. The researcher has identified that traditional prediction practices commonly used by pastoral communities in the region did not show significant improvement because of the following four challenging factors:

1) **Lack of recognition** for traditional prediction practices: Modern prediction practices were acceptable to only 50% of the community, which shows neutral views on modern practices. The public believes that drought prediction made by government institutions does not effectively show the true reality and therefore is not acceptable to local communities. Another factor in this aspect was the problem of politicising the effects of drought on the community creating a lack of trust between the local people and regional, national authorities including international stakeholders working in the basin.

2) The primary **negative influence** in discouraging traditional practices in the region originates from religious practitioners and their representatives. The traditional ways of prediction are very complex and it is all-inclusive, whilst some practices contradict the given religion. The accuracy of prediction is acceptable by a majority, 50% to 75%, of the community members.

3) **Lack of alternatives**: The study shows that both the government's modern ways of prediction and the influence of local religion over traditional prediction practices failed to provide adequate and acceptable prediction alternatives to the pastoral community of the region. This situation gives rise to severe dissatisfaction for the local people in the region, which could possibly provoke unrest and an increase in conflicts.

4) **Exposure to risks**: The region is highly exposed to risks related to flooding, drought and volcanic eruptions. It was also observed that the communities were exposed to problems that occurred as a result of the increase in the size of Lake Basaka that could be critical and damaging for the population, resources and the eco-system of the region unless dealt with immediately. The problem has proved very complex in its nature and cannot be resolved locally without the support of national and internationally-concerned stakeholders.

7.4.4 The Process of Local WEC Information Pyramid Framework

The researcher has designed a flow chart (Figure 7-25) that incorporates the practical findings of the WEC information pyramid components. It outlines the process of data flow in Afar region as compared to theoretical frameworks for a water conflict pre-identification, prediction, management and preparedness process.

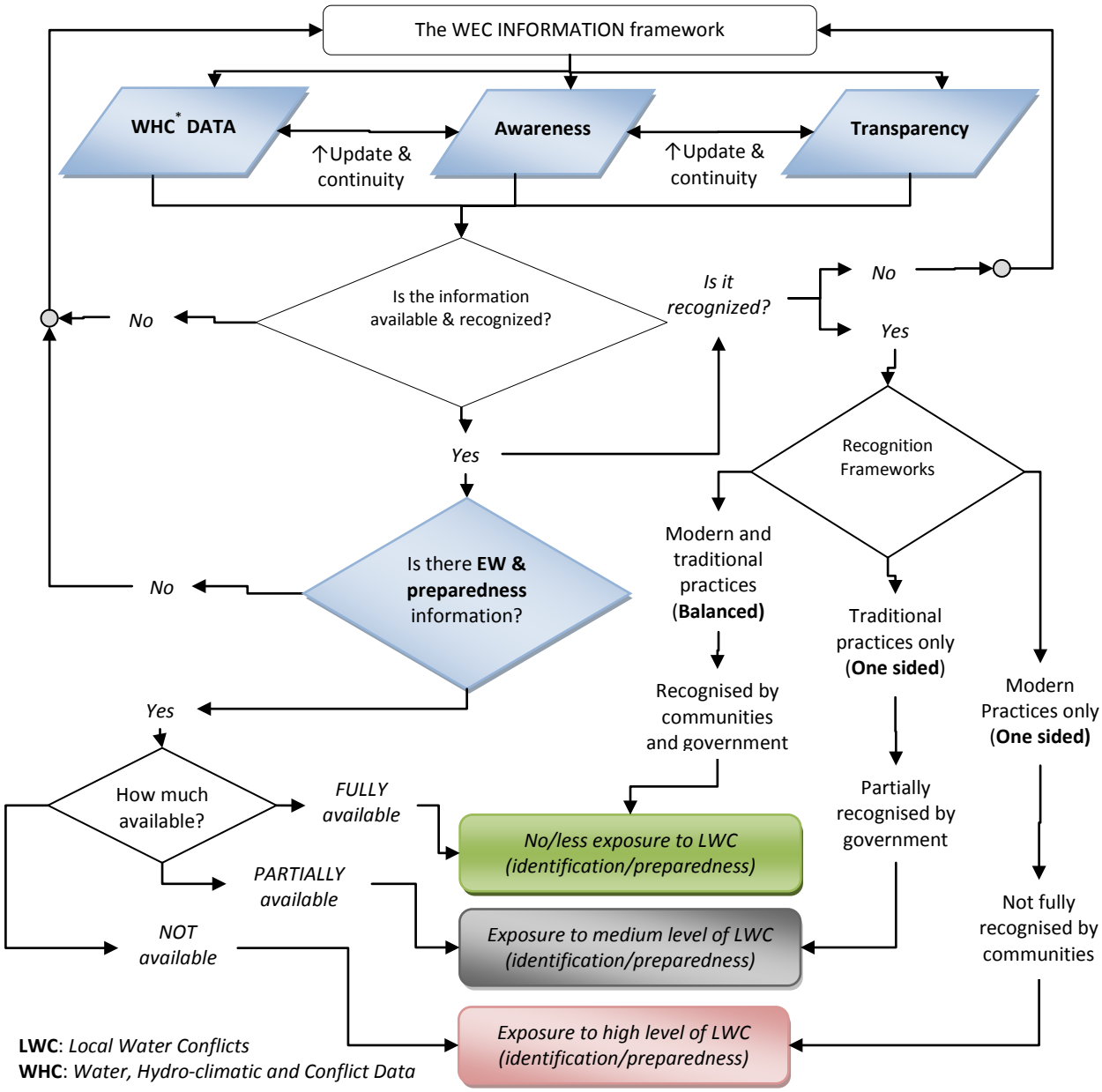


Figure 7-25: Components of WEC pyramid framework for the three parameters

7.5 Stakeholders Role Link and Collaboration in the Process of Local WaCoMa[13]

[INTERACTION AMONG COMMUNITIES AND INSTITUTIONS] - DIPTI PARAMETER-II

This section discusses, frames and interprets the type of relationships, collaboration and links among different stakeholders in the region that are participating in the process of local water resources and conflict management areas as part of answering the third research question stated as follows:

> ***RQ3**: "What are the types, roles, collaborations and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water conflict management areas?"*

This research question is answered by showing the method, the boundaries and the process in which stakeholders are interacting. In addition, integration of the frameworks about risks affecting the local communities and institutions in the region is discussed. In the framework, the researcher has incorporated the awareness of strategic partnerships among multiple stakeholders. This will help to explicitly identify and resolve the local problems in order to have a positive future through sustainable collaboration and development between stakeholders in low-income developing and developed countries. Indeed, in order to generalize these approaches so as to achieve maximum benefit, we need to test and prove the findings in different areas other than the Afar region.

The process of availability of large-scale interaction within a community has a great role in the identification and management of problems related to local water conflicts. On the importance of interaction within a people, Emmitt (2010) concluded that group interaction changes the behaviour of individuals and, as a general rule, individuals will accommodate greater risks within a group environment than they would on their own.

As the results of this research in the previous chapter show, conflict over grazing, water and other natural resources proved to be a major setback for improving the relationships and livelihood of the communities in the region. The findings show that overall communication status in the region was encouraging due to better communication within the clans of the Afar tribe as well as the moderately good relationships between communities and institutions. However, the status of communication among the different tribes in the River Basin and the relationship among different institutions was discouraging. The result shows that the levels of local communication and cooperation are directly proportional to each other depending upon the type of network available in the region. However, there were inadequate social, economic and infrastructural networks among communities of different tribes in the region. Similarly, the network activities among institutions in the Afar region, and in the Awash basin in general, were not properly functional. Next, the boundaries and the process of the local interaction framework displayed in Figure 7-26 will be discussed in detail.

[13] WaCoMa; Water conflict management.

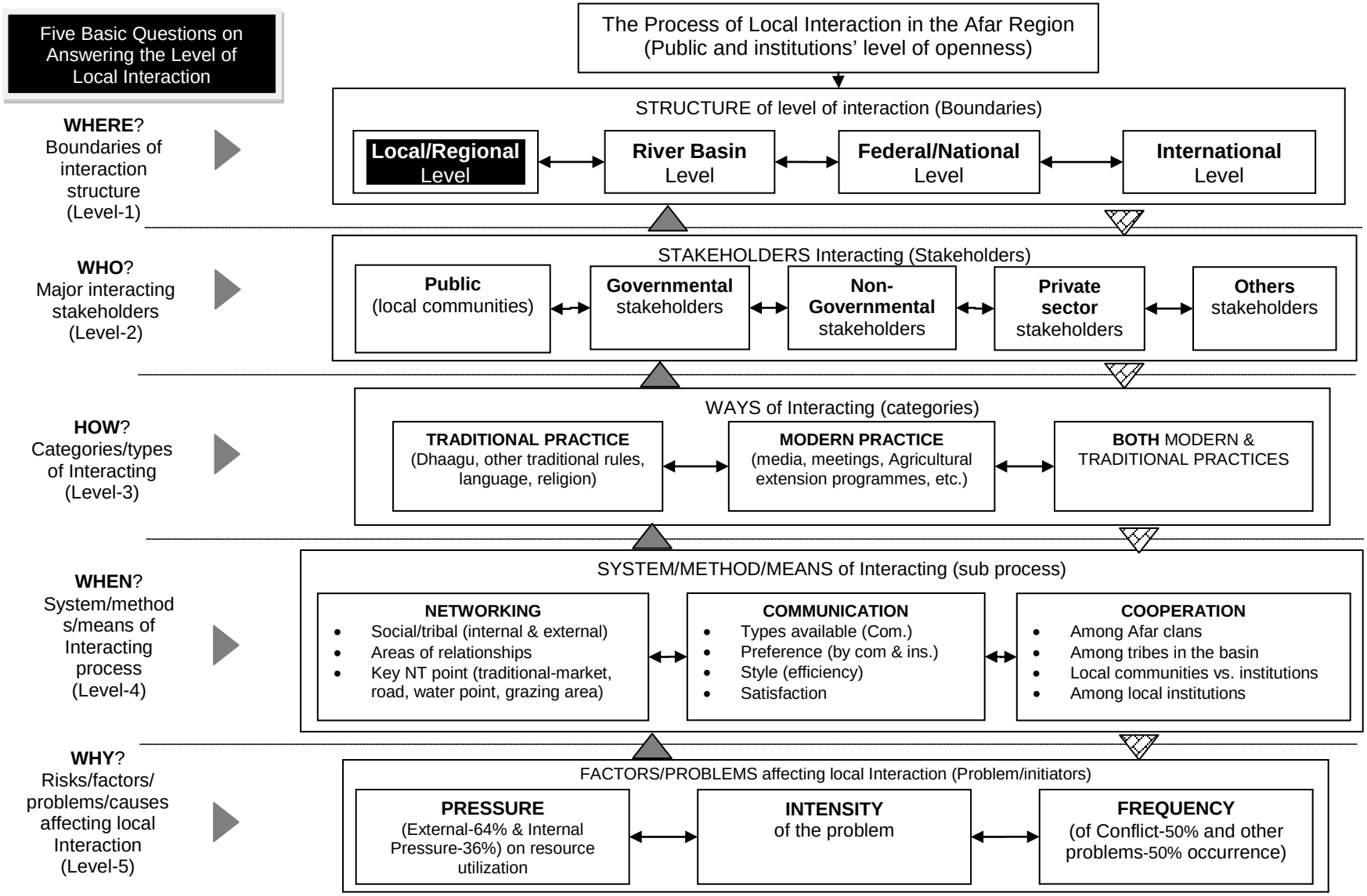


Figure 7-26: The process of local interaction for pre-identification and preparedness for LWC

The above framework model (Figure 7-26) was prepared based on the process of local public and institutional interaction, identification and preparedness in the Afar region. It is one of the major parameters for local water conflict early warning preparedness and is designed on the basis of answering the five basic questions at the interaction level, which have been already incorporated in present traditional and modern practices.

In conclusion, the importance of interaction is to reduce or neutralize the level of conflicts among the potential conflicting parties in the region by channelling and clearing out the contents of information and the level of communication. During communication, it is equally important to check the way the information is communicated, understood or received by other parties as compared to the message that it was intended to convey. In most cases, conflicts occur when the intended information is understood and received in incompatible ways. With this in mind, repetitive interaction helps to clear out these communication problems. See a detail of the boundaries of the interaction framework in Figures 7-26, 7-27 and 7-28.

7.5.1 Boundaries and Areas of Local Interaction (Where, Who and How- Levels 1, 2 and 3 of Fig. 7-26)

The predominant approaches to interaction in the region were traditional, mainly practised and limited to a high number of pastoral communities. The level of networking points for interacting with conflicting or other neighbouring tribes was either limited or not available.

The main structure of water, conflict and early-warning-related institutions working in the region can be categorized into four parts mainly at local/regional level, Federal/National level, occasionally at River Basin level and at the international level (see Figures 7-26, 7-27 and 7-28). Lack of adequate interaction at River Basin level has a negative impact on having integrated information and as a result, it causes disagreements. The study also shows that the hierarchical information flow, exchange or reporting relationships within different levels of organizations was not satisfactory in the region.

There was a minimum level of interaction among communities in the field of water resources information. The formal task of information processing and dissemination is carried out mainly by government institutions. Similarly, interaction at River Basin level was not adequate as compared to other competitive structures in the region.

The custom of handling a handgun is part of a tradition in the region and it is one of the reasons for public interaction. The majority (44%) of respondents agreed that the level of illegal handgun interaction is decreasing. Furthermore, 79% of the trends of interaction on handgun movement show that the causes for the supply and demand for illegal handgun movements are mainly derived from local sources followed by a few sources at the international, regional and national levels. The region has two international boundaries and formally and informally interacts with many members of communities who share the same tradition, language and religion in the neighbouring countries.

In general, the areas and levels of interaction among stakeholders in the region were not satisfactory though there are relatively adequate boundaries of structure for interaction. The integration of sustainable water resources development could achieve with the integration of the interaction structure and responsibilities of institutions. This is based on activities that depend on the maximum services and capacities of each responsible body in the region, as seen in the following flow chart and diagram. The findings of activity shown in Figures 7-26, 7-27, and 7-28 are based on maximum of adequate services and capacities of each responsible body in the region, which indicates maximization of working area through interaction.

Figure 7-27: Boundaries of local level interaction in the Afar region of the Awash river basin

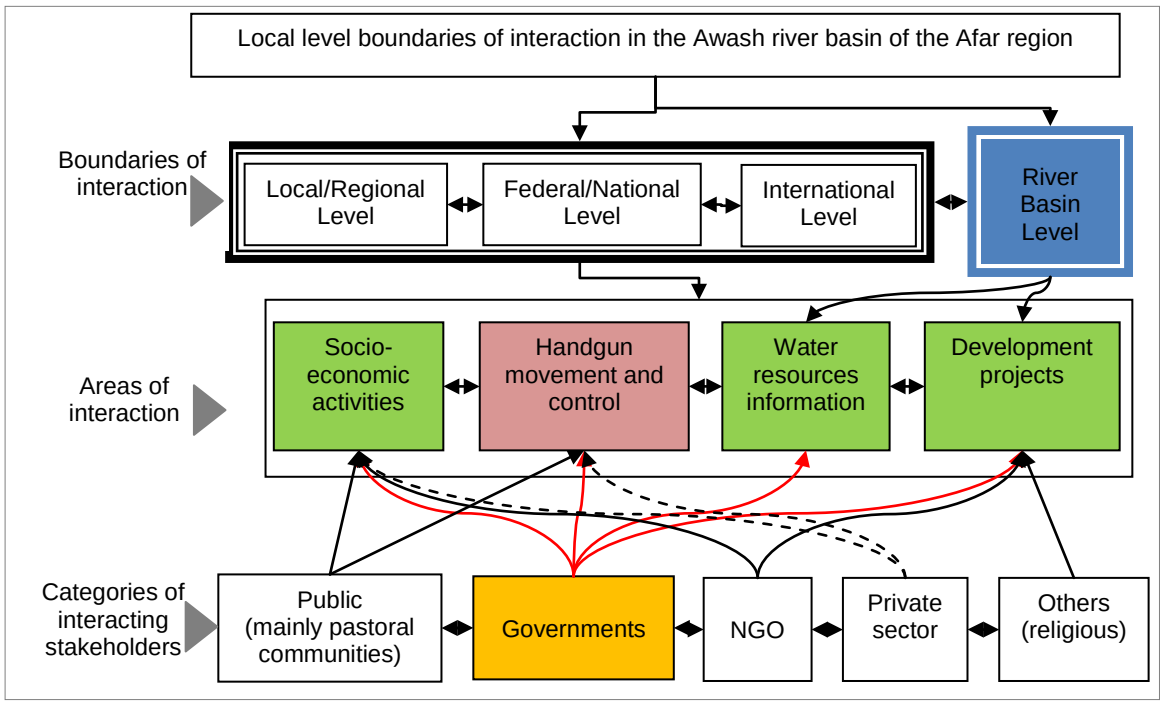
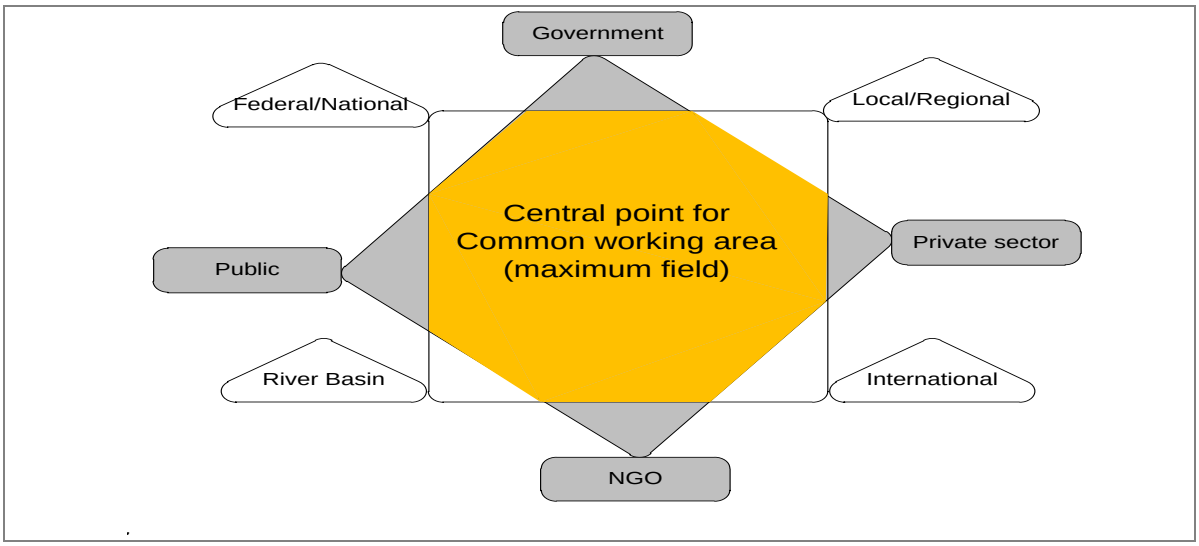


Figure 7-28: Mapping the stakeholders' boundaries for common local interaction areas



7.5.2 Methods of Local Interaction Process (When - Level 4 of Fig. 7-26)

7.5.2.1 Networking

Public networking in the Afar region is mainly observed among clans, tribes and other stakeholders interacting at locations such as water points, grazing land, markets and main roads. The study shows that women are to be found at almost all networking points as compared to men and children. Men are secondary networking stakeholders who have the primary role of participation in the conflicts occurring in the region. A question could be asked concerning the level of conflict in the region if men were to have as many networks as women. Most of the networking tools and points in the river basin are located or utilized in unstable ways and exposed to create unbalanced methods of communication in the region, and *vice versa*. In Figures 7-29 and 7-30 below, the researcher has presented the three alternative scenarios that indicate the output for unbalanced ways of communication between internal and external stakeholders.

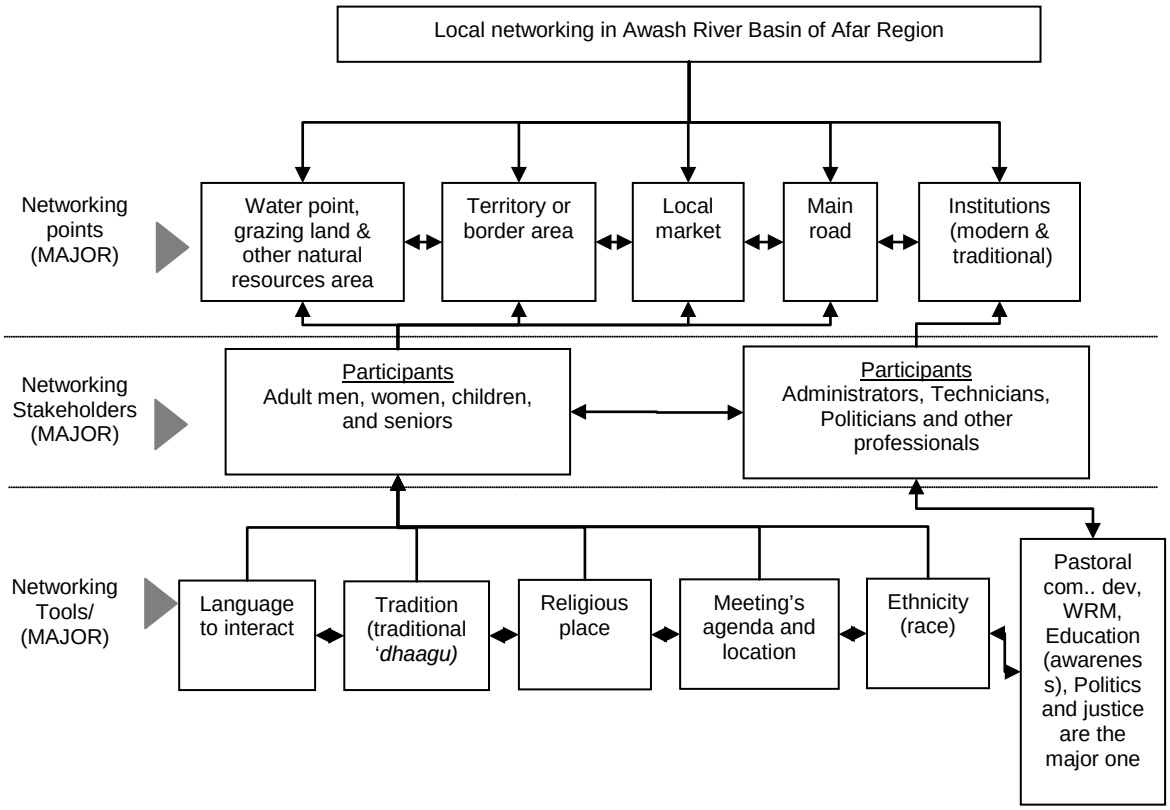


Figure 7-29: Local NT map related to water, conflict and early warning in Afar region

The *Dhaagu* traditional networking system for information communication exchange is highly applicable between members of the Afar language speakers and it makes the internal network among them very strong. However, the region has many conflict zones due to high levels of external pressures from Issa tribes, as indicated in scenario 2 displayed in Figure 7-30 below.

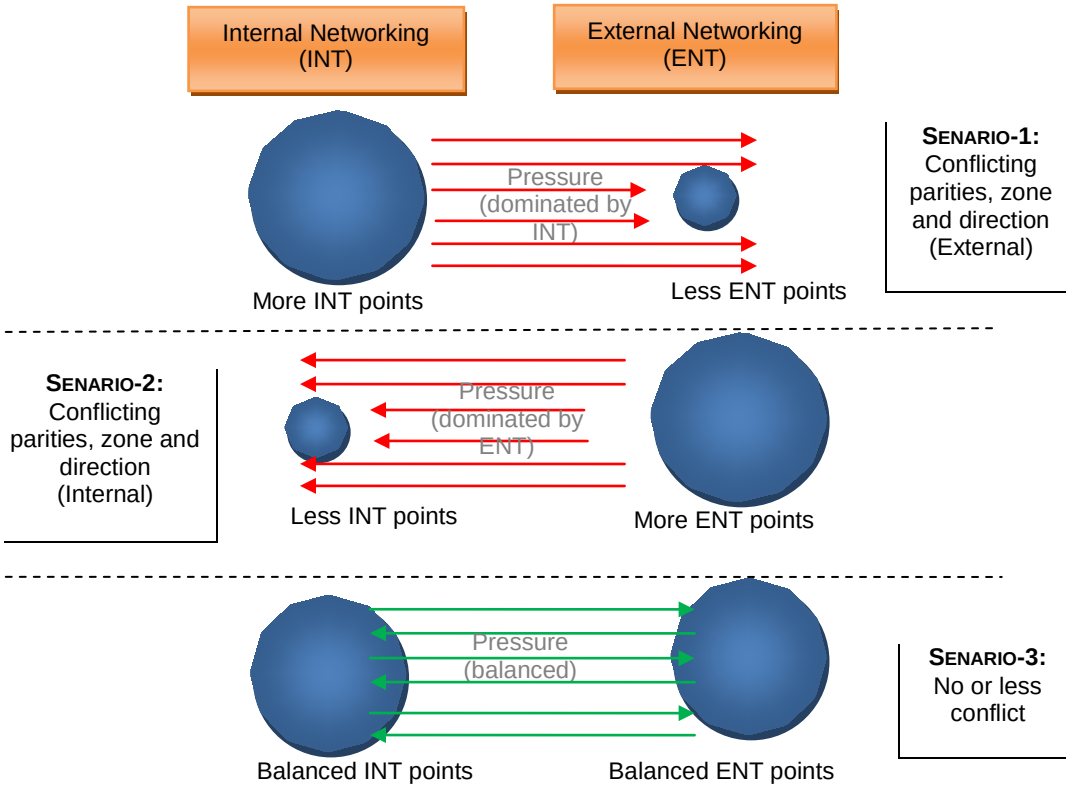


Figure 7-30: Mapping unbalanced ways of local communication networking

7.5.2.2 Communication

The process of an efficient local communication system is mostly achieved by the *availability* of the locally *acceptable* types of practices, public *preference* and *satisfaction* on the *effectiveness* of the existing relations among the communities and concerned stakeholders. Efficient interaction is demonstrated by the efficient participation of stakeholders. Participation will be more effective if individuals are able to understand one another and communicate effectively (Emmitt, 2010).

The level of communication in the region is relatively increasing especially among members of the community and government institutions. Through the practice of tribal political administrations and related policies, the level of communication between people of the same tribe is greatly increasing. In contrast, the level of communication between different tribes is decreasing due to a problem of tribal political limitations and lack of adequate networking opportunities necessary for, and reflective of, intra-tribal communications. The level of communication required within different institutions did not show progress at the desired standard level of interaction. The findings show that when the communication gap between the primary conflicting groups in the region was increasing, the level of communication with non-conflicting secondary stakeholders was also increasing as a result of SEC effects.

Figures 7-31 and 7-32, below, display the interaction framework of the process of identification of local level communication focused on community and institutions in the Afar region. The

framework adapted the following four main communication components: the major motivating factors for local communication (resources); local communication style (comparing internal and external); problems affecting local communication (pressures); and categories of communicating stakeholders (stakeholders).

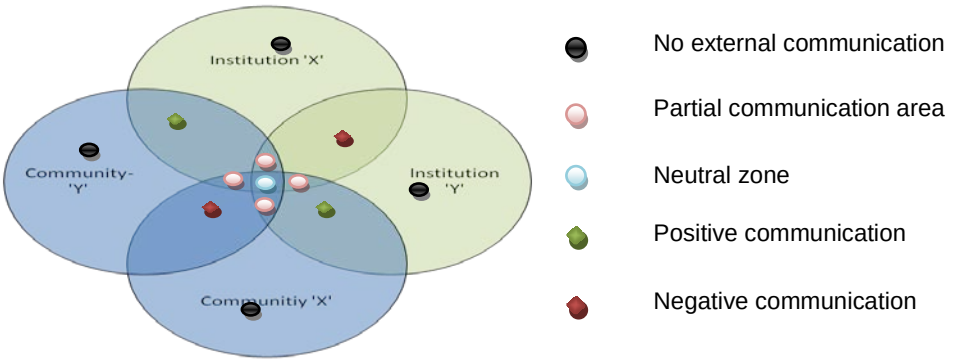


Figure 7-31: Mapping the status of local communication

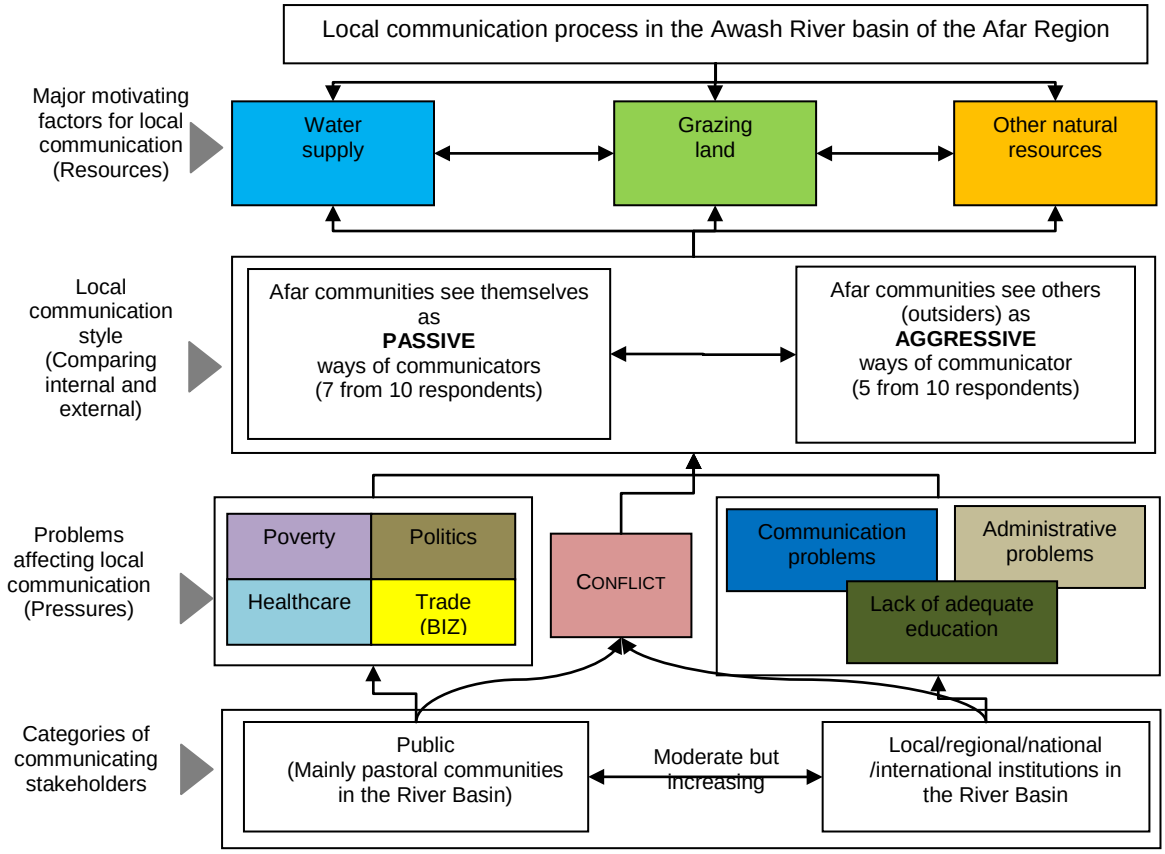


Figure 7-32: Local communication process in the Awash River basin of the Afar Region

7.5.2.3 Cooperation

The areas and status of collaboration between communities of the same or different tribes and stakeholder institutions in the river basin expressed by different stages of cooperation categories are indicated in Figure 7-33. Cooperation between different stakeholders in the region was fragile due to the unsatisfactory level of networking and communication among the neighbouring people in the region. Local institutions have relatively better cooperation as compared to intra-cooperation with different tribes of the community. It should be

advantageous if one utilizes the enhanced status of cooperation of institutions with a community as a tool for bringing together other communities in the region. However, lack of political willingness and infrastructure problems are some of the major reasons why there is a lack of progress in resolving the deep-rooted conflict in the region, mainly between Afar and Issa tribes.

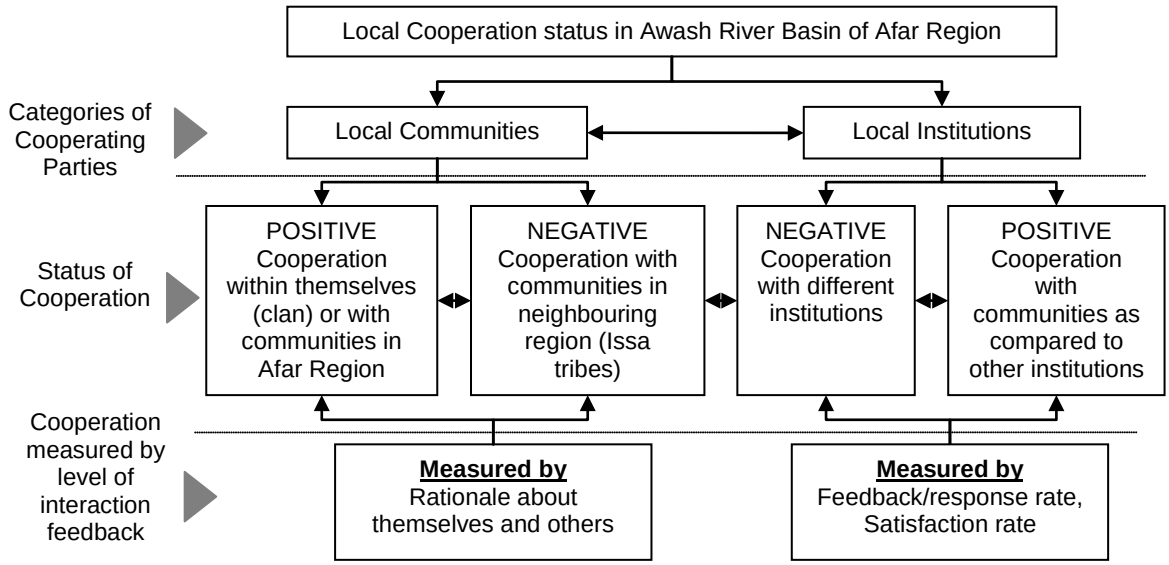


Figure 7-33: Local water, conflict and early warning cooperation maps of the Afar Region

7.5.3 Risks/Factors/Problems Affecting Local Interaction (Why- Level 5 of Fig. 7-26)

In section 7.5.2.1, scenario 2 in Figure 7-30, indicates that locally vulnerable people in the region are highly exposed to conflict risks arising because of external pressures. For instance, 64% of respondents agreed that external pressure problems were a driver of tension among conflicting parties in the region. The other 36% believed that internal pressures over resource utilization are a main driver of tension that leads to conflicts. The intensity of the problem varies from one season to another depending on the availability of natural resources and the intentions of the conflicting parties.

All respondents agreed that the region is highly exposed to causes of problems that affect the optimum interaction among the people in the river basin. The problem in the basin has been stretching from simple day-to-day conflict to severe catastrophes involving human and animal death. Inadequate efforts have been made to improve these problems due to lack of efficient communication and networking situations.

Some of the complex problems in the river basin occurred unintentionally and others intentionally. Half of the respondents (50%) agreed that NCC-related problems in the region occur because of conflicts over grazing and water resource utilization and allocations. The other 50 % decided that problems occur due to lack of understanding of the neighbouring community's language; livestock and human health problems; lack of adequate awareness of

traditional customs, laws, rules and regulations and a lack of good communications mainly with the Issa tribes in the river basin..

7.6 Identification of the Main Hazards/Risks and Costs Related to Local WC Problems

[TOLERANCE/CAPACITY TO RESOLVE PROBLEMS/ CRISES]- DIPTI PARAMETER-III

This section investigates the challenges and exposures of local communities to natural and manmade vulnerabilities and risk factors. It compares the awareness of locally-available capacity and public tolerance in mitigating the local water-conflict-related problems in the region as ways of responding to the main and the fourth research questions.

RQ: "How can we pre-identify and prepare for local water conflicts in low income developing countries?"

***RQ4**: "What are the main hazards, risks and costs associated with local water-conflict-related problems?"*

Local people's tolerance towards crises that cause conflict and locally-available capacity for resolving the problem is one of the key WEC parameters referred to in the sections of analysis and presentation of the findings. The local capacity, both as individuals and institutions, in tolerating the crises and resolving problems that occur because of local water conflict is mainly determined by the depth of the risk factors, the size of local vulnerability and local awareness of, and capacity for, reducing the risks associated with water-related problems.

Local people's tolerance and capacity to tackle problems were predicted by the level of local people's vulnerability in mitigating risks that occur because of local water-conflict-related problems. Figure 7-34 shows the integration of the link between the negative effects of local vulnerability, together with the risk factors, and the awareness of positive risk-mitigation factors.

Figure 7-34: Positive and negative factors affecting local people's tolerance and capacity to tackle problems

Whereas,

- *Level of local vulnerability,* indicates the level of public and water resources exposure to vulnerability, factors increasing the problems and the availability and functionality of

institutions working on these problems related to conflicts and other socio-economic problems (see Figure 7-35: - local vulnerability model framework),

- *Severity of local risks*, shows the type of risks, severity and frequency of occurrence of the root causes of the problems that harm and challenge the local people and affect the limited natural water resource capacity (see Figure 7-36: - status of local risk exposure model framework), and
- *Level of mitigation factors*, explains the local community's and local institutions' awareness of, and capacity for, alleviating the problems related to water resources development, conflict resolution and early warning prediction and preparedness (see Figure 7-37: - status of local risk reduction/mitigation awareness model framework).

The next sections discuss these three components: local vulnerability, risks and risk mitigation factors in the region together with the frameworks shown in Figures 7-35, 7-36 and 7-37.

7.6.1 Exposure to Vulnerability

The study in the region has shown that local people's exposure to vulnerability and the water supply resources' exposure to vulnerability are the two major interconnected problems that speed up conflict. Exposure to vulnerability problems directly challenges and affects the tolerance and day-to-day private and institutional capacities of the local people. An accumulation of such problems pulls the people into two opposite and conflicting ways of looking at things in their areas. For instance, some people become more emotional and fail to give any space for reasoning, whilst others become more logical and reasonable due to practical lessons they have learned from the problems. The observed situation in the Afar region proves similar in relation to the findings.

A report on the global environmental outlook indicates that “vulnerability involves a combination of exposure and sensitivity to risk, and the inability to cope or adapt to environmental change; and most often, the poor are more vulnerable to environmental change” (UNEP, 2007:14). According to the UNICEF (2009) report on Ethiopia, children remain very vulnerable to threats of infectious diseases in several parts of the country; and displaced communities require urgent support including water, sanitation, shelter and education.

The study has shown that local problems related to jobs, duration, education, demography, homelessness, people with special needs and exposure to water-resources-related factors play a major role in increasing the vulnerability of the people to local conflicts in the region. The research suggests that those people who stayed for a long time (over 15 years) in the region were exceedingly vulnerable, as displayed in Table 7-16, below. In fact, local indigenous people *a*re the ones who stay in the region. A few private business people from

other regions and more government and a few NGO employees are the ones who stay in the area for a shorter period.

Table 7-16: Local duration of stay and vulnerability

Residence/duration of stay (in years)	Vulnerability(percentage)
1 - 5	1%
6 - 10	4%
11 - 15	6%
15 +	89%
Total	100%

In principle, the longer people have stayed in one place, the higher the probability of having a sustainable life compared to the newcomers. One could adapt to the local environment and feel comfortable. In this case, the data collected in the basin conflicts with the principle indicated in the previous sentence. Government and NGO employees and private business people who have been there for a short period of time have better livelihoods in terms of work, education, finance, shelter and obtaining clean, adequate and affordable water supplies. Pastoralists, farmers, daily labourers and jobless people have been exposed to a vulnerable way of life and have been living in the region for a long period.

The reason why members of the pastoral communities are highly vulnerable relates to the risk and vulnerability factors shown in Figures 7-35 and 7-36. The survey result shows that the more the people stay in the region, the more they focus and depend on limited local resources and it makes them more vulnerable to external alternative views, work and living environments. Alternatively, it is possible that such problems could somehow be reduced through work exchange programmes facilitated by concerned stakeholder institutions.

Another great concern in addition to the vulnerability of the majority of people who stayed longer in the region, is that the findings indicate that the numbers of female infants or under-aged females are less than their male equivalents. The researcher did not find any evidence for the reason why such problems occurred. Moreover, the study did not find any significant harmful traditional or modern practices at infant level that could affect the preference of males over females. The situation requires further and urgent investigation and study.

The researcher would like to put some further questions in terms of these problems such as, does the evidence show the indigenous community to be in danger or highly vulnerable? How could this happen? Can we call them a highly vulnerable community? Does the problem occur naturally? Is it manmade or a politically motivated problem? Can we say that this is a time of urgency for the communities in danger?

7.6.2 Exposure to Hazards/Risks

Hazards and risks are interdependent. The effects on local people's exposure to water-conflict and early warning-related problems are determined by a combination of the severity and frequency of the occurrence of the problems and the existing institutional and individual

capacity in preventing the risks. Equation 2-5 (Chapter 2) and Figure 5-10 (Chapter 5) show the link between risk, hazard and vulnerability situations in the Afar region of the Awash River Basin..

Many respondents (73%) generally agreed that these problems have occasionally occurred in the region in the last 5 years (2004-9). They also expressed their uncertainty about concerns that these problems are occurring sometimes seasonally and at other times unpredictably.

Though it has not been efficiently addressed for many years, more has been known about the type of hazards and the level of local people and natural resources' exposure to vulnerability problems in the region. As a result, the water resources and livelihood of the pastoral communities residing in the region being critically exposed to natural and manmade hazards related to flood, conflict, drought, car accident and tornado. The people's vulnerability to the lack of an adequate response to water-resources-management-related problems is the most critical risk. On the other hand, the figure shows that 67% of the communities have adequate awareness on local methods of risk reduction. Figure 7-36, below, displays details of the process of risk exposure in the region.

7.6.3 Awareness on Risk Reduction and Mitigation Factors

The pastoral communities, other members of society in the region and most local institutions have relatively adequate awareness about the causes and mechanisms for mitigating the critical risks and high level of vulnerability in the region. Local communities also have optimum awareness through traditional prediction practices. However, due to certain limitations, an evident lack of capacity, poor coordination and functional structural issues, the development of effective working resolutions to the outstanding problems has proved to be a very difficult task. The level of awareness varies from sector to sector as displayed in Table 7-17. Additionally, Figure 7-37 displays the status of local awareness of the risk reduction process.

Table 7-17: Local views on awareness of risk reduction categories

Risk reduction awareness categories	Frequency	Percent
Water resources development	13	50.0
Early warning and preparedness	8	30.8
Conflict resolution	5	19.2
Total	26	100.0

Most institutions in the region do not have an adequate work force and capacity in preparing the long-term plans useful for planning a locally-feasible early warning and preparedness activities**.** Indeed, international institutions provide general country-specific awareness plans to concerned stakeholders. However, there was extensive disagreement on the EW information between the government and international institutions concerning the size of early warning situations.

Figure 7-35: A model for the local **vulnerability** framework in Afar region

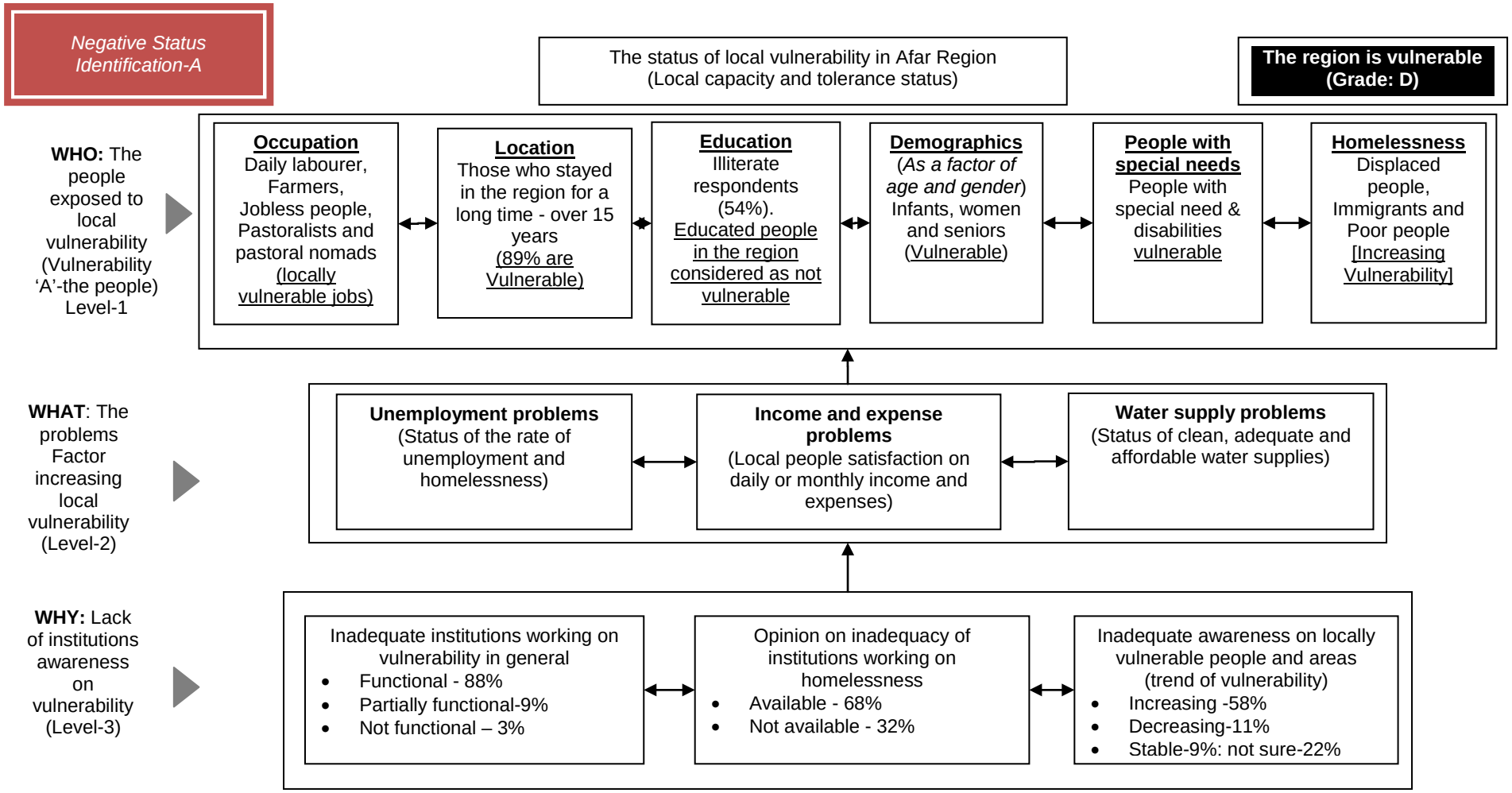


Figure 7-36: Mapping the local **risk exposure** status in Afar region

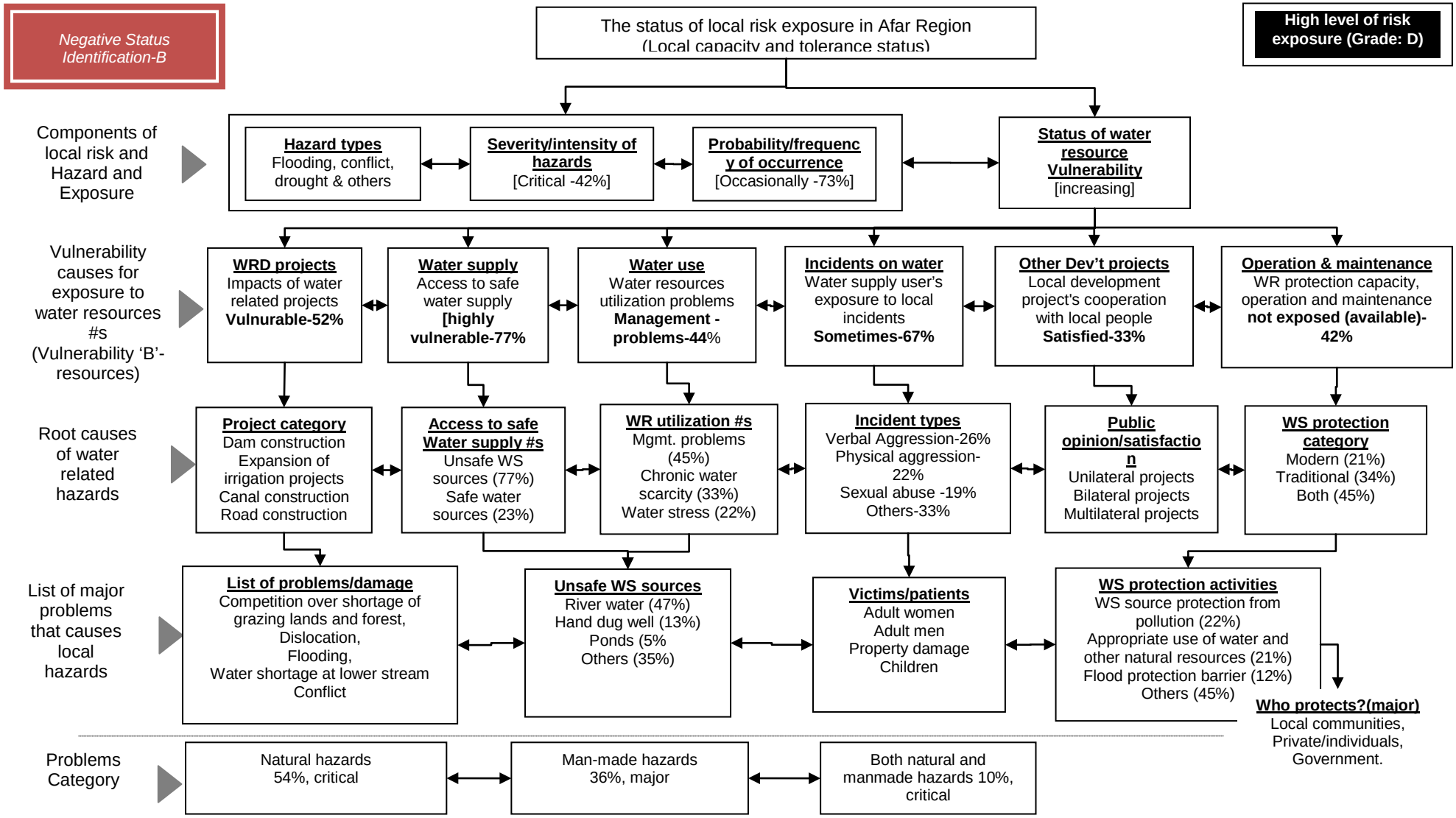
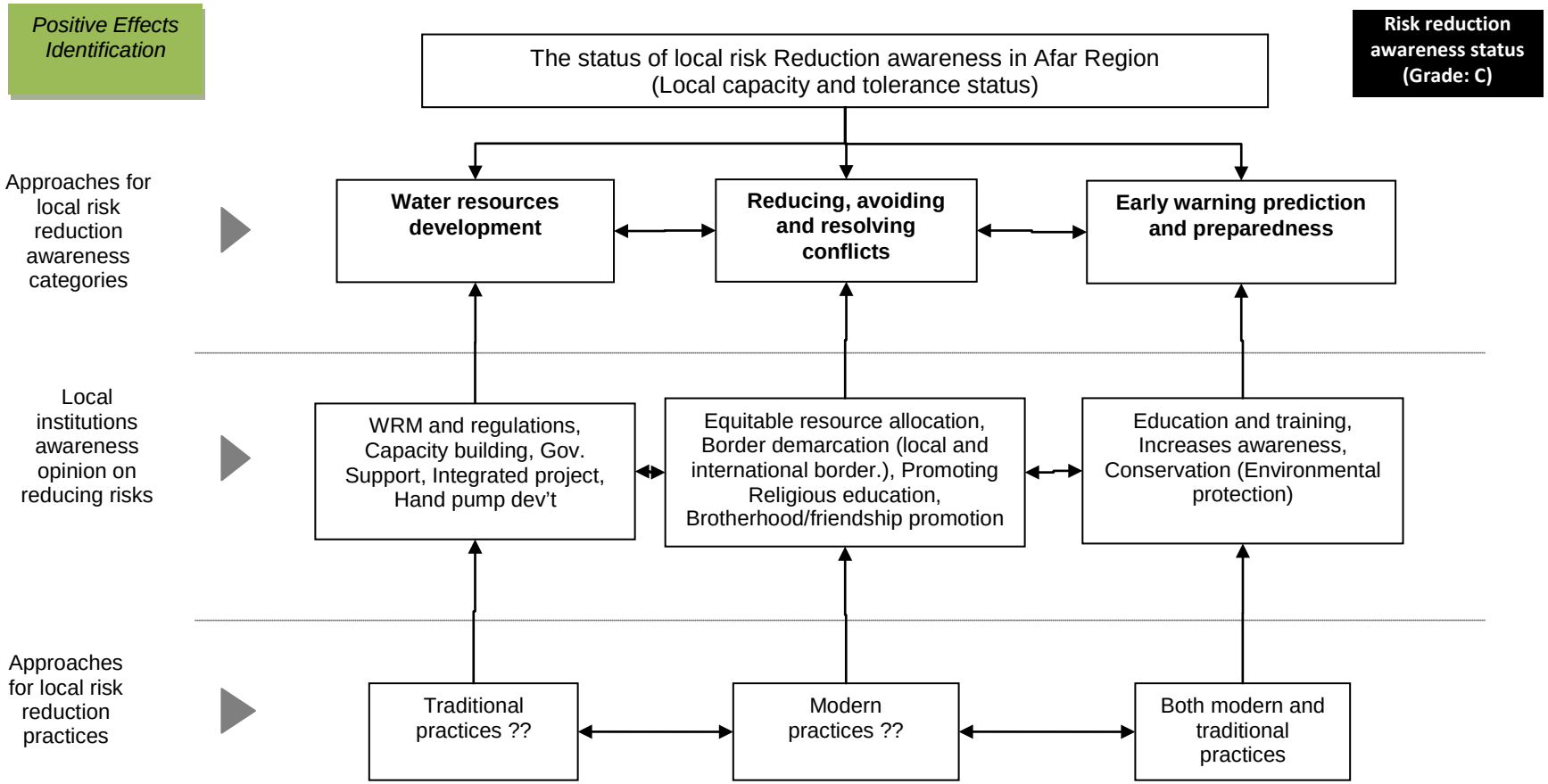


Figure 7-37: Mapping opinions on the local risk-mitigation awareness factors in Afar region



7.7 Designing a Local Water Conflict Prediction and Preparedness Model

[PREPAREDNESS AVAILABILITY]- DIPTI PARAMETER-IV

This section focuses on answering fundamental components of the main and the fifth research questions.

RQ: "How can we pre-identify and prepare for local water conflicts in low income developing countries?"

RQ5: *"How can tools like modelling and a policy indication guideline be applied in developing good local water conflict management frameworks in low-income developing countries?"*

The study deals with the process of local people and institutional awareness of practice concerning the existence of specific early warning services and the general capacity for local preparedness. This provides a maximum level of understanding of the core point of the problems on local water conflicts in the region. The section discusses the following two key components related to the process of awareness practices:

(1) Existence of modern or traditional early warning prediction services provided by local communities and institutions; and

(2) Existence of knowledge, data and information on local communities and institutions preparedness capacity that is useful in resolving local conflict-related problems.

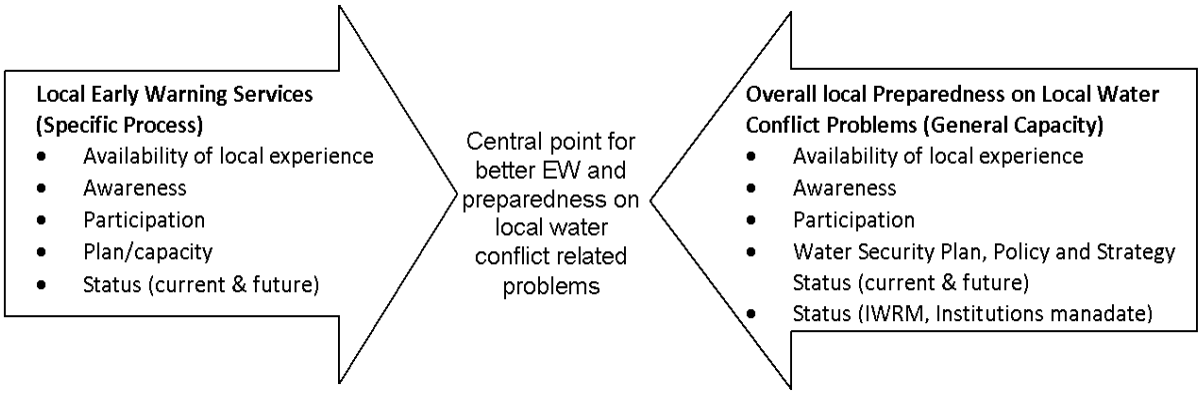


Figure 7-38: Central point for EW and preparedness on local water conflict problems

The exposure to inadequate preparedness leads to failure in resolving the WEC problems. The public and stakeholder institutions' awareness of locally-available traditional or modern practice is determined by the existence of general preparedness and specific early-warning services in the region. Specific EWS and general preparedness capacity are two main variables that help to maximize areas for resolving the problems, as displayed in Figure 7-38, above. The findings of the research show that the level of awareness is better than preparedness capacity. There were inadequate forecasting tools and institutional capacities in the region. Local communities are frequently using traditional prediction practices due to lack of adequate alternative modern EW practices. More detailed discussions on EW and the preparedness process in the region will be presented in the next sections and in Figures 7-39 and 7-40.

7.7.1 The Process of Early Warning Services in Afar Region

The process and identification of local WEC early warning services practice in the region is determined by four major variables: (1) existence of modern or traditional EWS practices, (2) EWS awareness of participation, (3) EWS capacity for planning and (4) the status of EWS within the public and stakeholder institutions. The details are indicated in Figure 7-39, below. The findings show that there were moderate levels of planning; inadequate capacity due to a minimum level of development and accessible and steadily-available modern facilities; high level of concerns and awareness of under-capacity and insecure situations. In addition, the public and institutional concerns are on raising the inadequate and unsustainable status and practice of local EWS in the region.

The reason why the level of planning was better than others is due to the fact that there was a nationwide government campaign in preparing strategic planning and management activities at all levels and sectors. Nevertheless, many planning activities that are prepared with inadequate information have a problem becoming fully successful or achievable.

Communities and institutional respondents agreed that local water supply and sanitation coverage in the region is increasing. However, the status indicates that it is unsustainable due to potential conflicts and security concerns in the river basin. The survey indicates that there were affirmative traditional early warning practices implemented by male-predictors '*Gignili'* and female-predictors '*Kaluwale'*. Besides, there was an inadequate number of modern forecasting tools and a minimum rate of institutional participation. There was a minimum level of awareness of local water resources development practices, early warning services and understanding of the cost-effects of pre-and post-conflict problems.

7.7.2 The Process of Local Preparedness Availability in Afar Region

Local preparedness is determined by the feasible links and cooperation that exists among public and institutional practices related to water resources and conflict management. In addition, institutional experience in the region was explained in terms of efficiency, mandate and planning, together with the management of water resources and conflicts. Both local communities and institutions have inadequate levels of modern and traditional ways of preparedness for alleviating the water-conflict-related problems, as displayed in Figure 7-40, below. The work on water security plans in local institutions is relatively moderate and encouraging. However, most of the activities are done at the federal level and local participation is minimal, which left the plan in question.

Figure 7-39: Mapping the process of local early warning services (EWS) awareness and practices model in the Afar region

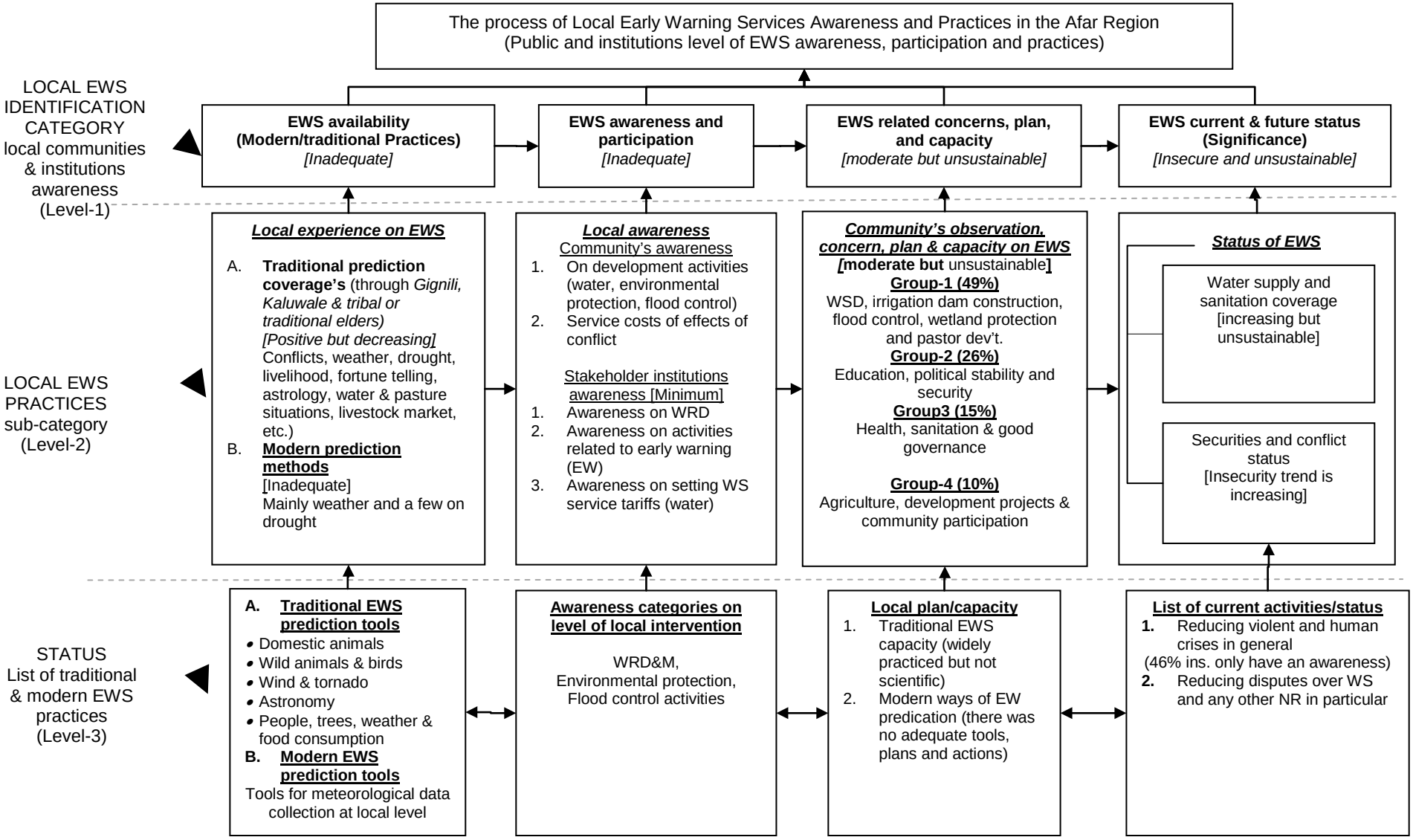
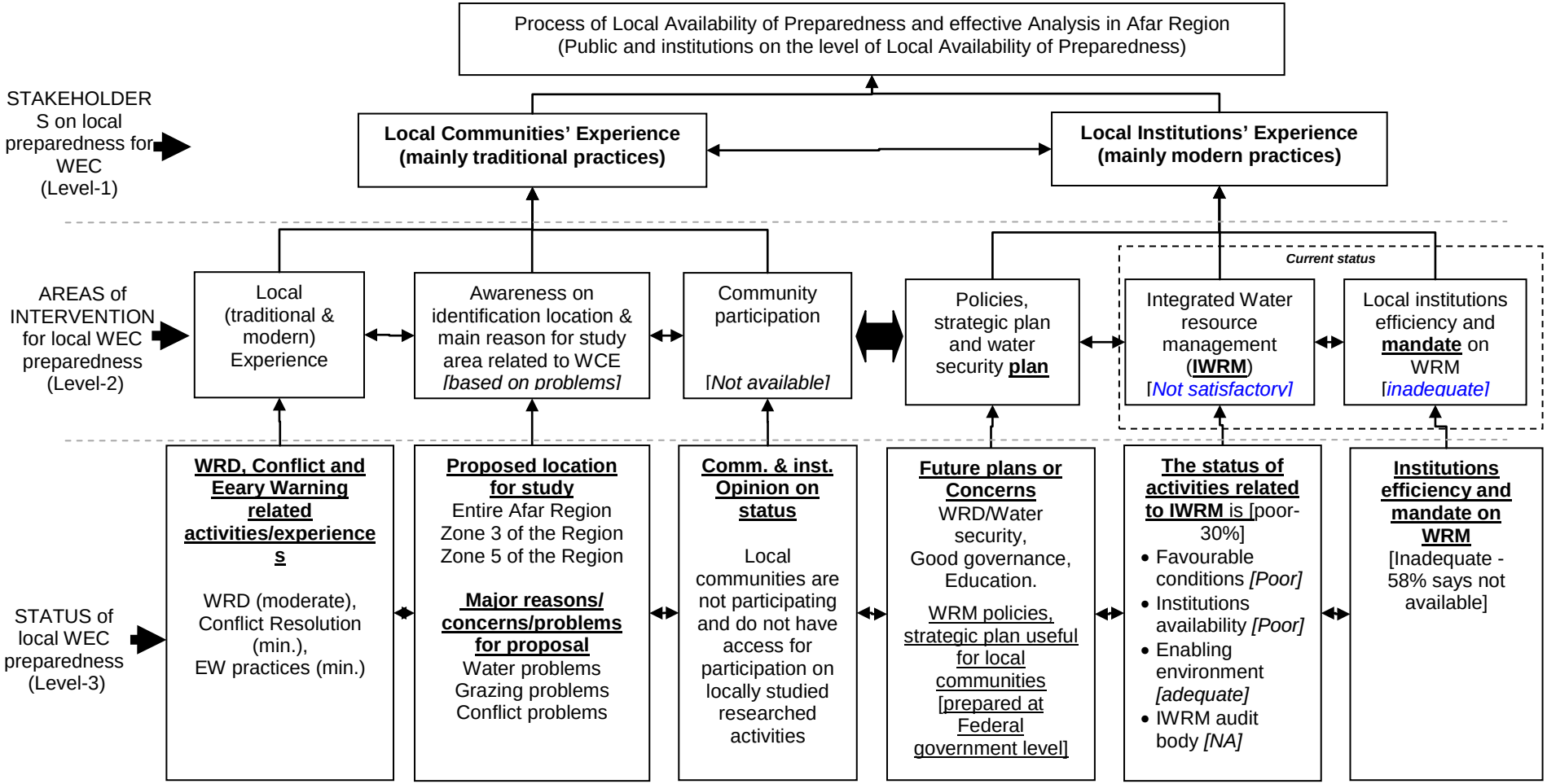


Figure 7-40: Mapping the process of local availability of preparedness and effective analysis in Afar region



7.8 Contribution to Sustainable Development

[DEVELOPMENT/ IMPLEMENTATION]- DIPTI PARAMETER-V

This section explains and put together parts of the DIPTI components, the approaches involving a local contribution towards securing the sustainable development of the local resources. The process includes stakeholders' rate of involvement; the type of problems that affect development; and local water conflict diversity factors (SRDF) as displayed in Figure 7-41. It is part of one of the major processes in answering the main research questions on the pre-identification and preparedness for local water-conflict-related problems. The framework can be applied in the WRM policymaking process. This helps to reduce crises that occur because of local water conflicts in low-income developing countries.

RQ: "How can we pre-identify and prepare for local water conflicts in low income developing countries?"

Local water conflict often occurs as a result of the failure of water resources development projects due to lack of concerned stakeholders' participation and contribution as well as public dissatisfaction on the process and the intended output of the projects. Emmitt (2010) noted that conflict exists where there is an incompatibility of interests; conflict in projects also occurs in association with control of scarce resources, which often shows when changes are introduced to the design, budget or programme, resulting in power struggles.

The findings show that local communities are neither satisfied nor dissatisfied regarding their contribution to the sustainable development of the resources in the region while they are not actively participating in the state farm-plantation projects. However, the pastoral communities in the region have chosen not to speak openly about their dissatisfaction on unsustainable ways of significantly increasing deforestation activity, mainly for state agricultural purposes. Communities' contributions were relatively high in environmental protection activities due to a nationwide campaign to plant a tree seedling. Local institutions expressed their concerns about the existence of a high level of problems that affects the sustainable development of the region. There was a negative correlation between the views of communities and institutions. In general, there was a positive correlation between communities' activity versus the rate of satisfaction or satisfaction versus participation. However, there is a negative correlation between activities versus the need for participation.

7.9 Framework Model of Local Water Conflict Pre-Identification and Preparedness

This section introduces the possible causes of local water conflicts as conflict initiating factors, the key stakeholders, parameters of analysis and the historical trend analysis of conflicts in the region. Figure 7-42, below, shows the framework of the process of overall parameters that is useful for the pre-identification of possible causes of conflict patterns and approaches to preparedness. Appendix O shows the core findings of the research compared with DIPTI parameters. The researcher has presented them in such a way it indicates the past, the present and the future expectations rate of the local water conflict situations in the region.

Figure 7-41: Mapping the process of local contribution to the sustainable development of the region

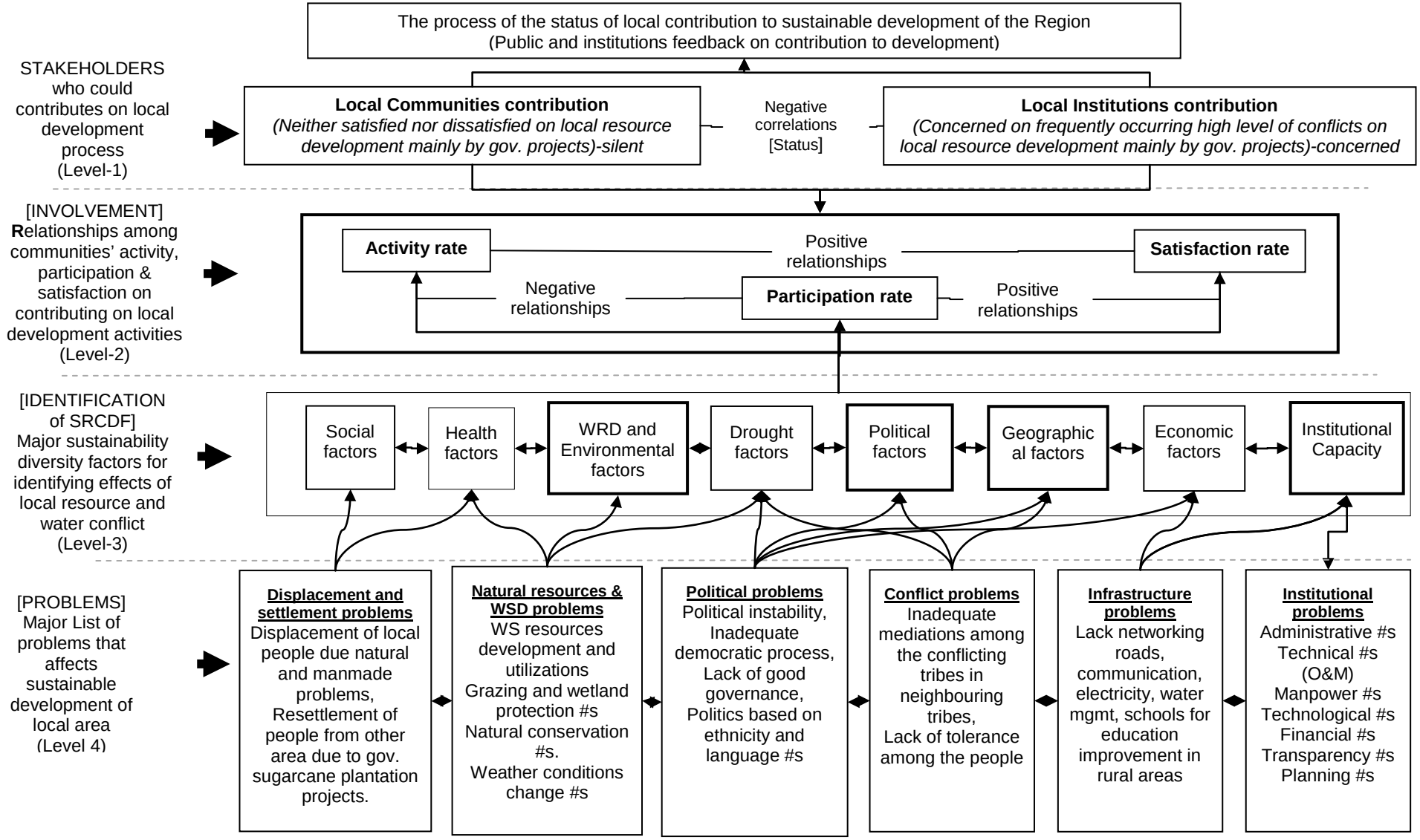
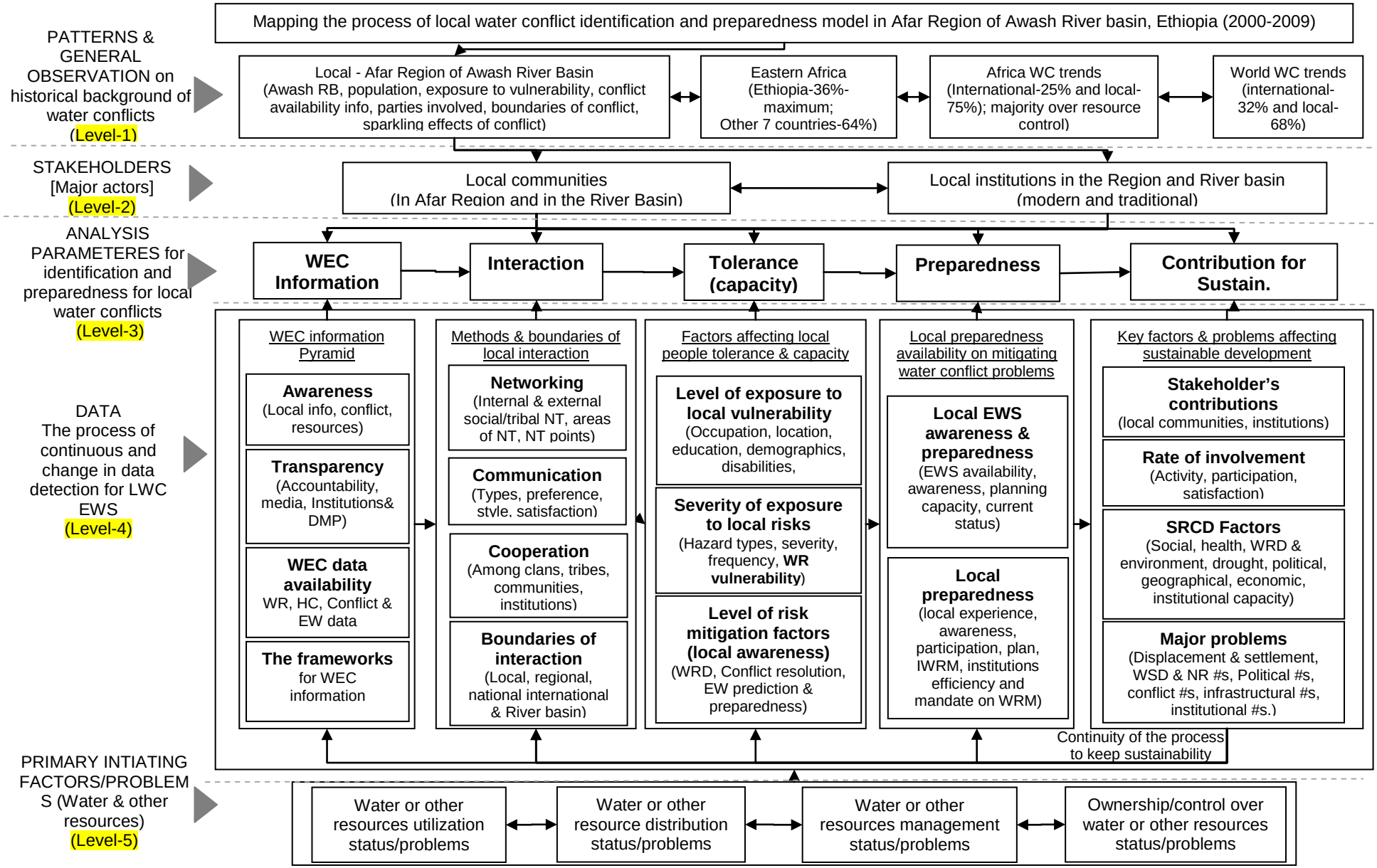


Figure 7-42: **DIPTI matrix (multidimensional) framework**: an integrated framework model for LWC pre-identification EW and preparedness in Afar region



7.10 Connecting the Hypothesis and Application of the Research

7.10.1 The Hypothesis

This section has explained and critiqued the hypothesis and results of the local water conflict EWS research variables evidence and discussed the significance of the present results. The hypothesis is:

> **"Local water conflict pre-identification and preparedness framework modelling will contribute towards the pre-identification, preparedness, neutralization and resolution of the risks occurring due to local water conflicts, and will improve the efficiency of the sustainable use of the scarce water resources in low-income developing countries."**

Through the process of validating the hypothesis, the researcher develop, update or acquire new knowledge in the areas of this research. The hypothesis of this research is not numerical and will be validated by a relationships map as indicated in Table 7-18, Figure 7-43 and Figure 7-44 below. Mauch and Park (2003) in their 'Guide to the Successful Thesis and Dissertation', point out that the hypothesis is stated as a suggested solution to a problem or as the relationship of specified variables; it retains the character of a guess until facts are found to confirm or discredit it.

Table 7-18: A comparison of the research theory with the findings (Hypothesis-prediction-observation)

Major components of the research theory (The HYPOTHESIS)	Facts (Findings of the research) (The PREDICTION)	Testing the results of data collection	
		Data OBSERVATION	Results of the TESTING-PREDICTION
The importance of early stage local water conflict pre-identification and preparedness framework modelling *(The Significance)*	Designed a framework of study and developed DIPTI framework model. For example, negative results from the DIPTI parameters on the status of water, conflict and early warning services in the region signify the availability and probability of occurrence of local water conflicts in the region	A questionnaire developed in accordance to10 major DIPTI parameters and 116 sub-variables in order to validate the hypothesis. Through field survey, data collected from 134 local people and 26 institution representatives.	Afar region (*Observation*) is selected for testing the hypothesis. DIPTI data analysis shows the region is highly exposed to local water conflicts (grading a negative value of D). ▼Can be *applied* for low-income developing countries (larger groups)
The framework's contribution towards preparation and resolution for risks occurring due to local water conflicts *(Reducing Risks)*	Theoretical discussion and new approaches to conflict identification and resolution process, the "*sparkling effects of conflicts" and other findings.* (The process of local water conflict intensity pre-identification and management)	The study suggests that out of two people in the region who were not involved in conflicts, one person thinks that the conflict problem was not resolved. ▼ From data and literature gaps (examples) to theory development	A new theory was formulated that if a conflict was resolved for the benefit of 'x' number of communities directly involved in conflicts, then more than '2x' number of communities still believe that the conflict was not resolved due to the extended effects of conflicts
Improve the sustainable use of water resources as a contribution towards sustainable development *(Sustainability)*	Pre-identification of a problem helps to plan further and mobilize the required resources and stakeholder contributions in resolving the problem and creating stable condition to sustainable development.	The researcher has developed application frameworks for DIPTI parameter that requires more future works. ▼ (Linking theory with application)	The trend indicates that the development activity in the region is poorly contributing to sustainability (grading D). More findings useful for sustainable development are presented in the study ▼(See Figure 7-43)

In Table 7-18, above, the researcher has compared the key components of the hypothesis with some of the findings of the research. In Chapter 8, the conclusion, the researcher will present a list of the research's contribution to new knowledge. Figure 7-43 shows parts of procedure for testing the sustainability parts of the hypothesis. It includes the theoretical links and the prediction factors within the five components of the DIPTI parameters. The illustration shows the dependency of each parameter together with the prediction and implementation direction during the process of sustainable development. Under normal conditions, the DIPTI parameters are highly dependent on one another, as seen in Figure 7-43.

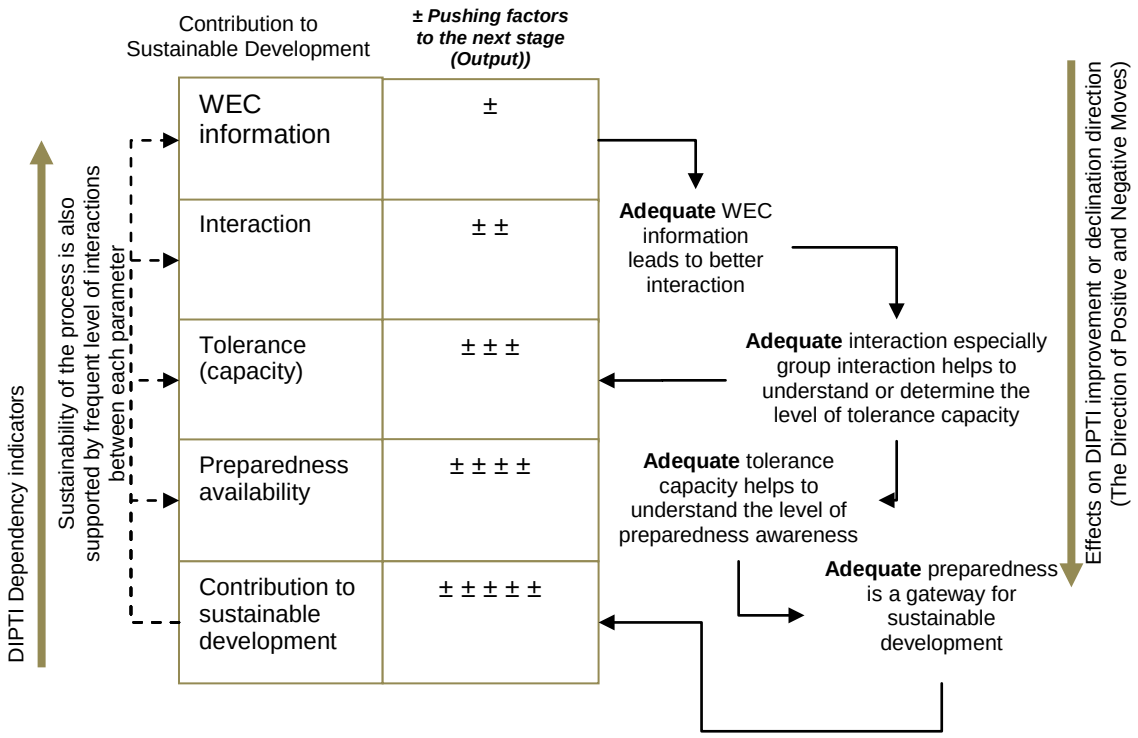


Figure 7-43: Theoretical links and prediction factors among the DIPTI parameters

7.10.2 Application of Local Water Conflict Framework Model

Glasman-Deal (2010), in *Science Research Writing,* notes that research work does not always have a clear application; however, in some cases it is clear how the work can be used, particularly if a project has resulted in a device or product of some kind. Figure 7-44 of this section reflects the possible frameworks for the application of the results of this research as an initial attempt. One can also develop alternative implementation frameworks based on the output of the research and conditions on the ground. It compares and indicates the relationships between participant stakeholders and the size of their contribution and the major beneficiaries of the study in the process of sustainable development through the pre-identification and preparedness of local water conflicts in low-income developing countries. It also highlights the implications of the results as compared to other unanswered questions

related to sustainable development and knowledge related to local water conflict early warning systems.

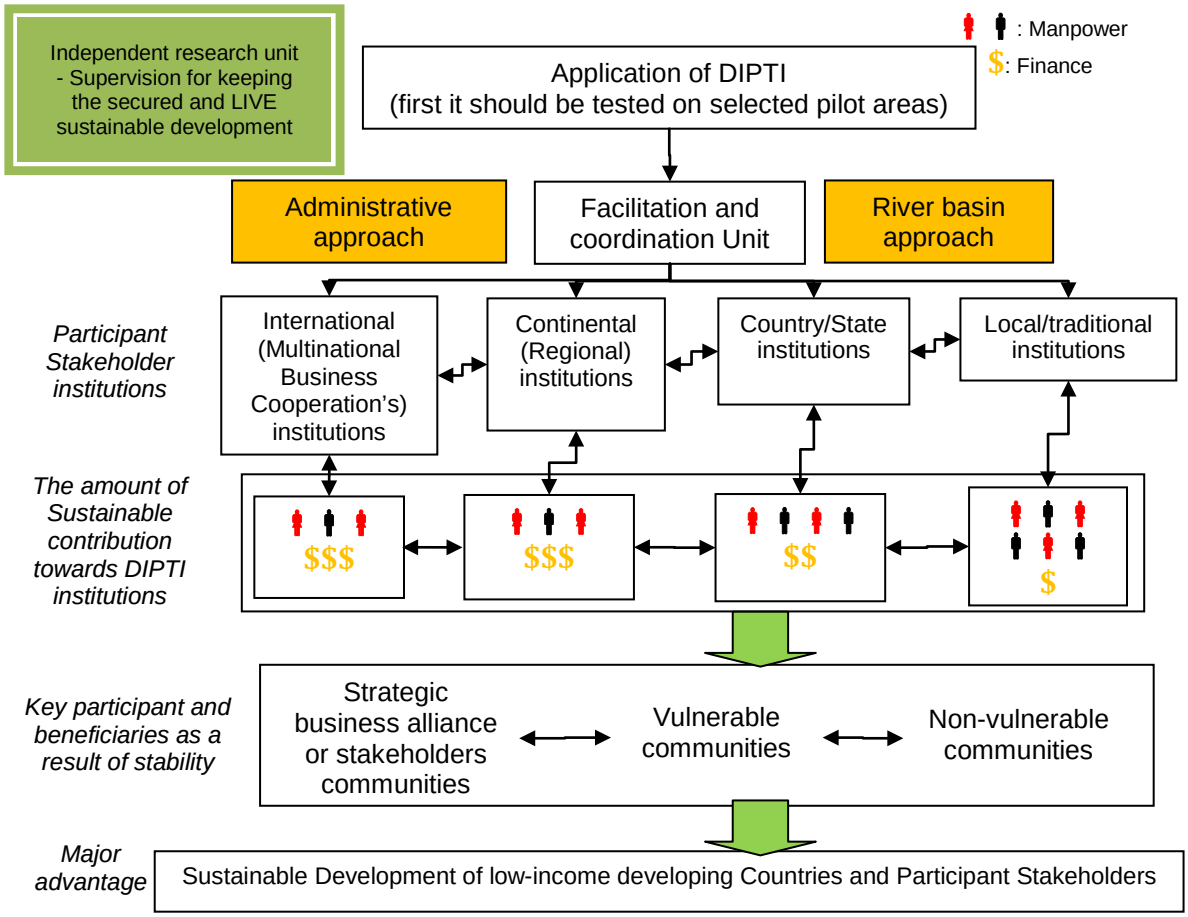


Figure 7-44: Application of the DIPTI framework model for sustainable and secured development

7.11 Chapter Summary

In this chapter, we have further discussed, reflected and framed the core components of the discussion of the research findings. These include the pillars of conflict pyramid, the WEC information pyramid, DIPTI process-based parameters and the sparkling effects of conflict. A process-based and integrated framework model was developed that summarizes all the five components of the DIPTI parameters: information, interaction, tolerance, preparedness and sustainable development. It helps in pre-identifying and preparing for local water-conflict-related problems as well as in facilitating a path that leads to sustainable development through incorporation of IWRM practices.

The pillars of conflict pyramid, as applied to local water resources, indicates the causes of local water conflict and includes: water and other natural resources and the user communities or stakeholder institutions together with any binding modern or traditional rules and regulations. The availability and accessibility of WEC data has four major components related

to water resources: early warning, conflict and information on the effects of hydro-climatic situations. Lack of integrated local water conflict information is the result of inadequate specific information in the identification of the core components of the WEC information that comprises the process of awareness, transparency and data availability.

The researcher has identified and presented the new findings on the trends of local water conflicts (see § 1.3 of Figure 1-3) in comparison to international transboundary conflicts. It can be seen that a tribal conflict, mainly between Afar and Issa pastoralists, frequently occurs because of:

- The lack of adequate clean water and a shortage of grazing land;
- A minimum level of awareness on information related to resources, conflicts and early warning situations;
- A high level of exposure to risks associated with natural and manmade hazards;
- A minimum level of networking, communication and cooperation with neighbouring tribes in the river basin, and
- A medium level of participation in, and satisfaction with, local activities related to the sustainable development of water resources by communities and institutions.

The level of communication in the region is relatively increasing between members of the community and government institutions. In contrast, the status of communication within different institutions or within different tribes in the basin was not found at the desired level. The level of cooperation within different stakeholders in the region was fragile due to the unsatisfactory level of networking and communication among the neighbouring people in the region.

An investigation on vulnerability has shown that local people and the water supply resources' exposure to vulnerability are the two major problems that speed up conflicts in the region by affecting local capacity and people's tolerance when challenging the problems. On the aspect of local awareness and practices on the availability of specific early warning services and the general capacity for local preparedness and preparation, the work on water security plans in local institutions is relatively moderate and encouraging. However, most of the activities are undertaken at the federal level and local participation is minimal, which leaves the plan in question. Factors and approaches that improve sustainable development in low-income developing countries in relation to the process of identification, reducing and/or resolving local water conflicts are stated and framed in detail in the study.

Chapter Eight
CONCLUSIONS AND IMPLICATIONS

"Peace cannot be kept by force. It can only be won, through understanding. Our longing for understanding is Eternal." (Albert Einstein)

This chapter summarises the results of the research in comparison to the research aim, objectives, questions, hypothesis, research problems, existing theories, policy, local traditions and practices. It points out the limitations of the study and makes suggestions for future work on local water-conflicts. Moreover, it also highlights and puts forward the new opportunities that will occur as a result of the implementation of the results of this research.

8.1 Introduction

This chapter brings together the work done and what has been found out; and it is more than a summary of the thesis (Hart, 2006). According to Brewer (2007), it is important that the conclusion addresses the outcome of the research in such a way that it is open and honest; even if the outcomes are negative or inconclusive, there may be important issues for future research.

This section presents the achievements and recommendations of the study related to the aim and objectives of the research; mapping the validity process of the research; indicating the limitations of the research and emphasising its contribution to the theoretical and practical knowledge in the field of water-conflict studies. Moreover, the study helps to increase the level of cooperation and understanding of the rationale for strategic partnerships with low-income developing countries to promote sustainable development, international businesses and for the strengthening of strategic alliances in today's complex and interconnected global environment. This will be achieved through prior awareness of the level of local conflicts and preparation of a plan for reducing, neutralizing or resolving high levels of conflict related to water and other natural resources.

Sufficient and frequent fieldwork took place to collect survey data on local water-conflicts that helped to test the functionality and validities of the various parameters used in local water-conflict identification, preparedness and early warning framework models. During the process of this research work, the researcher has identified six major problems among many addressed in Chapter 4 (§4.11.2) and concluded as follows:

1. Limited literature and information on local water-conflicts is reflected by virtue of the limited number of journals, books and institutions focused on local water-conflict-related issues;
2. The challenge of getting adequate institutional respondents due to frequent and intensive meetings since most of the institutions in the region belongs to the government;

3. The difficulty of finding an adequate number of pastoral communities because of the mobile nature of the local people's way of life;
4. There are fewer women respondents in the survey. The reason for this is related to traditional and religious influences within communities; it is difficult to talk privately with individual respondents, especially if they are women. In addition, they have limited time at their disposal due to their workloads and family responsibilities;
5. The traditional '*dhaagu'* communication system in the region speeds up information flow within the communities and the researcher has found that sometimes respondents provided the same answer for the same question. This situation proved time-consuming in screening up and getting the right independent opinion from respondents; and
6. A number of the research survey questions are politically sensitive in the context of the Afar region of Ethiopia. The researcher has found that some of the respondents cautiously responded or required more time for confidence-building in response to politically sensitive survey questions. Some think that answering the questions might create unexpected political complications in their daily lives.

This research indicates that three quarters of the number of water conflicts occurring in Africa are local and the remaining one-quarter are related to international river basins. The study shows that East Africa, and Ethiopia in particular, is exposed to highly volatile water-conflict problems. Since the end of the Cold War (1991), international water-conflicts are decreasing while the trends of local water-conflicts are increasing significantly all over the world. Indeed, control over resource ownership, poor management and high levels of competition for limited natural resources are the major causes of the problem. In today's interconnected world, international conflicts have a great impact on local-level activities and related problems. In particular, there was no clear and directly indicative figure that supports the transformation of international water conflicts into local water conflicts.

The researcher has identified over 180 lists of miscellaneous and complex problems in the Awash River Basin of the Afar region. These problems are mainly related to local water resources, other natural resources, agriculture and grazing land, livestock, health, development projects, corruption, infrastructure, communication and others mentioned in the previous chapters that are directly related to, or play a major role in fuelling local conflicts. The region is highly exposed to a tribal conflict between the Afar and Issa pastoral communities. There was also a growing conflict with government institutions functioning in the region in relation to the construction of large-scale development projects on the Awash River and within the river basin.

8.2 Findings as Related to Research Objectives

The aim of this research was very broad and complex. It has focused on identifying prediction, preparedness and neutralization techniques for local water-conflicts. Another part of the aim was to put forward appropriate recommendations that could be used to eliminate or reduce violence, deprivation or humanitarian crises that threaten the sustainable development in low-income developing countries. It is also intended to raise further awareness about the extent of the existing and future world water supply problems through the study of local water-conflicts. The research aim introduced in the first chapter has multiple objectives, which have been achieved through the research outcomes addressed in the next four sections.

8.2.1 On Achieving the First Research Objective: A Cyclical Framework Model for Local-Water Conflict Early Warning and Neutralization Processes

The first objective (OB) of the research:

> OB-1: To investigate the state-of-the art in the local water conflicts and develop a pre-identification, preparedness, early warning and conflict neutralization framework model designed to assist policy makers, governments, international institutions, donors, military experts, at-risk vulnerable populations and other risk-affected stakeholders.

This objective was achieved through the process of designing and testing the framework models as well as by identifying key factors useful for enhancing sustainable development. In addition, issues affecting vulnerable communities in the region were addressed in detail. In addition, the study highlights the link and the significant importance of enhancing global strategic partnerships, as presented in the next sections.

8.2.1.1 A Model Framework for Local Water-Conflict Identification, Preparedness and Neutralization (Early Warning System)

A complex local water-conflict early warning system framework model having five sequential, dependent and cyclical parameters (the DIPTI parameters) was designed. The parameters in the framework are supported by 10 independent variables as fundamental components for local water-conflict pre-identification and preparedness activities. The parameters of the framework incorporated the following key factors on which their development was based:

1. Maximization of the availability and the utilization of WEC information among the communities and institutions in the region;
2. Increasing the process of interaction among all concerned stakeholders with the activities of any development-related projects in the region;
3. Maximization of the level of local capacity and tolerance among local communities and stakeholders participating in resolving problems helpful to the sustainable development of the projects;

4. Increasing the level of preparedness for, and awareness of, early warning situations; and
5. Increasing the level of communities' contributions through active participation in, and satisfaction with, the sustainable development projects.

Figure 8-1 below shows a useful framework model that indicates the cyclical process and approaches towards local water-conflict pre-identification, early warning and neutralization designs at the local level.

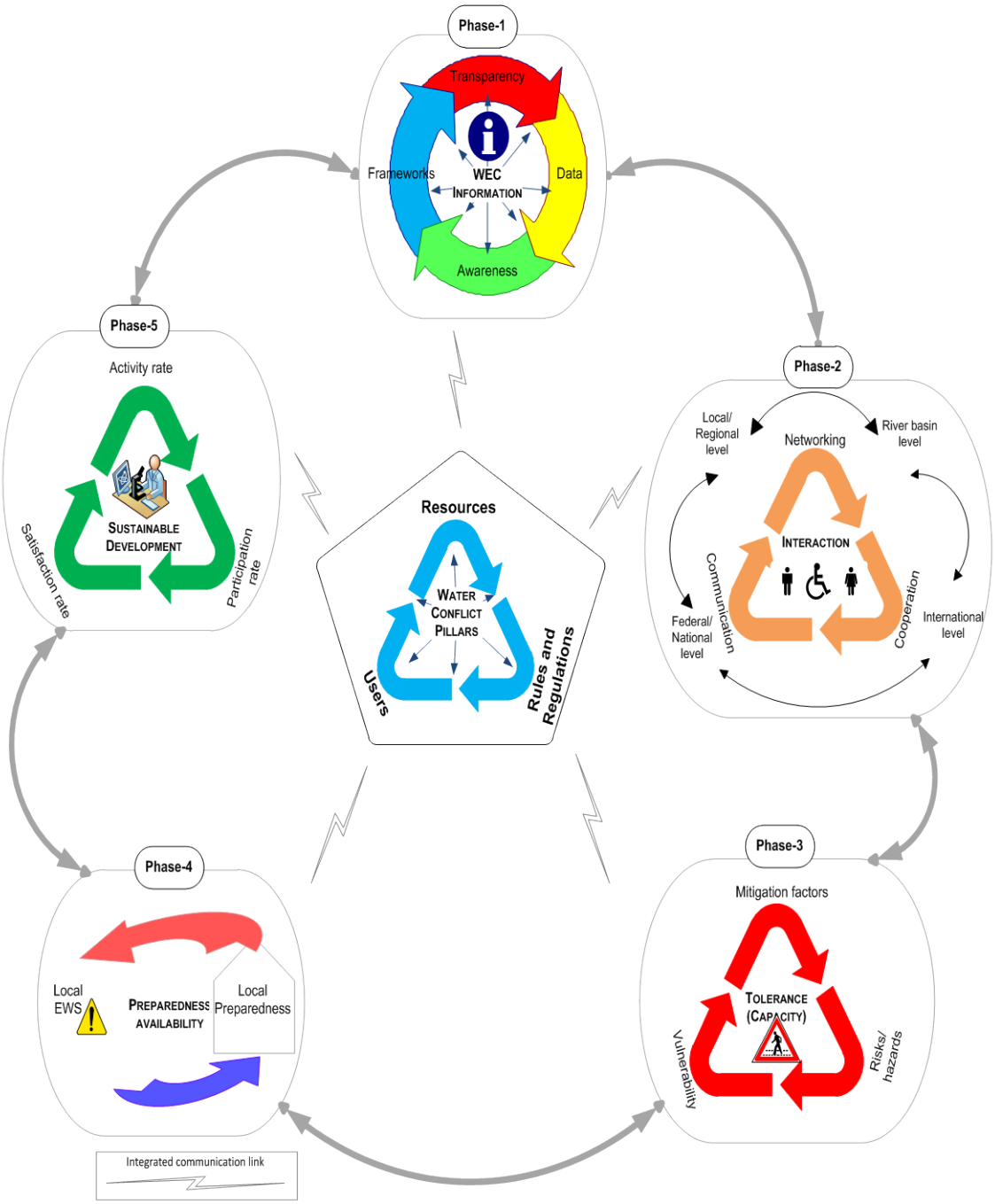


Figure 8-1: DIPTI cyclical framework**:** A cyclical framework model for local water-conflict pre-identification, early warning, preparedness and neutralization

The framework has been tested based on data collected in the Afar region as a sample area within one low-income developing country. Positive and negative data on each of the respective parameters have indicated the existence, or non-existence, of forms of early warning systems for local water-conflicts. In support of this model, in Chapter 7, the Discussion, the researcher has displayed (Figures 7-42 and 7-43) a simple integrated framework designed to indicate the significant importance of the participation of many stakeholders at different levels in providing a flexible, wide and highly-interactive working environment to assist high-level policy makers and practitioner at local levels. This includes stakeholders working at local, regional, basin, national and international levels.

8.2.1.2 Sustainable Development

Policy makers have to consider the process of incorporating the components of the aforementioned cyclical model of a WEC framework in any integrated water resources-management activity. It helps to contribute in bringing stability to the political, economic and social well-being of the communities as well as enhancing the sustainable development of the low-income developing countries in general and human development in particular.

Any sustainable development project activity within water-conflict-prone areas should address locally-applicable and acceptable traditional and modern practices. This includes the recognition of direct and indirect stakeholders without the limitation of geographical boundaries of local, regional, national and international political borders. Any high-level project activity must address local issues in order to reduce the level of conflicts and speed up local development.

The availability of a system for sustainable development in low-income developing countries has a great importance in reducing local water-conflict-related problems. In addition to the WEC parameters, the active participation and empowerment of women in conflict-prone areas has a positive role in improving the standard of living of the communities and creating stability in the region. The research has shown that women are equally and more concerned with social issues and physical fitness (health) in contrast to men, who are primarily concerned with physical fitness/health followed by social issues. Both women and men equally agreed on the time taken-up by local-conflict-related problems.

The purpose of this research is not to indicate the way each gender is using its time. With this in mind, the author concurs with the opinion of Valerie Bryson and Pamela Fisher (2011) in their book *Redefining Social Justice.* They state that time-use studies show women spend more time in providing unpaid work, while men spend longer hours in paid employment. However, most studies of conflict have focused on class conflicts and workplace struggles between labour and management over terms and conditions, and to rather ignore other fundamental divisions such as gender, race, religion and capacity limitations (Knights *et al*.,

2007). Therefore, policy makers or concerned stakeholders should consider a significantly higher commitment to empowerment of women at any level.

Another factor that speeds up sustainable development is through increasing the number and types of formal and informal communication networking points within local communities.

8.2.1.3 Vulnerable Communities

The study in the Afar region shows that the vulnerable members of local communities that include women, children and people with special needs were not well protected from harmful traditional and modern practices. Due attention was not given to reducing the impacts of harmful modern practices as compared to reducing harmful traditional practices. In both cases, the vulnerable people are highly affected by the outcomes of harmful practices.

As presented above, it was observed that women's participation at the decision-making level was very limited or non-existent in conflict-prone areas and low-income developing countries in general. This research reveals areas where women's participation plays a positive role in reducing conflicts in a society. The research highly-emphasizes the vital importance of women's participation, along with other vulnerable groups, at the local level and their role in resolving, reducing or neutralizing conflicts.

8.2.1.4 Global and Local Strategic Partnership

The findings show that over 90% of organizations or institutions that have been working on conflict management activities are found in developed countries, mainly in Europe and the USA; places where there are insignificant water conflicts as compared to low-income developing countries. The numbers of local organizations that participate in the process of conflict management activities in conflict-prone areas are evidently limited.

The study provides an increasing level of cooperation and understanding of the rationale of strategic partnership with local people and institutions in low-income developing countries. It promotes sustainable development, inter-regional and international businesses strategic partnerships through the identification and preparation of stable and favourable environments. It also helps in strengthening strategic alliances and inter-sectoral cooperation in today’s complex and interconnected global environment. The successful strategic partnership could achieve, through prior awareness of the level of local conflicts, the preparation of a plan for reducing conflicts, and resolving the high level of conflicts related to water and other natural resources.

8.2.2 On Achieving the Second Research Objective: Providing Adequate Data/Information on Local Water-Conflicts

The research showed that there is limited literature and information on local water-conflicts. Indeed, the second objective of the research was:

OB-2: *To examine the underlying* problems, information and dimensions of local water conflicts by providing relevant and timely *data* supported by valid theoretical and practical findings.

The objective was achieved by providing information on the existence of, and trends in, local water-conflicts; also about the level of recognition for traditional and modern practices and stating the importance of communication between stakeholders. In addition, dimensions of the problems areas were identified that are necessary to develop awareness on the pre-identification and existence of local water-conflicts.

8.2.2.1 Water Conflict Data/ Information

The research shows the vital importance of studying and focusing on local water conflicts due to their significant increase as compared to the problem of international transboundary water conflicts. Water conflict data from the years 2000 to 2009 indicate that 68% of conflicts worldwide are local and only 32% international. Among the eight countries of East Africa, Ethiopia is ranked as a country highly exposed to local water-conflicts even though the least number of water conflicts were recorded in the highly volatile conflict areas of Somalia. The research shows 63% of the people in the Afar region of the Awash River Basin are vulnerable to critical problems related to poor working conditions, water supply, demography, illiteracy, housing and shelter.

The survey data on the identification of information on local water-conflicts indicate that 1 person in 10 is directly involved in conflict; 1 family member in 5 is affected by conflicts; 1 person in 2 believes there were unresolved conflicts while 9 in 10 knew the conflicting parties. Moreover, 7 in 10 agreed that there are conflicts between Issa/Somali tribes.

The findings of the local-water-conflict trend data in the region show that slowly-occurring conflicts are occasionally followed by violence; and that frequently-occurring conflicts are followed by frequent violence between the conflicting stakeholders.

The research emphasizes the importance of local-level information, networking, communication and cooperation as a base for sustainable development. The WEC information pyramid and the framework are designed to indicate the core components of local water-conflict-related information.

8.2.2.2 Stakeholder's Institutions

There are many governmental, non-governmental, and public institutions working on alleviating harmful traditional practices in low-income developing countries in order to achieve effective sustainable development in a local area. However, equal attention has not been given to protecting the community from harmful modern practices. Hence, the communities are reluctant to change their harmful traditional practices. There is also a lack of an alternative approach, which further worsens the situation. Unfortunately, information about the present

availability of active institutions working on avoiding harmful modern practices is unclear. In addition, the apparent lack of adequate identification systems on the borderline between useful and harmful traditional or modern practices was a challenging problem in the region.

8.2.2.3 Communication between Stakeholders

There were inadequate levels of networking points, communication systems, tools and initiatives among institutions in the river basin, although the conflicts in the Afar region are increasing. Similarly, the levels of communication were very poor and intense conflicts among different groups of people or tribes in the basin were evident. However, there was a relatively better level of communication or attraction between tribes and institutions in the basin as compared to the level of conflicts within themselves. There was no clearly-justifiable indication why such poor communications should be observed mainly between institutions in the region. Another factor could be the policy of tribal-federalism politics implemented by the government administration and the customs of the local people in the region who mainly follow traditional approaches.

The status of interaction at river basin level was not adequate as compared to other competitive structures in the region. The areas and level of interaction among stakeholders in the region was not satisfactory, though there are relatively adequate boundaries in the interaction structure of the region. Hence, the process of maximization of interaction at river basin level requires more work in the future.

Another important finding of the survey is that local women are involved in many networking points as compared to men and children. However, they are vulnerable and significantly more affected by conflicts as compared to their male counterparts. Although men are secondary networking stakeholders, they are the primary participants in the conflicts occurring in the region

8.2.3 On Achieving the Third Research Objective: Encouraging a Priority for Better Water Resources Management

The third objective of the research:

> **OB-3**: *To develop an approach* that prioritizes better water resources management and encourages optimum political, social, economic and traditional commitments.

The objective was achieved through the process of indicating the early effects of this research on local communities and institutions, introducing new theory about understanding the sparkling effects of conflict and issues to be considered in the conflict resolution process.

8.2.3.1 Early Effects of the Research in the Region

During the early stage of this research process, many respondent representatives from local communities and institutions working in the region were cautiously enthusiastic in responding

to survey questionnaires. Though the questionnaire was lengthy and complex, they were experienced and aware of the need for integrated water resources management and sustainable development as well as being motivated in the quest to build peace and security in the region. At the end of the survey questionnaire, the feedback from participants was very positive and encouraging. The importance and the problems related to local networking, communication and cooperation to secure improved and proper conflict and water resources management were recognized by all respondents. During this study, the researcher observed that the lack of adequate networking points for local people (e.g. on roads, in markets, at schools and in health centres) has contributed to conflicts. As a result, the problems were attributed to inadequate levels of communication and cooperation in the region.

The advantages of increasing communication tools, such as the construction of roads, could help to enhance interactions between communities and minimise communication problems. They could help to facilitate resource-sharing within the framework of responsible and equitable distribution, which plays a big role in reducing the intensity of conflicts and enhances sustainable WRM.

8.2.3.2 Sparkling Effects of Conflicts (SEC)

The measurement of the effects and dimensions of local water-conflicts go beyond the predictable primary conflicting parties and locations. It is also highly influenced by the secondary effects – 'the Sparkling Effects of Conflicts'. This research underlines that adequate and equal recognition should be given to those stakeholders indirectly related to the conflicts and conflicting parties. Approaches for a conflict resolution process should also recognize and accommodate the co-existence of useful modern and traditional ways of resolving conflicts.

According to the findings of this research discussed in Chapter 6, a new theory was formulated on SEC. Thus, if a conflict was resolved for the benefit of 'x' number of communities directly involved in conflicts, then more than '2x' number of communities still believe that the conflict was not resolved due to the extended effects of conflicts that the researcher calls the '***Sparkling Effects of Conflicts'***. That is the reason why many conflicts re-emerge after extensive efforts to resolve the problem involving only the primary conflicting parties.

For example, suppose the conflict problems in Iraq are resolved or about to be resolved between the conflicting parties in the country. According to this study, there is twice the number of those conflicting parties who believe the problem has not been resolved because of the extended - 'sparkling' - effects of conflicts (SEC). Another example, the late King of Ethiopia, Haile Selassie the First (Ras Tafari) died in 1975 due to political conflicts in that country. However, there are still many people, especially among the Rastafarians, who do not believe in his death.

The SEC conflict theory helps to have an adequate understanding, increases awareness of the areas to be covered, and allocates the amount of useful resources required and the necessity for integrated approaches to the situations that arise during the process of conflict resolution. The theory also clearly indicates another option of confirming the availability and the transfer link between local and international water conflicts.

8.2.3.3 Input for Better Conflict Resolution Process

Most people and researchers believe that if the root cause of the problem of one situation is clearly known, it will be considered as if the problem is partially resolved. This approach does not fully work when it comes to conflicts because of the fact that a conflict could easily be understood but very difficult and complex to resolve. The study provides ***six additional tools*** that help to enhance the difficult conflict resolution process in low-income developing countries.

Tool-1. ***Conflict Location-Dependant Approaches****:* One of the findings of the research was the immediate positive impacts on conflict resolution practices between conflicting parties, which is the consideration of location in the conflict reconciliation process. In the view of this, the stakeholders participating in the resolution process should not seek after a neutral and independent location. Notably, they must understand, feel and recognize each conflicting party's location. *Location-dependant approaches* have a positive influence on the reconciliation process. The disadvantage of this is that conflict areas are not safe for a reconciliation process due to insecurity problems. In addition, some stakeholders may want to exploit a specific location for a potential political advantage that may affect the other party.

Tool-2. ***Sparkling Effects of Conflicts (SEC):*** An additional, important, but difficult, approach involves recognizing that all primary and secondary stakeholders are fundamental factors in the process of conflict resolution. The stakeholders could be categorised as natural primary conflicting parties and artificial secondary conflicting parties caused because of the *'sparkling effects of conflicts'.* In most of today's long-standing conflict areas, this is one of the major causes that has prevented conflicts from being quickly resolved. This approach helps to understand and closely monitor the problems in order to reduce the burdens on vulnerable communities.

Tool-3. ***The Use of both Traditional and Modern Practices:*** Another idea supportive of the conflict resolution process is the incorporation, balancing and validating of both *traditional and modern practices.* The process does not mean the dictation of one approach over the other. It is finding some kind of a balanced approach or co-existence of useful practices from both approaches that could help in resolving the problems. In most cases, traditional, indigenous or inter-cultural approaches are not

adequately recognised in conflict resolution processes as compared to modern approaches.

Tool-4. ***The Power of Quotations:*** Quotations are made from a combination of words that have a soft power to send strong messages. In addition, the studies showed the importance of *the tradition of using quotations* in conflict resolution processes.

Tool-5. ***The Natural Power of Women***: Another key recommendation on enhancing a conflict resolution process is the inclusion of representatives from a *women's* group. For instance, the positive rhetoric of "***ladies first***" tradition worldwide, which is practised in daily activity, should be upheld in high-level decision-making practices. This could help to have a better understanding of the social aspects of the problem.

Tool-6. ***Vulnerable Communities:*** In addition to women as indicated above, inclusion of representatives from *vulnerable members* of the community that are affected by local conflicts could speed up the resolution process. This tool helps to identify and clearly understand the intensity and diversity of the problems.

8.2.3.4 Conflict Neutralization

The findings of the research have a major impact on the process of neutralizing local water-conflicts and conflicts in general. The minimum/negative results of the DIPTI parameters indicate the availability and exposure to local conflicts, the maximum or positive values lead to the process of neutralization and resolution of conflicts.

8.2.4 On Achieving the Fourth Research Objective: Contributing a Policy Guideline to Reduce Local Water Conflicts

The research objective (OB-4) stated:

> **OB-4:** *To contribute a policy guideline* that helps to reduce local water conflicts in low-income developing countries mainly based on information generated from an appropriate pilot *water-conflict study location*.

The fourth objective of the research is to contribute a policy guideline for local water conflict management and establish a number of pilot water-conflict information sites. This is carried out in such a way that facilitates the further exploration and prediction of the low-income developing countries' water conflict problems, which in turn will be used for effective management of any outstanding water-conflict issues.

The first part of the objective is achieved by choosing the Afar region as one of the study areas for local water-conflicts in low-income developing countries (Chapter 1, 3 and 5). Evidence shows that the scarcity of local resources in the Afar region has been the cause of disputes over which people fight or engage in conflicts. Here, it is useful to note that another factor for selection is the region's complexity results from its overwhelming pressures of conflicts due to natural and human-induced problems. In addition, the Afar region is

considered as a well-known site where early hominid remains have been found (Lemke, 2010).

It needs to be reiterated that the primary study of any water conflict should start from a local-/low-level aspect in order to address the large international issues. Concurrently, the study should have to address the local issues at catchment area level. Perhaps, more importantly, local grassroots user communities and any stakeholders at the local level should be properly involved. In this regard, both the water conflict management (WaCoMa) factor and water conflict diversity factors (WCDF) should be integrated within any water or development-related projects in the region.

Proceeding from the discussion above, the second part of the objective (OB-4) is achieved by the pre-identification of a policy guideline matrix for local water conflict and the stages of preparedness and neutralization process (see Table 8.1 below). The table does not only show the links between a list of 10 performed tasks and key components of the objective that have been identified in all previous chapters of the research, but it also reveals the dimensions of local water conflicts and a list of the 180 identified WEC problems as the key foundation for developing a policy guideline. Furthermore, the table illustrates the link between various categories such as infrastructure and capacity-building, environmental and resource management, the economy, etc., amongst other factors and their direct or indirect links to local community problems that include: reducing risks that cause vulnerability, IWRM, peace and sustainable socio-economic development. Central to the idea of the policy guideline is that it lays emphasis on the critical role in the process as a contribution to the effective management of water conflict and other conflict-related crises in low-income countries.

Table 8-1: A policy guideline matrix for the local water conflict pre-identification, preparedness and neutralization process

Multidimensional approach to local water conflicts' in low-income developing countries (A policy guideline linked with a case study in the Afar Region/Ethiopia)				
Components of local water conflict: pre-identification and preparedness linked to key policy objectives	Key links to the 4th 'policy objectives' of the research X = *direct links to the policy* (X) = *indirect links to the policy*			
	Sustainable socio-economic development	IWRM	Peace and security	Reducing risks that cause vulnerability
1. INFRASTRUCTURE AND CAPACITY BUILDING				
• *Institutions and regulatory frameworks* (modern and traditional)	X	X	X	(X)
• *Stakeholders' and communities' participation* (e.g. pastoralists, local leaders, experts and other stakeholders at national, regional local and international level)	X	X	X	X
• *Strategic business partnerships* with local communities and other stakeholders (at national, regional and international level)	X	(X)	(X)	(X)

Multidimensional approach to local water conflicts' in low-income developing countries (A policy guideline linked with a case study in the Afar Region/Ethiopia)				
Components of local water conflict: pre-identification and preparedness linked to key policy objectives	Key links to the 4th 'policy objectives' of the research X = *direct links to the policy* (X) = *indirect links to the policy*			
	Sustainable socio-economic development	IWRM	Peace and security	Reducing risks that cause vulnerability
• *Providing* locally affordable and accessible *energy resources* that doesn't affect local environment	X	(X)	(X)	X
• *Infrastructural development* (transportation, school facilities, health services, water supply, communication, energy and financial services)	X	X	X	X
2. ENVIRONMENTAL MANAGEMENT				
• *Developing sustainable environmental management* practices at local level that helps to combat drought and other prevalent climate issues	X	X	X	X
3. ECONOMIC DEVELOPMENT				
• *Establish holistic economic development strategies* in the communities	X	X	X	X
• Promoting policies that enables the efficient ways of *management and ownership over water and other natural resources*	X	X	X	X
• *Controlling and monitoring financial inflations and regulations* that affect vulnerable communities	X	(X)	X	X
4. HEALTHCARE SERVICES				
• *Provision and improvement* of *local health services* (human and livestock)	X	X	X	X
5. POLITICAL STABILITY				
• *Enforcing policies and practices that promotes local political stability*	X	X	X	X
6. EDUCATION OPPORTUNITY				
• Improving opportunity to *education and skill acquisition programmes*	X	X	X	X
• Improving *appropriate research development and locally-based technology as a provider to solutions for water conflicts*	X	X	X	X
7. INFORMATION ACCESSIBILITY				
• Promoting local awareness and developing measures to enable the accessibility and utilization of *WEC (water, early warning and conflict) information*	X	X	X	X
8. PROTECTING VULNURABLE MEMBERS				
• Empowerment of *women and other vulnerable members* of the communities in *decision making processes*	X	X	X	X
9. CONFLICT MANAGEMENT				
• Improving the capacity to safeguard *peace and security* of the local communities.	X	X	X	X
• *The use of SEC (Sparkling Effects of Conflict) approaches* in addressing local water conflict studies, analysis and management	X	X	X	X
10. MONITORING AND EVALUATION				
• *Monitoring and evaluation* of locally implemented projects within the framework of DIPTI	X	X	X	X

8.3 Limitations of the Research

Glasman-Deal (2010), in her book on science research writing stated that the limitations of research are not to be regarded as a problem, rather they provide suggestions for future work; they are an invitation to the research community to improve the work in question.

This research puts forward justifications for the key factors that may possibly affect the validation process of the results. These suggest some limitations, which the researcher hopes, will encourage further investigation in the field of local water-conflicts.

8.3.1 Limitations on Observed Data

- Limited literature and information on local water-conflicts. This was observed through the inadequate number of journals, books and institutions focused on local water-conflict-related studies;
- The difficulty of finding an adequate number of pastoral communities because of their nomadic way of life;
- The difficulty of obtaining institutional respondents due to frequent and intensive meetings as most of institutions in the region belong to the government.

8.3.2 Limitations on Missing Data

- There are fewer female than male respondents in the survey. The reason for this was the traditional and religious influences within communities; it is difficult to talk privately with individual respondents, especially women. In addition, women in the region have many household responsibilities and do not have adequate time at their disposal.

8.3.3 Limitations Arising Through Possible Bias

- The research mainly focused on low-income developing countries but highlights the indirect impacts of local conflict and the need for strategic partnerships with low-income developing countries and developed countries in general.
- Fundamentally, most of formal and informal institutions in the region belong to the government and the probability of this being otherwise is very limited or zero. Among 26 local institutional respondents, 92% were involved with government institutions and the remaining 7% were with NGOs and private institutions. Hence, the feedback mainly reflects views found within government institutions based on the awareness of the service costs of conflicts.
- The traditional '*dhaagu*' communication system in the region speeds up the information flow within the communities and the researcher has found that sometimes respondents provide pre-prepared answers to some questions.
- Most respondents from government institutions seemed uncomfortable in responding to some politically sensitive questions.

- The study did not include more complex, unexpected and unpredictable conflicts that occur because of influences created by external special interest groups outside of the country.

8.4 Validity Chart of the Identification of the Research Topic

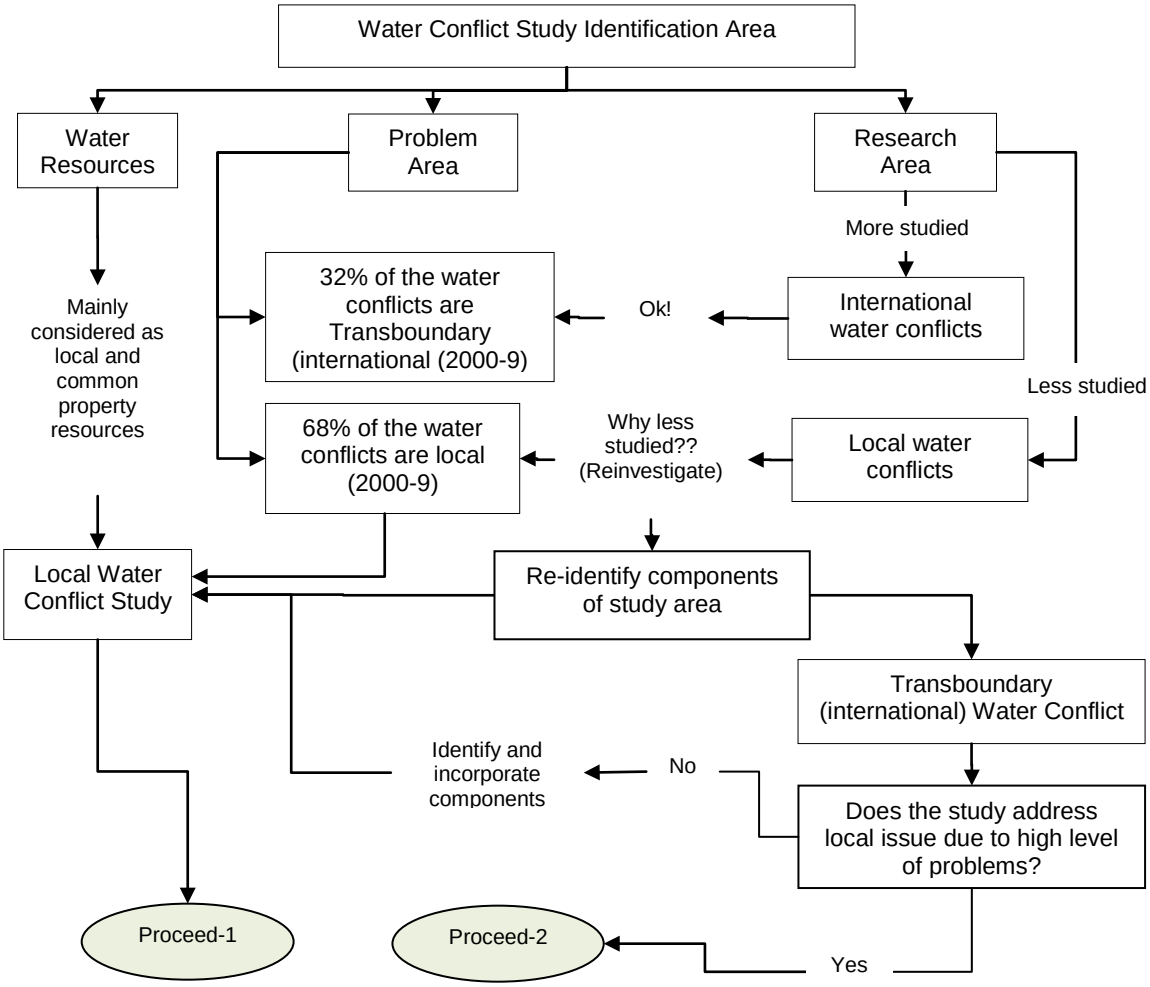


Figure 8-2: Validity chart of the identification of the research topic

8.5 Contribution to New Knowledge

The conceptual and practical contribution of this research to the creation of new knowledge is identified on the basis of detailed comparison and evaluations of the outcomes of the study in achieving the proposed aim and multiple objectives of the research. It is also based on the gaps to be found in the literature in the field of local water-conflict pre-identification and preparedness at early stages that will help to enhance the sustainable development of low-income developing countries.

Table 8.2 below indicates a list of 28 descriptions of the research contributions to theoretical and practical knowledge. The contributions to the theoretical findings include the development of new DIPTI framework models, the WEC information pyramid and the pillars of local water-

conflict that help the process of local-water-conflict identification, preparedness and neutralization activities.

The practical contribution parts of the study address the advantage of the co-existing link between the traditional and modern approaches to resolving water-related conflicts. It identifies key stakeholders who could participate in the process of identification of major problems in the region as well as addressing new approaches to conflict resolution. Both these approaches have been developed based on the facts and beliefs practised within local communities and institutions.

Table 8-2: Contribution of this research to theoretical and practical knowledge

List of Contributions to Knowledge		Types of Contribution
Chapters and Sections)	Description	
1. *The thesis (in general)*	The whole research paper contributes additional knowledge in the area of local water conflicts, which has not been investigated by other researchers (multidimensional approach to local water conflicts).	Theory-and-practice-based study together with methodology
2. *Chapters 1* §*1.2.3, and 2* §.*2.2*	Definition of local water-conflicts and redefining of conflicts.	Theoretical
3. *Chapters 1, 5 ,6 and 7*	Identification of trends in local water-conflict.	Theoretical and numerical
4. *Chapter 2* §*2.2.1*	Conflict problems and resolution road map model.	Theoretical and practical
5. *Chapter 2* §*2.2.4 and* §*2.2.5*	Mapping and designing an anatomy of conflict.	Theoretical
6. *Chapter 2* §*2.2.7*	Mapping information and probability of conflict (conceptual map).	Theoretical
7. *Chapter 2* §*2.3*	Mapping the dimensions of water conflict.	Theoretical
8. *Chapter 2* §*2.3.9*	A Conceptual Time-gap between Conflict and Conflict Management	Theoretical
9. *Chapter 2* §*2.3.10*	The Conceptual Map of the Boundaries of Disagreement-Dispute-Conflict -Violence.	Theoretical map
10. *Chapter 2* §*2.4.1*	Designing approaches to conflict study (Sparkling effects of conflicts).	Theoretical
11. *Chapter 2* §*2.5.4*	The use of quotations in traditional conflict-resolution.	Theoretical findings
12. *Chapters 2, 5 and 7(*§7.1 and §*7.2.4)*	Formulation of the WEC-sparkling effects of conflict (conflict factors that affect the internal and external communities in the ratio of 1:2).	Theoretical, numerical and practical findings
13. *Chapter 2* §*2.6.1*	Designing and mapping the anatomy of a conflict early warning system	Theoretical framework
14. *Chapter 3 Fig 3-6*	Mapping the Local Water-conflict Pre-Identification, Preparedness and EWS Variables and Flow Charts.	Theoretical model
15. *Chapter 4* §4.2.*1*	Mapping concepts of research validity.	Theoretical methodology
16. *Chapter 4* §4.3	Conceptual guideline for designing the research methodology (Fig 4.11).	Theoretical methodology

List of Contributions to Knowledge		Types of Contribution
Chapters and Sections)	Description	
17. *Chapter 3*	Key components of research design and frameworks (Fig. 3.3).	Theoretical and practical
18. *Chapter 3*	Local Water-conflict Early Warning System Conceptual Model (Fig. 3.5).	Conceptual model
19. *Chapter 5* §5.5	Identification of list of 180 main WEC problems in the Awash River Basin of the Afar Region, Ethiopia.	Practical findings
20. *Chapter 7 and 8 (*§7.3, §7.9, §8.2.1)	Formulation of Interrelated DIPTI Framework Models: DIPTI Directional for conflict pre-identification, DIPTI Matrix (Multidimensional) for early warning and preparedness, and DIPTI Cyclical Framework useful conflict neutralization/resolution. The core parameters incorporated in all frameworks are Information, Interaction, Tolerance/capacity, Preparedness and Sustainable Development (Conflict pre-identification/measurement process parameters)- (Fig.7-11, 7-42 7-43 and 7-44) and 8 (Fig.8-1).	Conceptual model
21. *Chapter 7* §*7.4*	Development of the WEC information pyramid (Fig. 7-13).	Conceptual model
22. *Chapter 7* §*7.3*	Pillars of local water-conflict pyramid.	Conceptual model
23. *Chapter 7*	Discussion on the contribution of useful traditional practices in the conflict resolution process and use of both the traditional and modern practices in conflict resolutions.	Theoretical and practical findings
24. *Chapters 5 and 7*	The findings that women are equally and more concerned with both social issues and physical fitness (health) as compared to men whose primary concerns are with physical fitness/health followed by social issues. A useful and advantageous cause for empowering women in conflict-prone areas.	Theoretical and practical findings
25. *Chapters 5 and 7*	The approach of conflict resolution through inclusion of each conflict and conflicting party's areas alternatively in the process of conflict reconciliation instead of always looking for neutral and independent areas. Location-dependant areas have a positive influence on the reconciliation process.	Theoretical and practical findings
26. *Chapter 5*	The link between Networking, Communication and Cooperation (NCC) in the aspects of conflict (Fig. 5-14).	Theoretical and numerical findings
27. *Chapter 7*	Identification of the need to improve harmful traditional and modern practices by giving equal attention.	Recommendations and practical findings
28. *Chapter 7 and 8 (§8.2.4, §8.2.1. and §7.10.2- Fig. 7.44)*	A policy guideline matrix for the local water conflict pre-identification, preparedness and neutralization process; introducing the concept of reducing local water conflicts through the process of promoting sustainable development that includes global and local strategic business partnership with local people, institutions and other stakeholders.	Theoretical and practical findings

8.6 Demonstration of Research Questions

In Chapter 7 (§7.2 - §7.10), the discussion, the presentation and the road map of the findings were framed to answer the primary and secondary research questions. In Chapter 3 (Table 3-1) of the framework of the study, all research questions are flagged to the corresponding research objectives. Here, the research questions, together with their major corresponding answers and the research objectives, will be highlighted.

Main Question: How can we pre-identify and prepare for local water conflicts in low-income developing countries?

The core research question, which is mainly linked with multiple objectives and the aim of the research project, is extended through five secondary questions and linked with corresponding objectives of the study. RQ1 mainly demonstrates the DIPTI framework model; RQ2 gives data and theories about WEC information and the sparkling effects of conflict; RQ3 provides answer about the role of stakeholders and strategic partnerships; RQ4 provides variables useful for hazard identification and the output of risk information; RQ5 reflects the implementation strategy of the developed framework for local water-conflict pre-identification, preparedness and early warning. The main research question answered through multiple secondary questions, is described as follows in connection with the objectives of the study.

Research Question 1: What type of frameworks, models or theories could be applied to pre-identify and prepare for local water related conflicts?

A multipurpose framework with five fundamental parameters has been developed, namely: contribution to sustainable Development, Information, Preparedness, Tolerance capacity and Interaction (DIPTI), as indicated in Chapter 3 of the framework of the study. Chapter 7 (§7-3 and Figure 7-11) presents a **DIPTI** directional framework model: a hierarchy, progression trend and milestone framework model for local water-conflict pre-identification, early warning and preparedness. Section 7-9 and Figure 7-42 of the chapter give the DIPTI Matrix (multidimensional) framework: *an integrated specific component framework model for local water-conflict pre-identification, early warning and preparedness in the Afar region*. Chapter 8 (§8.2 and Figure 8-1) provides a DIPTI cyclical framework: *a cyclical framework model for local water-conflict identification, early warning, preparedness and neutralization*. The study also found the “Sparkling Effects of Conflict (SEC)” presented in Chapter 2 (§2.4.1) and Chapter 7 (§7.1 and §7.2.4) to be a new approach to understanding and predicting the coverage of the effects of conflicts other than the primary conflicting parties and conflict location. In this Chapter (§8.2.3.3), a new approach to selecting a location for the conflict resolution processes was identified. The research question is answered by fulfilling the aims stated in the first research objective (OB-1) “*To investigate the state-of-the art* in the local water conflicts and develop a pre-identification, preparedness, early warning and conflict

neutralization framework model designed to *assist* policy makers, governments, international institutions, donors, military experts, at-risk vulnerable populations and other risk-affected stakeholders".

Research Question 2: What are the available and relevant data, theories, literature and information on pre-identification or management of local water-related conflicts or war?

The frameworks and issues stated in Chapter 7 (§7.4, Figures 7-13 to 7-25) deeply addressed the fundamentals of local WEC information identification and management. The type and relevancy of WEC data are based on over 116 variables indicated in Chapter 3 (Table 3-6), which are core parameters for 13 frameworks designed for this section. The issues addressed in answering this research question cover vast areas of the findings (Chapter 7 §7.4). The major area includes the identification of the core components of WEC data identification, management and availability as well as the use of traditional and modern systems that are practised in the region. The process also includes the boundaries of information analysis with respect to WEC (Figure 7-13). The question is highly related to addressing the second research objective (OB-2) *"To examine* the underlying problems*, information and dimensions of local water conflicts* by providing relevant and timely data supported by valid theoretical and practical findings".

Research Question 3: What are the types, roles, collaboration and links among local and international organizations or stakeholders like governments, the private sector, public institutions and NGOs participating in local water-conflict management areas?

Chapter 7 (§7.5) interprets, compares and frames the type of relationships, collaboration and links among different stakeholders in the region. It is focused on those who are participating in the process of local water resources and conflict management. This includes the identification of boundaries of interaction in the local area (§7.5.1); the key components of stakeholders' collaboration (Networking, Communication and Cooperation) are further discussed in this section (§7.5.2) and Chapter 6, the data analysis. This research question is closely related to three objectives (Chapter 3 of the Framework of the Study) of the research study: assist concerned local and international stakeholders (OB-1), develop an approach that encourage the prioritisation of water resources management (OB-3) and contribute a policy guideline based on information generated from local water-conflict study identification areas (OB-4).

Research Question 4: What are the main hazards, risks and costs associated with local water-conflict-related problems?

Chapter 3 (Table 3-6) provides the key variables useful for identification of hazards and risks related to local water-conflicts. The data presented in Chapter 5 (§5.4.4) and data analysis in Chapter 6 (§6.8) indicates that the Afar region is highly exposed to man-made and natural hazards and risks related to local water conflicts. In Chapter 5 (§5.5), a list of the identified

180 (23 categories) WEC hazards and risk problems in the Awash River Basin of the Afar region together with the level of intensity of problems are presented in detail. In Chapter 7, the discussion, the issues of giving equal attention to alleviating harmful traditional and modern practices at the local level were also given high attention. In addition, Chapter 7 (§7.6) frames the theoretical and practical findings of the three major risk factors. This includes, a model for the local vulnerability framework in the Afar region (Figure 7-35), mapping the local risk exposure status in the Afar region (Figure 7-36) and mapping the local Risk Reduction/mitigation awareness factors/opinions in the Afar region (Figure 7-37). In Appendix H, local communities' and institutions' opinions on the status of hazards and risks are tabulated and illustrated. This research question is linked to addressing the points emphasized in the third research objective (OB-3) "*To develop an approach* that prioritizes better water resources management and encourages optimum political, social, economic and traditional commitments".

Research Question 5: How can be tools like modelling (quantitative) and a policy indication guideline (qualitative) be applied in developing good local water conflict management frameworks in low-income developing countries?

Chapter 7 (§7.10.2) gives the application description of a framework of local water conflict management called the DIPTI framework (see Figure 7-42: DIPTI Matrix/multidimensional Framework: An Integrated Specific Component Framework Model for Local Water-conflict Pre-Identification, Early Warning, Preparedness and Neutralization in the Afar region). In particular, section 7.7 (Figures 7-38 to 7-40) explains the links among the key components of the process of local water-conflict early warning and preparedness. Chapter 8 (Table 8.1) displays components of the key links and the process of a policy guideline matrix for local water conflict pre-identification, preparedness and neutralization. The research question is linked to the fourth objective of the research (OB-4): "To contribute a policy guideline that helps to reduce local water conflicts in low-income developing countries mainly based on information generated from an appropriate pilot water-conflict study location".

8.7 The Need for Future Works

Scientific research is a continuous process that requires a number of improvements. Explaining the importance of future works in scientific research writing, Lebrun (2007) states, "**my work ends here, and now yours starts**". In the previous sections, the researcher has not addressed some of the potential areas of study that require future investigation. In the following sections (§8.8 and §8.9), the researcher presents two major issues: (1) the potential opportunities of this research as a foundation, and (2) reflection of the future work that this study has left for other researchers.

8.8 New Opportunities as a Result of this Research

This section emphasizes the research output as a base for future opportunities in terms of the following works **:**

- The research increases the level of local, inter-regional and international **strategic partnership alliances.** It promotes sustainable development and investment opportunities through prior awareness of the intensity of conflicts that help in reducing risks causing local conflicts. It also uniquely addresses the multidimensional sustainable links among communities and institutions working within different geographical boundaries.
- The study provides an additional **new approach for conflict resolution processes and the concept of conflict neutralization**. It reflects the need to consider the conflict area and the DIPTI-process-based approach to conflict resolution and conflict neutralization.
- The research enhances and provides great opportunities for **sustainable development** in low-income developing countries, as it is key factor in designing the DIPTI frameworks. The researcher strongly believes in the sequential approaches of promotion and implementation of the use of these key factors in any development activities irrespective of their primary role in local conflict identification, preparedness and neutralization efficiencies.
- The study will provide wide opportunities for the efficient and **sustainable use of common property natural resources** through increasing the positive awareness of WEC and on the process of responsibilities shared by all stakeholders and communities in the river basin.
- The research promotes the **efficient use and co-existence of useful traditional and modern practices** at local level in addition to its role in reducing the level of conflicts among different parties. It provides many alternative options for interactions among people in the neighbouring regions of the river basin. People start investing in confidence privately or jointly with other people, which helps to **maximize investment or economic opportunities** in the local region. The framework also helps in **facilitating feasible working environments for attracting** professionals, investors, local politicians and any other stakeholders who believe in a win-win business and development strategy.
- Political instability was one of the causes that fuel local water-conflicts and it affects the sustainable development of human resources in the region. This research opens up a door for approaches that bring opportunities for political stability. An efficient implementation of the study helps in providing a sound environment in the process for the **political stability, conflict resolution and conflict neutralization** activities.
- The findings of the study will bring wide opportunities and new approaches that can integrate the local area, working environment, working time, stakeholders and activities

and be directly helpful for local people within the framework of sustainable development. This approach helps in **reducing poverty** in the region.

- The output of the study re-emphasizes the contribution **for** proposing the participation of vulnerable groups in development activities, mainly on **empowering women**. This plays a great role in **reducing vulnerability**. It also addresses the concept of a local link under frameworks of widely acceptable ideas such as **"think locally, and act globally**".
- The study **narrows the information gap on local water-conflicts** by providing basic information about them together with a list of organizations working on conflict management; a list of key international professionals working on water conflict areas and a database that shows the anatomy of conflict.
- As a result of the study, the level of awareness of local traditions, the co-existence of useful modern and traditional practices and the livelihood of local people will be improved. In addition, it helps to measure and integrate their role or contribution in the opportunities of today's rapidly growing scientific world **[Contribution to knowledge].**

8.9 Indicating Future Research Directions for Other Researchers

This section raises the awareness level of researchers by highlighting opportunities for future research information identified across multiple directions of the direct and indirect outcomes of this study categorized in the next six sections.

8.9.1 Local Water-conflict Preventive Measures (Phase II of the Study)

- This research is phase one of the study, which is mainly focused on pre-identification and defining the WEC problems together with the DIPTI framework development for LWC early warning systems. As a result of communication, dissemination and implementation of the research, **phase II of the study** should be focused on measures taken on **preventive action** for the LWC problems. Phase II of the study requires further technical and non-technical information including better **modern and traditional organizational structures** to reduce potential hazards and risks causing conflicts.
- There was no standard for measuring the **magnitude** of the scale of **conflicts** that lead to violence crises. This study proposes **future work on establishing ways of identifying the intensity and magnitude of a conflict** in order to speed up decision-making processes.

8.9.2 Application Software Development (Database, GIS and Web Page)

- **Visualization and Database Development**: Detailed LWC data analysis and forecasting methods should be carried out using different computer software like GIS (a system for visualization of data in association with the real geographical coordinates) and the use of advanced use of Microsoft Access Program for database development.

- Interactive **Webpage Development:** Developing an integrated and interactive web page related to local water resources, local water-conflicts and local institutions that address the issues of local communities having a reliable central system for decision makers but that can help the vulnerable communities and all stakeholders involved in **creating a** sustainable environment for strategic investment opportunities.

8.9.3 Establishing an Academic Science Journal Home Page on Local Conflicts

- An academic, inter-sectoral, science journal useful for publishing issues related to local conflicts, local water-conflicts, **vulnerable communities,** and the improvement of harmful traditional and modern practices. Establishment of such a journal will enhance sustainable development, with a special focus on low-income developing countries.
- To make progress in drafting **international guidelines** for incorporation or addressing the issues of global concern regarding **vulnerable communities** connected with any stakeholder, including governments, NGOs and the public and private sectors in order to enhance local activities (investment, finance, economy, loan, politics, etc.).

8.9.4 Establishment of International Advocacy Groups

- Establishing and strengthening the advocacy group dealing with **wetland protection** having different levels of NCC at international, national, regional and local levels.
- Strengthening and reforming the **duties and obligations of the UN and international financial regulations** on efficiently addressing the need of vulnerable communities. In addition, establish a system to monitor and improve the effects of poor UN regulations on vulnerable communities. This also includes r**anking** each country's accountability in terms of addressing issues related to **vulnerability problems**.

8.9.5 Instructional/Teaching Media on DIPTI Water Conflict Parameters

Preparing a short educational media presentation on DIPTI conflict parameters, which might take from 15 to 30 minutes. It is hoped that this will play a key role in neutralizing local conflicts, especially in low-income developing and conflict-prone areas.

8.9.6 Further Studies on Conflict NCC and SEC

- Establishing a dynamic research centre to address a better strategic partnership involving useful and compatible traditional and modern practices and improved resource utilization within the framework of local and global partnerships.
- An in-depth study on the measurement of a correlation linking the processes of Networking, Communication and Cooperation in defining conflicts and resolution activities.
- An in-depth study on the sparkling effects of conflicts (SEC) related to local grassroots communities and the influences of regional and international powers.

- An in-depth study on enhancing the necessary tools for the processes involved in different types of conflicts neutralization activities.
- Organize quotations relating to water conflicts and conflicts in general in the form of a book/web/database.

8.10 Chapter Summary

A process-based integrated framework was developed as the core component of the findings of the research that includes the pillars of conflict pyramid, the WEC information pyramid, DIPTI-process-based parameters and the sparkling effects of conflict. In covering the information gap on local WEC data availability and accessibility, the researcher has identified the necessary parameters and information needed on water resources, early warning and conflict as well as information on the effects of hydro-climatic situations.

The researcher has highlighted some points that point to the future direction of the process of proving the results on the hypothesis on the local water-conflict pre-identification and preparedness model as well as further testing the appropriate framework for the application of the results. The implementation of the research is left open for anyone who wants to develop alternative implementation frameworks that could improve the sustainable development of low-income developing countries through resolving or reducing local water-conflicts.

A framework for local water-conflict identification and preparedness (early warning system) was developed. The vital importance of empowering women and enhancing their participation, together with other vulnerable groups, in communities at local level and their role in resolving or reducing conflicts was clearly addressed and relevant areas of importance highlighted. The researcher has clearly reflected and formulated the importance, the link and the framework of a system for sustainable development in low-income developing countries suitable for reducing local water-conflict-related problems. The research provides information on the increasing level of cooperation and understanding of the rationale of international strategic partnerships with local people and institutions in developing countries.

The research demonstrated that there was limited literature and information on local water-conflicts. Because of this weakness, the researcher has collected extensive multi-sectorial data useful for understanding the status of local water-conflicts. The study has identified the key stakeholder communities and institutions in WEC-related activities. As a result of the sparkling effects of local conflicts, the researcher has shown and emphasized the possible direction and approaches for the conflict resolution processes.

It was identified that there was limited information and theory on local water-conflicts while the problem is increasing exponentially because many researchers are mainly interested on studying conflicts related to transboundary rivers. There are unfavourable environmental

conditions, and limited funds, for studying local water-conflicts as compared to international water conflicts.

Equal attention was not given to harmful traditional and modern practices that affect the development of local areas. For instance, the natural potential of women was not adequately utilized in some low-income developing countries as well as in conflict-prone areas. There was a gap in focusing the advantage of co-existence between useful traditional and modern practices in resolving problems as well as in enhancing sustainable developments. The researcher has emphasized the importance of the co-existence of useful traditional and modern practices as opposed to harmful practices. In the world, people will have a balanced sustainable view if they re-consider useful traditional practices in the process of constructing future modern development based on old experiences.

This chapter has further discussed the limitations on observed and missing data as well as the possible bias. Most importantly, a list of 28 of the researchers' contributions was provided for future researchers who may be interested in this field of study.

New opportunities that have appeared because of this research were mainly in the direction of inter-regional and international strategic alliances, together with an understanding and utilization of DIPTI local-water-conflict parameters. It also includes approaches for the maximization of efficient investment approaches through sustainable economic opportunities, the creation of political stability through the conflict resolution process and reducing factors that affect vulnerable communities.

The researcher has properly addressed the research's contribution to knowledge and the need for more information on LWCs. The researcher has also identified the gaps in knowledge and exposed topics relevant to future research directions.

The major categories of areas of study include phase II of local water-conflict preventive actions, database management software development, recommendation of the need for an Academic Science Journal on local conflicts, the founding and development of international advocacy groups, teaching media on the DIPTI parameters and the need for further studies in the areas of the sparkling effects of conflicts.

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Appendices

A

APPENDIX A: ADMINISTRATIVE AND AWASH RIVER BASIN MAP OF ETHIOPIA

Appendix A 1: Administrative Regions and Zones of Ethiopia

APPENDIX B: LIST OF SURVEY QUESTIONNAIRES AND FIELD TRIP INFORMATION

Appendix B 1: Field trip support letter:

Water, Engineering and
Development Centre (WEDC)
John Pickford Building
Loughborough University
Leicestershire
LE11 3TU
UK

To whom it may concerns

Mr. Azage Gebreyohannes Gebremariam, a PhD research scholar, from Water, Engineering and Development Centre (WEDC) Loughborough University, UK is undertaking fieldwork in Ethiopia. He will be in Ethiopia for almost two months from 15/9/09. His study is looking into ways of how local water conflicts can be predicted and prevented. He intends to develop an early warning system based on the filed work in Ethiopia.

We will be grateful if you could spare your valuable time to give him information, your views and comments. For sensitive issues the respondents will remain anonymous. We hope that his work will be of interest to you and your organisation.

WEDC is one of the world's leading education and research institutes for improving access to infrastructure and services for the poor in low- and middle-income countries. [URL: http://wedc.lboro.ac.uk]

Sincerely,

Professor M. Sohail
Professor of Sustainable Infrastructure
BEng, MSc, PhD (UK), Fellow ASCE (USA)
Leader of Research and Consultancy
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Appendix B 2: Survey Questions on local communities/Population-Part I:

Survey Questionnaires on Early Warnings System on Local Water Conflicts

Ques. No. *LC-LP-002*

Description/Strata of local area: ☐ *Farmers,* ☐ *Pastoralists,* ☐ *Nomads,* ☐ *Semi-Urban,* ☐ *Urban*

☐ *Others (describe):* _____

Part 1: About the Survey:

The aim of this survey is to investigate the necessary parameters and collect data that helps to develop an early warning system on local water conflicts. Furthermore, the output of the survey helps to formulate effective strategy or guideline which helps to defuse conflicts over local water resources. We are looking forward to obtain your views and comments on information regarding local conflicts over shared water resources, negotiation practices, and any related information on Ethiopia and in developing countries in general.

You have been randomly selected to participate in this survey of local water conflict. Your assistance in this survey would have been much appreciated. Hence, we would like to get your opinion on some important issues mentioned in the questionnaire. You are kindly requested to spare a few minutes to help complete a survey. A scientific report will be safely published in a way it will not provide any respondent's name and other detail information who participated in answering this questionnaire. The given information will be kept strictly confidential in accordance with (ETHIOPIOAN) Data Protection Act…… .

Thank you very much!

Part 2: General information:

1) Respondent's address and related information

Name of respondent: *[Name OF RESPONDANT IS NOT NECESSARLY REQUIRED]*			Sex:	☐ Male ☐ Female
			Age:	
Address:	Region: _____	'Wereda': _____	'Kebele': _____	
Marital status	☐ Married, ☐ Single, , ☐ Engaged, ☐ Separated, ☐ Divorced, ☐ Widowed			
Respondent's work:	☐ Farmer, ☐ Nomad, ☐ Pastoralist, ☐ Gov. employee, ☐ NGO employee, ☐ Trader/private, ☐ Student ☐ No job			
Organization(If available):				

Education:	
Religion:	
Language spoken:	
Are you member of any social groups in your local area? If yes please select the appropriate box *[CAU-1]*	☐ Cooperative unions ☐ *Edir*, ☐ *Equb*, ☐ Political party, ☐ Any ethnic groups, ☐ Community dev't ☐ Others _____

Respondent's role in relation to water supply activity:	

Location (in geographical point of views) O Upstream O Downstream O In between

How long have you been living in this area (in years)? *[AN1-]* _____

How did you choose this location for living? *[AN1-]* _____

2) *General information on number of household members and average water consumption:*

Age groups	**Household members**			**Daily average water consumption**		**Specific problem in relation to water use**
	Male	**Female**	**Total**	**litre/person**	**Total**	
Below 1 year (infants)						
2-14 years (Children)						1.
						2.
15-24 years (Youth)						1.
						2.
25-**50 years** (**Adults**)						1.
						2.
51-65 years (**Adults**)						1.
						2.
65 years and over (Seniors)						1.
						2.

3) *Basic information on household members education:*

Level of household members education or illiteracy	School attendance			Monthly average gross income and expense (Birr/Person)		Remarks
	Male	Female	Total	Income (Birr/Person)	Expense (Birr/Persons)	
A. Illiterate/Uneducated:						
1.Children (7-15)						
2. Youth (16-24)						
3. Adults (25-50)						
4. Adults (51-65)						
5. Seniors (over 65 years)						
A. literate/Educated:						
1. Reading and writing only:						
2. Primary school (grade 1-6):						
3. Junior secondary school (grade 7-8):						
4. Senior secondary school (grade 9-12)						
5. Certificate (≤12+1):						
6. Diploma (≤12+ 2):						
7. Degree (≤12+4):						
8. Above (12+4):						
Total						

Part 3: Information on the vulnerable group of people

4) *List of vulnerable people in a household*

List	Gender			Remarks
	Male	Female	Total	
Children (7-15)				
Women (16-65)				
Seniors (old people above 65)				
People with disabilities (physically & mentally)				
Others (e.g. immigrants, displaced people, etc.)				

5) *Approximately, how many homeless people do you know in your local area?*

6) *Why do you think they are homeless?*

7) *How did you get any information related to early warning situations?*

8) *How did you see the trends or changes in the number of homeless people living in your local area during the last 5 years?*

O Increasing O Decreasing O Fluctuating O Constant/stable O I don't know

9) *Exposure for vulnerability during the last 5 years: What is your personal opinion regarding local communities vulnerability exposure towards unemployment, homelessness, financial expenses and poor water supplies?*

*A. **Unemployment***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. The rate of unemployment is decreasing in the area.	O	O	O	O	O
2. The number of homeless people in the local area is decreasing.	O	O	O	O	O

*B. **Income and Expense***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
3. Satisfied by average daily/monthly incomes	O	O	O	O	O
4. Average daily/monthly expense or debt is less than the respective income	O	O	O	O	O

*C. **Clean, adequate and affordable water supplies***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
5. People are getting *clean*, adequate and affordable water supplies during the last 5 years	O	O	O	O	O
6. People are getting *adequate* water supplies during the last 5 years	O	O	O	O	O
7. People are getting *affordable* water supplies during the last 5 years	O	O	O	O	O

Part 4: Daily Water Consumption Information

10) *Do you have any information regarding local unit of measurement for water collection? If yes, please indicate it in the next table.*

No.	Name of local UNIT of measurement	Estimated volume in LITRE	How many UNITS do you require for a household members?		Remarks
			Litre/day	Litre/Week	
1					
2					
3					

11) ***Water resources and ownership status**: Please, indicate list of key water supply resources beneficial for the local communities.*

No.	List of water supply resources	Total number of water resources	Ownership the resources
1			☐ Private, ☐ Communal, ☐ Municipal/Gov., ☐ Others:_____
2			☐ Private, ☐ Communal, ☐ Municipal/Gov., ☐ Others:_____
3			☐ Private, ☐ Communal, ☐ Municipal/Gov., ☐ Others:_____

12) ***Water collection frequency**: Could you please indicate the amount of travel frequency and number of people who participates in collecting water?*

Source		Time (*hh:mm*)			People	Frequency	
Water sources (e.g. Spring, borehole, river, etc.)	Purpose	Travel time	Waiting time	Return time	Who collects water (*number per household*)	Travel frequency (*number/person*)	
						Daily	Weekly

13) ***Water consumption**: Please estimate the amount of water collected by all members of your household used for domestic and non domestic services during the year 2000(2007/8).*

Purpose of water collection	Sources for water supply	Water consumption		How many times do you collect water? (frequency) *[CMY]*	
		Unit of measurement	Amount collected	Daily	Weekly
1. Household purposes:					
1.1. Drinking					
1.2. Washing clothes					
1.3. Bathing					
1.4. Cooking					
1.5. Other (specify)					
2. Livestock					
3. Agriculture					
4. Other (Specify)					

14) ***Water consumption satisfaction**: Please indicate your satisfaction/dissatisfaction regarding local water consumptions used for domestic and non-domestic services during the last 5 years.*

No.	Purpose	Rate of satisfaction in water consumption					NOT APPLICABLE
		Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied	
1.	Household uses *[DS]*	☐	☐	☐	☐	☐	☐
2.	Irrigation (agriculture) *[NDS]*	☐	☐	☐	☐	☐	☐
3.	Commercial *[NDS]*	☐	☐	☐	☐	☐	☐
4.	Industrial *[NDS]*	☐	☐	☐	☐	☐	☐
5.	Livestock *[NDS]*	☐	☐	☐	☐	☐	☐
6.	Religious or other community services *[NDS]*	☐	☐	☐	☐	☐	☐
7.	Others *[NDS]*:_____	☐	☐	☐	☐	☐	☐

15) *Please indicate the rate of your satisfaction regarding the qualities of water supplies since the last 5 years?*

O Highly satisfied,

O Satisfied,

O Neither satisfied nor dissatisfied,

O Least satisfied,

O Not satisfied,

What is the main reason for rating the above satisfaction?

_____

16) *What are the main factors that affect the qualities of local water resources?*

A. Technical factors:

_____

_____

B. Administrative factors:

_____

_____

C. Natural factors:

_____

_____

17) *What are the main factors that affect the quantities of local water resources?*

_____

_____

18) *Should you please indicate the main types of information that you want to know/use about the local water resources?*

No.	Types of information	Who should be the responsible organization for this information?	Why do you want this information?
1			
2			
3			

19) *Please list the key resource owners of the local water supply (e.g. Government, community, NGO, religious groups, military, etc.).*

No.	Water resources	Who shares the resources?	Who is the owner of the resource?	Do you agree/disagree on the resource ownership					Any comment on ownership
				Strongly agree	Agree	Disagree	Neither agree nor disagree	Strongly Disagree	
1				O	O	O	O	O	
2				O	O	O	O	O	
3				O	O	O	O	O	

Part 5: Hydro-climatic information

20) *Do you know any traditional or local or modern type of climate/weather prediction program/approach implemented in your local area during the last 5 years?* ☐ *Yes,* ☐ *No*

If yes, please list them down.

	Traditional/modern ways of climate/weather prediction programmes/activities	Estimated accuracy rate
1.		☐ *100%,* ☐ *75%,* ☐ *50%,* ☐ *25%,* ☐ *less than 25%*
2.		☐ *100%,* ☐ *75%,* ☐ *50%,* ☐ *25%,* ☐ *less than 25%*
3.		☐ *100%,* ☐ *75%,* ☐ *50%,* ☐ *25%,* ☐ *less than 25%*

21) Please, explain shortly about effects of climate change on your local family members

Year	*Effects of climate change*

Part 6: Communication/networking

22) Could you please list the group name and size of your neighbour communities or people who share the same water resources? [List any grouping including overlapping categories]

No.	Group name	Approximate number of people
1		
2		
3		

23) How did you hear about services or any information regarding your local area or neighbour communities?

Prioritize sources of your information by putting numbers in the Check-box: (1, 2, 3, 4, 5, 6, 7 & 8)	How do you rate the accuracy of the information	Specify your reason for rating
☐ Friend or family	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Newspaper	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Television	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Radio	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Flyer	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Meeting (e.g. Agricultural extension, political, religious, etc.)	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ traditional specify_____	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	
☐ Any other, please specify_____	O Accurate , O Partially accurate, O Not reliable and needs other sources to cross check O Not available	

24) *Please provide us the available list of traditional or modern type of communications or networking activities practiced between the two communities sharing the same water resources.*

*A. **Traditional**: Please indicate any traditional ways of social communication or networking activities known by the members of the local community.*

Types of social communications or networking	Main purpose of communication/net working	Level of communication/networking	Remarks
		O Normal , O Increasing, O Decreasing	
		O Normal , O Increasing, O Decreasing	
		O Normal , O Increasing, O Decreasing	

*B. **Modern**: Please indicate any modern ways of social communication or networking activities known by the members of the local community.*

Types of social communications or networking	Main purpose of communication /networking	Level of communication/networking	Remarks
		O Normal , O Increasing, O Decreasing	
		O Normal , O Increasing, O Decreasing	
		O Normal , O Increasing, O Decreasing	

25) *Please select the type of communications and networking activities available among the communities sharing, developing or managing the same water resources.*

Types of relationships	Level of communication	If NEGATIVE why?	Any recommendation
Religion	O Normal , O Positive, O Negative		
Language	O Normal , O Positive, O Negative		
Ethnicity/race	O Normal , O Positive, O Negative		
Political	O Normal , O Positive, O Negative		
Natural resources such as water	O Normal , O Positive, O Negative		
Economy	O Normal , O Positive, O Negative		
Territory/border related issues	O Normal , O Positive, O Negative		

26) *Thinking back to your discussion with some one who was sharing water resources with you, how do you evaluate the rate of your communication with this person?*

Title	Type of communication	Why?
How do you rate your communication style	O Passive , O Aggressive, O Assertive	
How do you rate the other person's communication style	O Passive , O Aggressive, O Assertive	

27) *Cooperation and communication:*

A. General Local Cooperation: *How do you generally evaluate or rate your level of cooperation with the other local groups?*

O Very good (high) , O Good (medium), O Less (minimum)), O Bad (not good)

If so, why and how? _____

_____

B. General Local Communication: *How do you generally evaluate or rate your level of communication with the other local groups?*

O Very good (high) , O Good (medium), O Less (minimum)), O Bad (not good)

If so, why and how? _____

_____

28) *Which language are you using during your communication or networking activity with those sharing the same water resources?*

Type of language	Type of communication
	O Frequently , O Sometimes only
	O Frequently , O Sometimes only
	O Frequently , O Sometimes only

29) *Please indicate if you know the availability of any communication problems related to those people sharing the same natural resources in your area?*

_____

_____

Part 7: Identification of individuals exposed to hazards,

30) *Please list the main natural and man-made hazards and risks occurred in your local area during the last 5 years (e.g. Risks on water bodies or any);*

A. Natural hazards:

Year	List of hazards	Estimation of damage measurement		Hazard and probability of occurrence		
		Number of people exposed or affected	Damage or exposure estimation in terms of money (BIRR)	Severity	Types of hazard	Probability of occurrence
				O Catastrophic, O Critical, O Major, O Moderate , O Minor	O Natural, O Man-made O Both	O Frequently , O Occasionally, O Unlikely
				O Catastrophic,	O Natural,	O Frequently ,

Year	List of hazards	Estimation of damage measurement		Hazard and probability of occurrence		
		Number of people exposed or affected	Damage or exposure estimation in terms of money (BIRR)	Severity	Types of hazard	Probability of occurrence
				○ Critical, ○ Major, ○ Moderate , ○ Minor	○ Man-made ○ Both	○ Occasionally, ○ Unlikely
				○ Catastrophic, ○ Critical, ○ Major, ○ Moderate , ○ Minor	○ Natural, ○ Man-made ○ Both	○ Frequently , ○ Occasionally, ○ Unlikely

B. Man-made hazards:

Year	List of hazards	Estimation of damage measurement		Hazard and probability of occurrence		
		Number of people exposed or affected	Damage or exposure estimation in terms of money (BIRR)	Severity	Types of hazard	Probability of occurrence
				○ Catastrophic, ○ Critical, ○ Major, ○ Moderate , ○ Minor	○ Natural, ○ Man-made ○ Both	○ Frequently , ○ Occasionally, ○ Unlikely
				○ Catastrophic, ○ Critical, ○ Major, ○ Moderate , ○ Minor	○ Natural, ○ Man-made ○ Both	○ Frequently , ○ Occasionally, ○ Unlikely

[For more information, please use the back of this page]

31) *Is there any water related development projects such as hydropower, irrigation, dam, etc., which are directly or indirectly related to your local area?*

○ *Yes* , ○ *No*

If yes, could you please list any damages/problems that affected the local communities livelihood as a result of the negative impacts of the project?

1. _____
2. _____
3. _____

32) *Would you please explain some of the local water resources protection techniques applied by individuals, communities, governmental institutions, nongovernmental organizations or others?*

Description of the resource protection	Who protects the water resources	Methods of protection	Who was exposed to potential risks if the resource was not protected?	Work schedule for protection
	☐ *Individuals,* ☐ *Local communities,* ☐ *Government,* ☐ *NGO's* ☐ *Others*_____	○ *Modern,* ○ *Traditional,* ○ *Both*	○ *Individuals,* ○ *Communities,* ○ *Others*	○ *Daily,* ○ Weekly, ○ *Monthly,* ○ Yearly ○ *Occasionally*

Description of the resource protection	**Who protects the water resources**	**Methods of protection**	**Who was exposed to potential risks if the resource was not protected?**	**Work schedule for protection**
	☐ *Individuals,* ☐ *Local communities,* ☐ *Government,* ☐ *NGO's* ☐ *Others______*	○ *Modern,* ○ *Traditional,* ○ *Both*	○ *Individuals,* ○ *Communities,* ○ *Others*	○ *Daily,* ○ Weekly, ○ *Monthly,* ○ Yearly ○ *Occasionally*
	☐ *Individuals,* ☐ *Local communities,* ☐ *Government,* ☐ *NGO's* ☐ *Others______*	○ *Modern,* ○ *Traditional,* ○ *Both*	○ *Individuals,* ○ *Communities,* ○ *Others*	○ *Daily,* ○ Weekly, ○ *Monthly,* ○ Yearly ○ *Occasionally*

33) The current status of water resources

Types/components of the local water resources	**Functionality status**	**Exposure to risks**	**Local capacity for maintenance**
	○ functional, ○ partially functional, ○ not functional, ○ abandon ,	○ High, ○ Medium, ○ Less, ○ Not exposed	○ Available , ○ Partially available, ○ Not available
	○ functional, ○ partially functional, ○ not functional, ○ abandon ,	○ High, ○ Medium, ○ Less, ○ Not exposed	○ Available , ○ Partially available, ○ Not available
	○ functional, ○ partially functional, ○ not functional, ○ abandon ,	○ High, ○ Medium, ○ Less, ○ Not exposed	○ Available , ○ Partially available, ○ Not available
	○ functional, ○ partially functional, ○ not functional, ○ abandon ,	○ High, ○ Medium, ○ Less, ○ Not exposed	○ Available , ○ Partially available, ○ Not available

34) Identification of local communities exposed to risks related to local water conflicts during the last five years - at family level [TFI]:

Victims or patients category in a family	**Number of people exposed to the problem**						**Status during the last 5 years**
	Verbal aggression	Physical aggression	Indecent *(impolite)* exposure	Arson *(inflammable)*	Acquisitive *(greedy)*	Sexual abuse	
Patients							○ Increasing ○ Decreasing ○ No change
Children							○ Increasing ○ Decreasing ○ No change

Victims or patients category in a family	Number of people exposed to the problem						Status during the last 5 years
	Verbal aggression	Physical aggression	Indecent *(impolite)* exposure	Arson *(inflam mable)*	Acquisitive *(greedy)*	Sexual abuse	
Adult Men							O Increasing O Decreasing O No change
Adult Women							O Increasing O Decreasing O No change
Property							O Increasing O Decreasing O No change
Others							O Increasing O Decreasing O No change

Acquisitive: eager to acquire and possess things especially material possessions or ideas

Part 8: Identification of the root causes of local water conflicts:

35) What would be the main sources of local conflicts related to water resources or any other?

_____

_____

36) How often local water conflicts occur in your area?

O Frequently,
O Occasionally,
O Suddenly,
O Slowly,
O Others (Specify) _____

37) What are the main causes of conflicts in your local area? How frequently do you experience conflicts in general?

Causes of conflicts	Frequency of conflict occurrence
Water resources	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Natural resources (other than water)	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Economy	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Religion	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____

Causes of conflicts	Frequency of conflict occurrence
Language	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Economy	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Ethnicity/race	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Politics	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Territory/border related issues	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____
Other (specify)	O Daily, O Weekly, O Monthly, O Yearly, O Others (Specify) _____

38) *Could you please indicate the rate and types of conflict that have been happening in your local area in relation to water resources and any other related aspects?*

Types of conflict	Rate of occurrence
Simple disagreement	O Frequently, O Occasionally, O Slowly, O None
Dispute	O Frequently, O Occasionally, O Slowly, O None
Conflict	O Frequently, O Occasionally, O Slowly, O None
Violence	O Frequently, O Occasionally, O Slowly, O None

39) *Could you please indicate any methods applied in resolving local conflicts?*

Description and methods used in resolving conflicts	Describe in detail
☐ Modern ways applied	
☐ Traditional ways used	
☐ Partnership approach	
☐ Places chosen for conflict resolution	
☐ Any forgiveness skill applied	
☐ What processes/procedures followed?	
☐ Who involved in the resolution process?	

40) *What are your feelings whenever thinking about the economic, politics, health, drought and ethnicity situations of your local area as compared to other local areas?* [DoC]

Socio economic diversity factors	Expression of satisfaction or feelings	Areas of the diversity intervention (coverage of the problem)
Economic activity	O Positive, O Negative, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban
Political situations	O Positive, O Negative, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban

Socio economic diversity factors	Expression of satisfaction or feelings	Areas of the diversity intervention (coverage of the problem)
Health situations	O Positive, O Negative, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban
Natural resources condition	O Positive, O Negative, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban
Drought incidents	O High, O Minimum, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban
Political accommodation of different ethnic groups	O Positive, O Negative, O No change	☐ Local, ☐ National, ☐ International, ☐ Urban

41) *Do you know any list of resolved and unresolved local conflicts that occurred during the last five years?* O Yes, O No; *If yes please answer the next two questions.*

a. List of resolved conflicts:

What happened?		Conflicting parties	How resolved?			Remarks
Description	Year (EC)		Agreed resolution	Other parties participated	Year	
	2000					
	1999					
	1998					
	1997					
	1996					

b. List of unresolved conflicts:

What happened?		Current status	Conflicting parties	Why not resolved?		
Description	Year (EC)			Reason-1	Reason-2	Reason-3
	2000					
	1999					
	1998					
	1997					
	1996					

Part 9: Identification of actions taken to reduce water related risks,

42) *Would you please describe any measures or actions taken in reducing risks associated to local water resources during the last five years?*

List of actions taken	Year (EC)	Who supported or participated in this activity? (INPUT)	What was the results of the actions? (OUTPUT)
	2000		
	1999		
	1998		
	1997		
	1996		

Part 10: Identification of local water conflicts or factors that ignites conflicts over water and effective responses and preparedness towards the problem

43) Could you please indicate the impacts of conflict on your family members residing in this local area?

Description the problem	Estimated loss in item	Estimated loss in BIRR

44) Could you please rank and describe the most serious problems that affect the day-to-day activities and socio-economic developments of the local people?

Description (Major global conflict areas)	Status/ranks of the problem that occurred on local communities as a result of the impacts of conflicts					Main reason for ranking
	Critical problem [1]	Major problem [2]	Moderate problem [3]	Minor problem [4]	Not applicable [5]	
Financial inflation problems	O	O	O	O	O	
Water related problems	O	O	O	O	O	
Health related problems (e.g. AIDS, Tb, Malaria, etc.)	O	O	O	O	O	
Internet related problems	O	O	O	O	O	
Other problems (please specify:_____	O	O	O	O	O	

45) Identification and growth rate of armies movement within the community. This information does not deal about issues related to formal or informal government military information- [WITOA]

A. Traditional believes about the use of gun

Who handles gun in the community?	Why

B. Do crime activities in the local area include any traditional or conventional weapons? O Yes, O No;

If yes, please list down the type of incidents and weapons used.

No.	Categories of incidents	Weapons used
2.		
3.		

C. Could you please indicate the frequency of handguns handling within different groups of the local communities?

Groups of the communities	How often do they use handguns?				Main reason for using handguns
	Frequently	Occasionally	Unlikely	None	
1. Urban	O	O	O	O	
2. Rural	O	O	O	O	
3. Farmers	O	O	O	O	

Groups of the communities	How often do they use handguns?				Main reason for using handguns
	Frequently	Occasionally	Unlikely	None	
4. Pastoralists	○	○	○	○	
5. Nomads	○	○	○	○	
6. Others	○	○	○	○	

D. Identification of gun movement at local level

Sources of gun providers for local communities	Distribution of gun providers	Eligibility of the distributors	Trends during the last 5 years
	☐ Local, ☐ Regional, ☐ National, ☐ International	☐ Legal, ☐ Illegal	○ Increasing, ○ decreasing ○ No change
	☐ Local, ☐ Regional, ☐ National, ☐ International	☐ Legal, ☐ Illegal	○ Increasing, ○ decreasing ○ No change
	☐ Local, ☐ Regional, ☐ National, ☐ International	☐ Legal, ☐ Illegal	○ Increasing, ○ decreasing ○ No change

E. Is there any regulation for controlling the local gun movement? ○ Yes, ○ No;
If yes, please fill the following table [RAGM]

List of guns control regulations/traditions	Level of distribution area	Government recognition
	☐ Local, ☐ Regional, ☐ National	☐ Recognised, ☐ Not recognised
	☐ Local, ☐ Regional, ☐ National	☐ Recognised, ☐ Not recognised
	☐ Local, ☐ Regional, ☐ National	☐ Recognised, ☐ Not recognised

F. What should be done in order to avoid or reduce any conflicts related to natural resources at local level?

1. _____
2. _____
3. _____

G. Please identify if you know any local conflict management practices or tools implemented so far?

1. _____
2. _____
3. _____

H. Have you ever involved in conflicts? ○ Yes, ○ No;
If yes, what is your experience or the local traditional practices of the people responding towards water conflict or conflict in general?

1. _____
2. _____
3. _____

Part 11: Consideration of timely warning (EWS and lead time)[14]

46) *What are the available traditional knowledge, practices and contribution to the member's of the local community in pre identification of water related conflict problems or conflict in general?*

Description	Knowledge, practice and level of acceptability
Available local knowledge in EWS prediction:	
The current practice:	
Level of acceptability and role in the community:	

47) *Please indicate your level of awareness on immediate deliverable service costs required because of water conflicts related problems?*

Description	Awareness on costs of conflict
Do you know the amount of fees or service charges paid for lawyers or professionals because of local conflict related problems? [*DC*]	☐ Yes, ☐ Partially, ☐ No
Do you know the amount of personal and working time spent because of local conflicts? *[PC-DL]*	☐ Yes, ☐ Partially, ☐ No
Do you know the availabilities of any opportunities that might have produced due to local conflicts? *[PC-OC]*	☐ Yes, ☐ Partially, ☐ No
Do you know the effects, expenses and values of losing your relationships and local communities because of local conflicts? *[CC]*	☐ Yes, ☐ Partially, ☐ No
Do you know the effects of anger, loss of energy and pain that occurs as a result of local conflicts? *[EC]*	☐ Yes, ☐ Partially, ☐ No

48) *Could you please indicate the level of your awareness/participation on your local area works related to water resources management, environmental protection and flood control activities?*

Categories of local awareness	Level of your awareness or participation	Activities sponsored by…
Water resources management	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know
Who participates in the water resources development process	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Gov, ☐ NGO, ☐ Public, ☐ Private ☐ Other_____ , ☐ Don't know
Water resources management regulation	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know
Activities related to flood control	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know
Environmental protection	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know
Political intervention	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know
Military intervention	☐ High, ☐ Moderate, ☐ Minimum ☐ Don't know/no response	☐ Local, ☐ Regional, ☐ National, ☐ Other_____ ☐ Don't know

[14] The aim that helps to avoid or reduce violence and human crises.

49) *What is you specific role in your local area related to water resources development and management, keeping safe environment and flood control related activities? Your contributions could be explained in terms of labour, money or time spent in advisory/discussion group related activities.*

A. In water resources development and management activities:

List of activities (your specific role)		Your participation or contribution in terms of…		
		In LABOUR (list/week)	Contribution of MONEY (Birr/week)	TIME SPENT in discussion/advisory (hours/week)
1.				
2.				
3.				

B. In keeping safe environment:

List of activities (your specific role)		Your participation or contribution in terms of		
		In LABOUR (list/week)	Contribution of MONEY (Birr/week)	TIME SPENT in discussion/advisory (hours/week)
1.				
2.				
3.				

C. In flood control related activities;

List of activities (your specific role)		Your participation or contribution in terms of		
		In LABOUR (list/week)	Contribution of MONEY (Birr/week)	TIME SPENT in discussion/advisory (hours/week)
1.				
2.				
3.				

Part 12: The issue of transparency

50) *Level of openness: Could you please indicate the availability of local based thinking, believes or tradition for openness by selecting appropriate check boxes in the following table?*

Categories of local openness	***Level of transparency***
Individuals day to day decision making process	O Transparent, O partially transparent, O not transparent
Traditional related practices/decision making	O Transparent, O partially transparent, O not transparent
Tax allocation system, inland revenue and tax payment and other performances of financial institutions	O Transparent, O partially transparent, O not transparent
How governmental organizations are functioning	O Transparent, O partially transparent, O not transparent
How NGO's are working or provide services	O Transparent, O partially transparent, O not transparent
The way local, regional and national mass	O Transparent, O partially transparent, O not

Categories of local openness	***Level of transparency***
medias are working	transparent
Legal related decision making process	O Transparent, O partially transparent, O not transparent
Individuals experience and practices of accountability in private, governmental, non governmental and public services	O Transparent, O partially transparent, O not transparent
Availability of the system/tradition of accountability	O Transparent, O partially transparent, O not transparent

Part 13: Level of inter-personal communication among the group of people sharing common resources [IC]

51) Please indicate how do you interact and communicate with a group of other communities sharing the same resources on the issue of exchanging information that are useful for common purposes?

1. _____
2. _____
3. _____

If not,….

We are not sharing or communicating information with the other groups because:

1. _____
2. _____
3. _____

52) How water, conflict and any related information transfers from one group of community to the other who are sharing the same water resources?

Description	**Rate of information flow**
1. The rate of **interactivity** between the communities	O High, O Medium, O Low, O Not available
2. The situation of **vividness** when communicating information among the members of the communities	O High, O Medium, O Low, O Not available
3. The amount of **information** that transfers within the communities (*In general*)	O High, O Medium, O Low, O Not available
3.1. **Direct information** that transfers	O High, O Medium, O Low, O Not available
3.2. **Indirect information** that transfers	O High, O Medium, O Low, O Not available

53) When you are interacting and communicating with those other groups who are sharing water resources, what do you observe in return? Mark all the applicable boxes below and rank them in terms of the one that frequently observed.

Observed interaction messages	**Status/rank of the observed interaction**	*Notes for internal use*
☐ Actions	O Frequently, O Occasionally, O Suddenly, O None	*[NIF]*
☐ Emotions	O Frequently, O Occasionally, O Suddenly, O None	
☐ Plans	O Frequently, O Occasionally, O Suddenly, O None	*[IFS]*
☐ Intentions	O Frequently, O Occasionally, O Suddenly, O None	
☐ Beliefs	O Frequently, O Occasionally, O Suddenly, O None	

54) *Where do you go when you have got conflict in the community in relation to natural resources or other related?*

☐ Local elder people ☐ 'Idir' ☐ Religious leaders ☐ 'Kebele' ☐ Court ☐ Other (specify)

55) *Could you please rate your satisfaction towards the local legal system and how they are working independently?*

O Strongly satisfied, O Satisfied, O Neither satisfied nor dissatisfied
O Dissatisfied O Strongly dissatisfied

Part 14: Each member of the community's contribution towards sustainable development [SCDF]

List of your activities in relation to sustainable development	Status of your participation	How would you rank the rate of your satisfaction in accordance to status of your participation
Effective water resources development and utilization	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Wetland protection activities	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Environmental protection	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Activities related to local economic development	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Feel responsible and participated in the activity that improves social relationships among the members of the communities	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Drought reduction and control activities	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Local communities health improvement activities	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Political stability	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,
Education improvement and diversification status	O Actively participated, O Participated, O Don't have interest neither to participate nor not to participate, O Not participated	O Highly satisfied, O Satisfied, O Nether satisfied nor dissatisfied, O Dissatisfied O Highly dissatisfied,

Part 15: Other issues/factors

56) Could you please further explain your local or traditional experience or education or training that may be helpful in water resource development and conflict resolution activities?

	A. Local water resources development, operation and maintenance
1.	
2.	
3.	

	B. Local conflict resolution experience/education
1.	
2.	
3.	

57) Could you please recommend the three most important locations useful to study water resources development and conflict related aspects?

	Proposed location	Reason for selection
1.		
2.		
3.		

58) Is there any research activities in your local area supported by local, regional, national or international institutions and governments? ☐ **Yes**, ☐ **No**.
If yes, do local communities participate in such activities? How do you rate their participation in general?-fill the next table, please.

Categories of participation	**Level of participation**
Water pollution control related researches	O High, O Medium, O Low, O None
Water recycling researches	O High, O Medium, O Low, O None
Search for extra water (desalination, rain water harvesting, from air, importing from other sources, other) specify please: _____	O High, O Medium, O Low, O None
On water saving technologies	O High, O Medium, O Low, O None
Any new concepts/knowledge /research on water sector development	O High, O Medium, O Low, O None

59) General comment: Do you know any other water related intensions/plans/threats directly or indirectly related to the local water resources? If yes explain please.

1. _____
2. _____
3. _____

Thank you for taking the time to complete this questionnaire.

If you have any questions about the survey or any related questions, please contact Azage Gebreyohannes Gebremariam, WEDC-Loughborough University, LE 11 3TU. Tel 01509 223780 or e-mail: a.g.gebremariam2@lboro.ac.uk

Appendix B 3: Survey Questions on local Institutions and regulatory frameworks:

Survey Questionnaires on Early Warnings System on Local Water Conflicts

Part 1: About the Survey:

The aim of this survey is to investigate the necessary parameters and collect data that helps to develop an early warning system on local water conflicts. Furthermore, the output of the survey helps to formulate effective strategy or guideline which helps to defuse conflicts over local water resources. We are looking forward to obtain your views and comments on information regarding local conflicts over shared water resources, negotiation practices, and any related information on Ethiopia and in developing countries in general.

You have been randomly selected to participate in this survey of local water conflict. Your assistance in this survey would have been much appreciated. Hence, we would like to get your opinion on some important issues mentioned in the questionnaire. You are kindly requested to spare a few minutes to help complete a survey. A scientific report will be safely published in a way it will not provide any respondent's name and other detail information who participated in answering this questionnaire. The given information will be kept strictly confidential in accordance with (ETHIOPIOAN) Data Protection Act…… .

Thank you very much!

Part 2: General information:

Ques. No. *LC-INS-003*

1) *What is the name and addresses of your institution?*

Name of the institution /organization:			
1. Address:	Region:	Zone:	Location/Kebele:
2. P. O. Box:			
3. Telephone:			
4. E-mail address:			
5. Web site (URL):			
6. Contact Person:			
7. Contact person position:			
8. Date Established:			
9. Type of Organization:	☐ *Gov,* ☐ *NGO,* ☐ *Private,* ☐ *Public,* ☐ *Religious,* ☐ *Traditional,* ☐ Other_____		
10. Coverage area:	☐ *National,* ☐ *Regional,* ☐ *Local,* ☐ *International*		
11. Number of staffs:			

Part 3: Identification of stakeholders/institutions/ infrastructures that helps to take actions in reducing risks over water related conflicts:

2) *Do you know the availabilities of any institutions or organizations working at local level and on the following areas of activities?*

Categories of institution or organizations	Do you know any?	Remarks
Water sector	O Yes, O No	If No ignore Q3 & Q4
Water production	O Yes, O No	If No ignore Q5
Early warning systems	O Yes, O No	If No ignore Q6
Construction	O Yes, O No	If No ignore Q7
Conflict management	O Yes, O No	If No ignore Q8

Water professionals	O Yes, O No	If No ignore Q9

3) *Please indicate list of all FORMAL institutions working on WATER SECTOR. The list doesn't include local based or traditional institutions, which will be separately answered under Q4, later.*

Institution/ organization Name		Address	Objectives (functions)	Date of estab.	Direct/indirect service coverage [Mark ✓ for yes]			Category: *Gov, NGO, Private, Public, Religious, etc.*
					Fed.	Reg.	Loc.	
1.								
2.								
3.								

For more information please use the back of this page

4) *Could you please list any local/traditional institutions engaged on water related activities?*

Institution Name		Objective/function	Date established	Direct/indirect coverage [Mark ✓ for yes]			Remarks
				Traditional	Religious	others	
1.							
2.							
3.							

5) *Please list of BUSINESS COMPANIES, INSTITUTIONS & ORGANIZATIONS working on the production of pure water supply services.*

Institution/ Company Name		Date established	Amount of water production		Direct Beneficiaries [Mark ✓ for yes]		
			Daily	Yearly	Local	National	International
1							
2							
3							

6) *Please list all Organizations working on any EARLY WARNINING AND DISASTER PREVENTION related activities..*

Institution/organization Name		Address	Objective (function)	Date of establishment	Direct/indirect service coverage [Mark ✓ for yes]			Category: Gov, NGO, Private, ublic, Religious, etc.
					Fed.	Reg.	Loc.	
1								
2								
3								

For more information please use the back of this page

7) *Please list all organizations working on any CONSTRUCTION activities related to your local area..*

Institution/organization Name		Address	Main intervention area	Date of estab.	Direct/indirect service coverage [Mark ✓ for yes]			Category: Gov, NGO, Private, ublic, Religious, etc.
					Fed.	Reg.	Loc.	
1								
2								
3								

For more information please use the back of this page

8) *Please list all INSTITUTIONS AND DEPARTMENTS working on CONFLICT MANAGEMENT related activities..*

Institution/organization Name		Address	Objective (function)	Date of estab.	Direct/indirect service coverage [Mark ✓ for yes]			Category: Gov, NGO, Private, ublic, Religious, etc.
					Fed.	Reg.	Loc.	
1								
2								
3								

For more information please use the back of this page

9) *Please list all PROFESSIONALS specialised on conflict management related activities working at local, regional and national level.*

Name		Address	Sex M/F	Level of education	Estimation of age groups (in years)		Work area			
					≤ 40	>40	Fed.	Reg.	Loc.	Int.
1										
2										
3										

10) *Please indicate the types of cooperation that are available among local institutions/stakeholders working on water related activities?*

Main areas of cooperation	Select categories of institutions that cooperate each other								Methods of cooperation
	Water inst.	Traditional inst.	Business & private sector	Early Warning & Disaster	Construction	Conflict management	Professional associations	Others?	
	☐	☐	☐	☐	☐	☐	☐	☐	☐ Task force ☐ Planned in advance ☐ Whenever required ☐ Weak collaboration
	☐	☐	☐	☐	☐	☐	☐	☐	☐ Task force ☐ Planned in advance ☐ Whenever required ☐ Weak collaboration
	☐	☐	☐	☐	☐	☐	☐	☐	☐ Task force ☐ Planned in advance ☐ Whenever required ☐ Weak collaboration

Part 4: The vulnerable population information

11) *Please, list all actively working institutions/organizations dealing with vulnerable populations in your local area*

Name of institution	year of establishment	Categories of institution						Areas of support or specialization	Functionality status
		Government	NGO	Religious	Private	Traditional	Other		
		O	O	O	O	O	O		O Functional O Partially functional O Non functional
		O	O	O	O	O	O		O Functional O Partially functional O Non functional
		O	O	O	O	O	O		O Functional O Partially functional O Non functional
		O	O	O	O	O	O		O Functional O Partially functional O Non functional
		O	O	O	O	O	O		O Functional O Partially functional O Non functional
		O	O	O	O	O	O		O Functional O Partially functional O Non functional

12) Total number of vulnerable populations in your area

List	Gender			Remarks on trend
	Male	Female	Total	
Infants(below 1 year)				O Increasing, O Decreasing, O Constant
Children (2-6)				O Increasing, O Decreasing, O Constant
Children (7-14)				O Increasing, O Decreasing, O Constant
Women				O Increasing, O Decreasing, O Constant
Number of households headed by women or mothers				O Increasing, O Decreasing, O Constant
Seniors (old people)				O Increasing, O Decreasing, O Constant
People with disabilities (physically & mentally)				O Increasing, O Decreasing, O Constant
Others (e.g. immigrants, displaced people, etc.)				O Increasing, O Decreasing, O Constant

13) Approximately, how many homeless people do you have in your local area?

Group of populations	Gender			Remarks
	Male	Female	Total	
Infants(below 1 year)				
Children (2-14 years)				
Youth (15-24 years)				
Adults (25-65 years)				
Seniors (above 65 years)				
Total				

14) Why do you think they are homeless?

15) How did you see the trends or changes in the number of homeless people living in your local area during the last 5 years?

O Increasing O Decreasing O Fluctuating O Constant/stable O I don't know

How and why?

_____

_____

_____

16) *What is your institution's opinion regarding local communities vulnerability exposure towards unemployment, homelessness, financial expenses and poor water supplies?[EV]*

*A. **Unemployment***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
1. The rate of unemployment is decreasing in the area.	O	O	O	O	O
2. The number of homeless people in the local area is decreasing.	O	O	O	O	O

*B. **Income and Expense***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
3. Satisfied by average daily/monthly incomes	O	O	O	O	O
4. Average daily/monthly expense or debt is less than the respective income	O	O	O	O	O

*C. **Clean, adequate and affordable water supplies***

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
5. People are getting *clean* or *safe* water supplies during the last 5 years	O	O	O	O	O
6. People are getting *adequate* water supplies during the last 5 years	O	O	O	O	O
7. People are getting *affordable* water supplies during the last 5 years	O	O	O	O	O
8. People are getting *easily accessible* water supplies during the last 5 years	O	O	O	O	O

17) *Are there institutions working on the issue of homelessness?* **O** Yes, **O** No; *If yes, please indicate list of organizations dealing with homeless people in your local area and specify your satisfaction regarding the services they are providing ?*

Institution	Main objectives	Rate of service satisfaction				
		O Highly satisfied	O Satisfied	O Neither satisfied nor dissatisfied	O Dissatisfied	O Highly dissatisfied
		O Highly satisfied	O Satisfied	O Neither satisfied nor dissatisfied	O Dissatisfied	O Highly dissatisfied
		O Highly satisfied	O Satisfied	O Neither satisfied nor dissatisfied	O Dissatisfied	O Highly dissatisfied
		O Highly satisfied	O Satisfied	O Neither satisfied nor dissatisfied	O Dissatisfied	O Highly dissatisfied

Part 5: Water pollution information

18) Availability of water qualities monitoring (WQM) information system

Types of information	Availability of information
WQM laboratory facilities are available	O Sufficiently available, O Inadequate, O Not available, O On progress
Transport facilities for fieldwork are available	O Sufficiently available, O Inadequate, O Not available, O On progress
The trend of manpower and training are encouraging	O Sufficiently available, O Inadequate, O Not available, O On progress
There are effective communication on WQM information	O Sufficiently available, O Inadequate, O Not available, O On progress
Inventory of sampling stations are taken frequently	O Sufficiently available, O Inadequate, O Not available, O On progress
Schedules for sampling expeditions are available	O Sufficiently available, O Inadequate, O Not available, O On progress
Availability of up-to-date literatures in the resource centre is encouraging	O Sufficiently available, O Inadequate, O Not available, O On progress
There is WQM data management and reporting system	O Sufficiently available, O Inadequate, O Not available, O On progress
Availability of monitoring guideline and standards	O Sufficiently available, O Inadequate, O Not available, O On progress
Monitoring stations are identified based on standard criterion	O Sufficiently available, O Inadequate, O Not available, O On progress

19) The size of local water resources information in your organization

Types of information	Amount of information (I)					Evaluate the amount of 'P' & 'UP': P+UP=I	
	Sufficiently available [100%]	Available [75%]	Partially Available [50%]	Inadequate [25%]	Not Available [<25%]	P[15]	UP[16]
Water resources	O	O	O	O	O		
River basin information	O	O	O	O	O		
Water consumption	O	O	O	O	O		

[15] Published information (published paper, report, document, etc.).
[16] Unpublished information (unpublished paper, report, document, etc.).

Types of information	Amount of information (I)					Evaluate the amount of 'P' & 'UP': P+UP=I	
	Sufficiently available [100%]	Available [75%]	Partially Available [50%]	Inadequate [25%]	Not Available [<25%]	P[15]	UP[16]
Water pollution	O	O	O	O	O		
Ground water	O	O	O	O	O		
Hydro-climatic information	O	O	O	O	O		
Others	O	O	O	O	O		

20) Who will be responsible organization for the collection and management of the other water resources information (if your answer for the above question remains less than 100%)?why?

Part 6: Water resources facilities functionality identification and a test for availabilities of effective and approved plan

No.	List of the most probable facilities	Availability/functionality/plan of facilities					Other comments
		Sufficiently available	Inadequate	On plan (on progress)	Not available	Not applicable	
I	**Availabilities of development PROJECTS on…(**see below**)**						
1.	Rural, urban, and industrial water supply facilities (e.g. water storage and distribution system and improvements);	O	O	O	O	O	
2.	wastewater management and treatment facilities;	O	O	O	O	O	
3.	Storm sewers management;	O	O	O	O	O	
4.	Water conservation projects;	O	O	O	O	O	
5.	Watershed management and restoration;	O	O	O	O	O	
6.	Solid waste management;	O	O	O	O	O	
7.	Ground water quality monitoring system	O	O	O	O	O	
8.	Surface water quality monitoring system	O	O	O	O	O	
9.	Drainage improvement works	O	O	O	O	O	
10.	Pollution prevention or remediation;	O	O	O	O	O	

No.	List of the most probable facilities	Availability/functionality/plan of facilities					Other comments
		Sufficiently available	Inadequate	On plan (on progress)	Not available	Not applicable	
11.	Dams, water wells and water tanks safety supervision and management projects.	O	O	O	O	O	
12.	Any local projects primarily includes a plan and have an approval for activities related to environmental impact assessment.	O	O	O	O	O	
II	**Information:**						
12.	Availability of water data and map	O	O	O	O	O	
13.	Availability of hydrology information	O	O	O	O	O	
III	**Education**						
14.	Water resources management is included in the curriculum of the education system(elementary and higher studies)	O	O	O	O	O	
15.	Hygiene and sanitation is incorporated in the curriculum	O	O	O	O	O	
IV	**Rules, regulations and policies**						
16.	Availability of effective water resources management laws, regulation and policies	O	O	O	O	O	
17.	Availability of specific water discharge permit and water use rights regulation	O	O	O	O	O	

[VIP]

Part 7: Hydroclimatic information

21) *Which institution or task force is mainly responsible for collecting, predicting and managing local hydroclimatic information and related activities?*

1. _____
2. _____
3. _____

22) *Please list if you are using any prediction program or model related to climate change?*

A. Modern/computer based prediction programmes:

1. _____
2. _____
3. _____

B. Local/traditional ways of climate prediction practices:

1. _____

2. _____
3. _____

23) *Could you please indicate the local status and the rate of food production during the last 5 years?*

Types of main agricultural products	Unit of meas.	1996	1997	1998	1999	2000	Sources of info
							VIN

24) *Please, describe the last 5 years effects of climate change on the local communities?.*

Categories for effects of climate change	What happened in the area? (primary impacts)	Any conflicts as a result of this problem (secondary impacts)	Measures taken	Future plan
Water supply				
Flooding				
Drought				
Health				
Agriculture				
Forest				
Vegetable and animal species				
Wild life				
Any opportunities?				

Part 8: Communication/networking

25) *Could you please rate your satisfaction or dissatisfaction on how your institution have been communicating and efficiently/ jointly working with other respective institutions in relation to water resources, conflict and early warning management systems?*

Areas of communications	Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied	Not applicable
Integrated water resources management (IWRM)	O	O	O	O	O	O
Conflict management	O	O	O	O	O	O
Early warning system	O	O	O	O	O	O

26) *How do you contact the local communities in order to achieve your organizational objectives? Please select your approach.*

O *Modern approaches,* O *Traditional approaches,*
O *Both Modern and traditional approaches,* O *Non applicable,*

O *Other, specify please:*_____

27) *Could you please further explain and list details of you approach mentioned in the above questions?*
   1. _____
   2. _____
   3. _____

28) *What is your institutional specific objectives or motto on traditional and modern ways of contacting the local communities?*

_____
_____
_____

29) *Have you observed any communication problems with other institutions or local communities? If yes, please list them down.*
   1. _____
   2. _____
   3. _____

30) *Do you have any projects or activities implemented in cooperation with the local communities?* O *Yes,* O *No;*

If yes answer the following two questions, please:

A. *How would you rate the level of the community's cooperation?*

O *Very good* O *Good (moderate)*
O *Encouraging* O *No cooperation*
O *Not applicable (eg. no common projects)*

B. *How do you evaluate the amount of communication or cooperation feedback available between communities and your institution?*

	Level/amount of feedbacks			
Communication feedback	O *High*	O *Medium*	O *Low*	O *not applicable*
Cooperation feedback	O *High*	O *Medium*	O *Low*	O *not applicable*

Part 9: Access to water resources information

31) *Could you please list the availabilities of adequate information that you may knows in any organizations which are directly or indirectly useful for having effective water related activities? What is the role or cooperation status of your institution in this regards?*

Responsible institution	**Availabilities of useful information that you may knows**			**Degree of cooperations/relationships with your institution**			
	Available	**Partially available**	**Not available**	**High**	**Medium**	**Low**	**None**
	O	O	O	O	O	O	O
	O	O	O	O	O	O	O
	O	O	O	O	O	O	O

32) *Could you please list down and indicate the status of information on water resources, conflict and EWS that are available or planned by your office. Indicate the sources of information if it was not collected by your organization?*

A. Water Resources:

List of the planned or available information by your institution	Information need or availability status			Sources of information	Why do you need the information?
	Fully available	Partially available	Required but not available		
	O	O	O		
	O	O	O		
	O	O	O		

B. Early Warning System:

List of the planned or available information by your institution	Information need or availability status			Sources of information	Why do you need the information?
	Fully available	Partially available	Required but not available		
	O	O	O		
	O	O	O		
	O	O	O		

C. Conflicts:

List of the planned or available information by your institution	Information need or availability status			Sources of information	Why do you need the information?
	Fully available	Partially available	Required but not available		
	O	O	O		
	O	O	O		
	O	O	O		

Part 10: Water consumption/usage Information

33) *Do you have any information regarding local unit of measurement for water collection? If yes, please indicate it in the next table.*

No.	Name of local UNIT of measurement	Estimated volume in LITRE	How many UNITS do you require?		Remarks
			Litre/day	Litre/Week	
1					
2					
3					

34) *Please, indicate <u>the main sources</u> of local water supplies registered/known by your institution?*

No.	Purpose	List sources of water	The amount of water required (in litre)	Rate the status of the resource during the last 5 years
1	Households			O Highly decreasing, O Decreasing, O Increasing, O No change
2	Livestock			O Highly decreasing, O Decreasing, O Increasing, O No change

No.	Purpose	List sources of water	The amount of water required (in litre)	Rate the status of the resource during the last 5 years
3	Agriculture			O Highly decreasing, O Decreasing, O Increasing, O No change
4	Industrial			O Highly decreasing, O Decreasing, O Increasing, O No change
5	Tourism			O Highly decreasing, O Decreasing, O Increasing, O No change
6	Hydropower			O Highly decreasing, O Decreasing, O Increasing, O No change
7	Fishing			O Highly decreasing, O Decreasing, O Increasing, O No change

35) Would you indicate the average travel time, frequency and number of person who participates in collecting water for each households?[ACC]

Time taken to collect water (in hours)					Average daily water collection info. (frequency)	
Location	Water source	Average travel time	Stay time at water source	Return time	Total number of people who collects water per day per household	Total number of travel frequency for each person
Rural						
Semi urban water points/stand posts						
Nomad areas						

36) Trends of daily, weekly or/and monthly water consumption [QW]

1=Highly satisfied,	*2=Satisfied,*	*3=Neither satisfied nor dissatisfied,*	*4=Dissatisfied,*	*5=Highly dissatisfied,*

No.	Purpose	Unit of measu.	Amount of water consumption (select applicable time)			Rate of satisfaction in using the resources (1, 2, 3, 4, or 5)
			daily	weekly	monthly	
1	Household uses					
2	Irrigation (agriculture)					
3	Commercial					
4	Industrial					
5	Livestock					
6	Religious purposes					
7	Others					

37) *Please indicate the rate of your satisfaction/dissatisfaction regarding the qualities of water supply sources since the beginning of the last 5 years?*

Sources of water	Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	dissatisfied	Highly dissatisfied	Main reason for your satisfaction or dissatisfaction?
	O	O	O	O	O	
	O	O	O	O	O	
	O	O	O	O	O	
	O	O	O	O	O	

38) *What are the main technical, administrative and natural factors that have been affecting the qualities and quantities of local water resources?*

A. Natural factors

Natural factors that affect local water resources		
	Factors affecting the QUALITIES of water	Factors affecting the QUANTITIES of water
1		
2		
3		

B. Administrative factors

Administrative factors that affect local water resources		
	Factors affecting the QUALITIES of water	Factors affecting the QUANTITIES of water
1		
2		
3		

C. Technical factors

Technical factors that affect local water resources		
	Factors affecting the QUALITIES of water	Factors affecting the QUANTITIES of water
1		
2		
3		

39) *Please indicate the main types of information you want to know/use about the local water resources.*

No.	Types of information	Who should be the responsible organization for this information?	Why do you want this information?
1			
2			
3			

40) *Please list the key resource of owners for the local water supply (e.g. Government, community, NGO, religious groups, military, etc.).*

No.	Water resources	Who shares the resources?	Who is the owner of the resource?	Agreement opinion on the resource ownership					Any comment on ownership
				Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree	
1				O	O	O	O	O	
2				O	O	O	O	O	
3				O	O	O	O	O	
4				O	O	O	O	O	

41) *How would your institution collect, analyse and report on water, natural resources, conflicts or early warning related information in your local area?*

No.	Types of information	Boundaries of information collection, analysis & reporting				
		Political administrative regions boundaries	River basin boundaries	Both	Other (specify please)	Not applicable
1	Water resources	O	O	O		O
2	Other natural resources	O	O	O		O
3	Conflicts	O	O	O		O
4	Early warning situations	O	O	O		O

Part 11: Identification of individuals exposed to hazards,

42) *Please indicate all lists of technical and natural factors that affect the water resources identified by your institution during the last 5 years.*

List of hazards	Location	Severity of hazards	Types of hazards	Probability of occurrence
		O Catastrophic; O Critical; O Major; O Moderate; O Minor	☐ Natural ☐ Man-made	O Frequent O Occasional O Unlikely
		O Catastrophic; O Critical; O Major; O Moderate; O Minor	☐ Natural ☐ Man-made	O Frequent O Occasional O Unlikely
		O Catastrophic; O Critical; O Major; O Moderate; O Minor	☐ Natural ☐ Man-made	O Frequent O Occasional O Unlikely
		O Catastrophic; O Critical; O Major; O Moderate; O Minor	☐ Natural ☐ Man-made	O Frequent O Occasional O Unlikely

43) *Please indicate the current status of local water resources, water bodies or water supply systems in relation to exposure to risks.*

Components of the water resources, water bodies or systems	Location	Functionality status	Exposure to risks	Local capacity for maintenance
		O functional, O partially functional, O not functional, O abandon ,	O High, O Medium, O Less, O Not exposed	O Available , O Partially available, O Not available
		O functional, O partially functional, O not functional, O abandon ,	O High, O Medium, O Less, O Not exposed	O Available , O Partially available, O Not available
		O functional, O partially functional, O not functional, O abandon ,	O High, O Medium, O Less, O Not exposed	O Available , O Partially available, O Not available

44) *What type of projects are undergoing in a basin located or that incorporates the specified local area?*

No.	Type of projects	Level of satisfaction on cooperation with local communities				
		Highly satisfied	Satisfied	Neither Sati. Nor dissatisfied	Dissatisfied	Highly dissatisfied
1	International projects within the newly established local boundaries	O	O	O	O	O
2	Unilateral projects (a project run by one stakeholder)	O	O	O	O	O
3	Bilateral projects (a project run by two stakeholders: eg. Gov & community)	O	O	O	O	O
4	Multilateral projects (a project run by three stakeholders: eg. Gov, NGO & community)	O	O	O	O	O
5	Other projects (specify please)	O	O	O	O	O

45) *How does your institution think that the community feel ownership of any projects in the local area?*

_____

_____

46) *What is the current local water supply status and related problems of the local water resources?- Early warning on water resources utilization*

Yearly water supply status	Main problem areas				
	Chronic water scarcity	Water Stress	General management problems	Limited management problems	Other problems (Specify)
Less than 500 m^3/person	☐	☐	☐	☐	
1000-500 m^3/person	☐	☐	☐	☐	
1,600-1000 m^3/person	☐	☐	☐	☐	
10,000-1,600 m^3 m^3/person	☐	☐	☐	☐	
Above 10,000m^3/person	☐	☐	☐	☐	

47) *What is the average trend of water supply and sanitation coverage of the local people in living the same basin, during the last five years?*

Category	Population size	Water supply and sanitation coverage in the year 2008 (in percentile)			
		Water supply		Sanitation	
		Coverage in %	Trend of last 5 years	Coverage in %	Trend of last 5 years
Rural			☐ Increasing, ☐ Decreasing, ☐ No change		☐ Increasing, ☐ Decreasing, ☐ No change
Urban			☐ Increasing, ☐ Decreasing, ☐ No change		☐ Increasing, ☐ Decreasing, ☐ No change
Total			☐ Increasing, ☐ Decreasing, ☐ No change		☐ Increasing, ☐ Decreasing, ☐ No change

Part 12: Investigating the root causes and effects of local water conflict (RCA)

48) *Have your institution come across any conflicts locally during the last 5 years? see the next table*

Confirm if conflicts are available	What are the main causes
O Yes, always	☐ Water, ☐ Land, ☐ Grass, ☐ Food, ☐ Energy, ☐ Other
O Yes, occasionally	☐ Water, ☐ Land, ☐ Grass, ☐ Food, ☐ Energy, ☐ Other
O Not at all	**Why**?

49) *Could you please indicate sources of conflicts related to local water resources? [RCA]*

Sources of conflict	Availability of conflicts	If yes, indicate the level of the problem			
		Critical problems	Major problems	Moderate problems	Minor problems
Conflicts over a limited resource,	O Yes, O No	O	O	O	O
Conflicts over the control of the distribution,	O Yes, O No	O	O	O	O
Conflicts over the quality of the resource, and	O Yes, O No	O	O	O	O
Conflicts in large infrastructure projects	O Yes, O No	O	O	O	O
Other conflicts (specify please) _____	O Yes, O No	O	O	O	O

50) *What are your institutions opinions whenever the current local water resources development and management activity is concerned during the last 5 years? [SCA]*

☐ Happiness ☐ Discomfort ☐ Fear ☐ Sadness

☐ Frustration ☐ Anger ☐ Pain ☐ Other (specify)

Why-1? _____

Why-2? _____

Why-3? _____

51) *What is your institutions opinion whenever considering local conflicts over the issues related to economic, political, health, drought and ethnic diversity situations in the local area in comparison to the two conflicting group of local people sharing the same water resources?[DC]*

Socio economic diversity factors	Activity satisfaction rate when comparing the two parties	Areas of the diversity intervention (coverage of the problem)
Economic activity	O Positive, O Negative, O Neutral	☐ Local, ☐ National, ☐ International, ☐ Urban
Political situations	O Positive, O Negative, O Neutral	☐ Local, ☐ National, ☐ International, ☐ Urban
Health situations	O Positive, O Negative, O Neutral	☐ Local, ☐ National, ☐ International, ☐ Urban
Natural resources condition	O Positive, O Negative, O Neutral	☐ Local, ☐ National, ☐ International, ☐ Urban
Drought incidents	O No , O High, O Minimum	☐ Local, ☐ National, ☐ International, ☐ Urban
Political accommodation of ethnicities	O Positive, O Negative, O Neutral	☐ Local, ☐ National, ☐ International, ☐ Urban

52) *Please indicate list of resolved and unresolved local conflicts that occurred during the last five years?*

a. List of resolved conflicts:

What happened?		Conflicting parties	How resolved?			The role of your institution in this aspect
Description	Year (EC)		Agreed resolution	Other parties participated	Year	
	2000					
	1999					
	1998					
	1997					
	1996					

b. List of unresolved conflicts:

What happened?		Current status	Conflicting parties	Why not resolved?		
Description	Year (EC)			Reason-1	Reason-2	Reason-3
	2000					
	1999					
	1998					
	1997					
	1996					

53) *In your opinion, which one of the following do you think more important or less important factors to be considered as a reason for causes of local conflicts between a group of people?*

No.	Main local conflict factors	Agreement or disagreement on conflict factors				
		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
1	Personality related factors	O	O	O	O	O
2	Value related factors	O	O	O	O	O
3	Ideology	O	O	O	O	O
4	Cultural	O	O	O	O	O
5	Behavioural	O	O	O	O	O
6	Territory	O	O	O	O	O
7	Language	O	O	O	O	O
8	Natural resources	O	O	O	O	O
9	Religion	O	O	O	O	O
10	Ethnicity/race	O	O	O	O	O
11	Migration	O	O	O	O	O
12	Political power	O	O	O	O	O

54) *Identification of level/status of conflicts: Would you please indicate your institution's views, observation or findings in the aspects of identifying the root causes of local conflicts in general? [OI-SA]*

Sources/Causes of high level Conflicts (Source: Blackman, 2003)	Strongly Agree	Agree	Neither agree nor disagree	Strongly disagree	Disagree	Not Applicable
There are equal job opportunities undergoing in the local area	O	O	O	O	O	O

Sources/Causes of high level Conflicts (Source: Blackman, 2003)	Strongly Agree	Agree	Neither agree nor disagree	Strongly disagree	Disagree	Not Applicable
There are equal opportunities for *political power*	O	O	O	O	O	O
Migration is not a problem in the area	O	O	O	O	O	O
There are always equal or balanced opportunities with respect to ethnicity or race. Furthermore, there is no significant conflicts based on ethnicity or race	O	O	O	O	O	O
There are no significant conflicts among the followers of different religion or non believers.	O	O	O	O	O	O
There is no significant conflicts in relation to the use of management of local natural resources	O	O	O	O	O	O
There is no significant conflict among the speakers of different languages in the local area.	O	O	O	O	O	O
There is no significant conflict related to geographical boundary or territory in the local area	O	O	O	O	O	O

Part 13: Identification of actions taken to provide or reduce risks,

55) *Would you please describe any measures or actions taken by any organizations in reducing risks associated to local water resources during the last five years? [RCRR]*

List of actions taken	Input (Who supported or participated in this activity)	Output (Result of the actions)

56) *What measures would you recommend in reducing risks related to local communities?*

1. _____
2. _____
3. _____

57) *Please indicate the type and number of victims or patients exposed to risks that occurred when using the local natural resources including water during the last 5 years-if such information was registered or known by your institution? [TR]*

Victims or patients category in a family	Number/volume of the problem in the local area						Status during the last 5 years
	Verbal aggression	Physical aggression	Indecent *(impolite)* exposure	Arson *(inflammable)*	Acquisitive *(greedy)*	Sexual abuse	
Patients							O Increasing O Decreasing O No change
Children							O Increasing O Decreasing O No change
Adult Men							O Increasing O Decreasing O No change
Adult Women							O Increasing O Decreasing O No change
Property							O Increasing O Decreasing O No change
Others							O Increasing O Decreasing O No change

Part 14: Identifications of conclusions to policy-makers to make strategic choice,

58) *Does your institution have any short-term, medium-term and long-term water security plan?* O *Yes,* O *No; If yes, please describe your opinion in the next table.*

Main components of water security plan	Status of security plan					
	Very good	Good	Neither good nor bad	bad	Very bad	Not availabl e
Availability of a plan for water supply systems or infrastructures security from threats (Source, treatment, distribution)	O	O	O	O	O	O
Status of drinking water from contamination	O	O	O	O	O	O
Availability of a method for improving and monitoring of drinking water	O	O	O	O	O	O
Availability of a plan on wastewater treatment and collection system protection	O	O	O	O	O	O
Availability of a plan on information assessment, communication and emergency response on water security, risk and resources information	O	O	O	O	O	O
Availability of water security training programmes and capacity buildings	O	O	O	O	O	O
Availability of a general local water supply planning and security model.	O	O	O	O	O	O

59) *Please indicate if there are the required policies, strategic planning, rules and regulations on local water resources management*

List of water resources policies, strategic planning, rules and regulations	Status of security plan			
	National Gov.	Regional Gov.	Local Gov.	Basin Authorities
Water Policies	☐	☐	☐	☐
Water Resources development strategic planning	☐	☐	☐	☐
Regulations on ground extraction and depletion control and recharge water monitoring	☐	☐	☐	☐
Regulation on surface water flow monitoring	☐	☐	☐	☐
Regulation on protecting water resources from pollution	☐	☐	☐	☐

60) *How do you evaluate the approaches of integrated water resources management (IWRM) in local area?*

Tasks	Functionality status					
	Very good	Good	Neither good nor bad	bad	Very bad	Not available
Availability of favourable conditions (polices legal frameworks, finance, etc.)	○	○	○	○	○	○
Availability of institutions useful for implementing IWRM (flood control, dam management, drought control, health safety, soil management, etc.)	○	○	○	○	○	○
Enabling environment (planning, training …)	○	○	○	○	○	○
Ensuring the continuity of the process (IWRM audit body)	○	○	○	○	○	○

61) *Do you think the level, efficiency and mandate for water resources management, which was given to different institutions adequate? if no why?*

○ Yes,

○ No, Why? _____

Part 15: Awareness and consideration of timely warning [EWS-LT]

62) *Please list some of the activities performed by your institution at local level in helping to avoid or reduce violence and human crises during the last 5 year?*

Year	List of activities performed in reducing violence or human crises
1996	
1997	
1998	
1999	
2000	

63) *What is the existing traditional or local knowledge, practice or contribution to the member's of the local community in pre identification of water related problems in general and conflict in particular?- if known by your institution.*

Description	**Knowledge, practice and level of acceptability**
List of available local knowledge in EWS prediction:	
The current practice or emergency reposes – implementation of local knowledge:	
Level of acceptability and role in the community:	

64) *What is the available police information on number of arrests, violence and damages at local level mainly in association to water and natural resources related disputes?*

Year	**Police or security information**				
	Number of arrests	**Number of people affected by the violence**	**Damage in description**	**Estimated damage in currency -BIRR**	**Parties involved**
1996					
1997					
1998					
1999					
2000					

65) *Is there any progressive awareness systems among members of the local people, traditional leaders, politicians and students regarding the direct and indirect costs of deliverable services related to pre and post conflicts on water resources? - Awareness on costs of deliverable services and conflicts*

Stakeholders	**Status of awareness on conflict related costs/values (The awareness gap analysis)**					
	Fully & correctly informed	**Informed- (medium)**	**Informed- (less)**	**Not informed or ignorant**	**Activist or Expert**	**Not applicable**
Local communities	☐	☐	☐	☐	☐	☐
Traditional leaders	☐	☐	☐	☐	☐	☐
Local administrators	☐	☐	☐	☐	☐	☐
Local politicians	☐	☐	☐	☐	☐	☐
Local professionals	☐	☐	☐	☐	☐	☐
Students	☐	☐	☐	☐	☐	☐
others?	☐	☐	☐	☐	☐	☐

66) *Please indicate your extent of agreement or disagreement on the statement that the local communities or concerned stakeholders have adequate information and participation on setting water services tariffs?*

O *Highly agree,* O *Agree* O *Neither agree nor disagree*

O *Disagree* O *Highly disagree*

67) *Could you please indicate the* ***level*** *of your institutions awareness on any on-going works or projects at local level related to water resources management, environmental protection and flood control activities?-[mainly applied for none-line organizations, e.g. Legal departments, police office, etc.]*

Categories of activity	Do you have any awareness?	If yes, who sponsored the project?	List of main activities
Water resources management	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	
Who participates in the water resources development process	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	
Water resources management regulation	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	
Environmental protection	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	
Political intervention	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	
Military intervention	O Yes, O Partially only, O None	☐ Gov, ☐ NGO, ☐ Public, ☐ Private	

Part 16: The aim that helps to avoid or reduce violence and human crises

68) *Please list down if you have come across any of the tools, plans or methods that can be used in the process of avoiding or reducing violence and human crises in local area during the last 5 years?- [FA]*

Description	Check if it is available	List of each description
Forecasting plan	O Available, O Partially available, O Not available	
Forecasting tools	O Available, O Partially available, O Not available	
Forecasting methods	O Available, O Partially available, O Not available	
Preparedness action-plan	O Available, O Partially available, O Not available	

Part 17: The issue of transparency in institutions

69) *Please indicate your observation with respect to traditional or modern local institutions in relation to water resources development and management?*

Title	Level of transparency
Institutions day to day decision making process	O Transparent, O partially transparent, O not transparent
Traditional related practices/decision making	O Transparent, O partially transparent, O not transparent
Tax allocation system, inland revenue and tax payment and other performances of financial institutions	O Transparent, O partially transparent, O not transparent
How governmental organizations are functioning	O Transparent, O partially transparent, O not transparent
How NGOs are working or provide	O Transparent, O partially transparent, O not transparent

Title	Level of transparency
services for local communities	
The way local, regional and national mass medias are working	O Transparent, O partially transparent, Onot transparent
Legal related decision making process	O Transparent, O partially transparent, Onot transparent
Individuals experience and practices of accountability in private, governmental, non governmental and public services	O Transparent, O partially transparent, Onot transparent
Availability of the system/tradition of accountability	O Transparent, O partially transparent, Onot transparent

Part 18: Level of inter-personal communication (Interactivity and communication) among the group of people sharing common natural resources

70) *Please indicate if your institution knows how do people interact and communicate with a group of other communities sharing the same resources on sharing common information that are useful for both parties?*

1. _____
2. _____
3. _____

If not,….

We are not sharing or communicating information with the other group because:

1. _____
2. _____
3. _____

71) *How water, conflict and any related information transfers from a group of communities to the others who are sharing the same water resources?*

The rate of **interactivity** between the communities	O High, O Medium, O Low
The situation of **vividness** when communicating information among the members of the communities	O High, O Medium, O Low
The amount of **information** that transfers	O High, O Medium, O Low
Direct information	O High, O Medium, O Low
Indirect information	O High, O Medium, O Low

72) *Could you please rate your institutions satisfaction towards current local legal systems and how they are working independently?*

O Strongly satisfied O Satisfied

O Strongly dissatisfied O Dissatisfied O Neither satisfied nor dissatisfied

Part 19: Contribution to sustainable development

73) *Please provide some of the major factors that affect the sustainable development of the water resources in the region during the last 5 years? [SRCDF]*

Categories of the problems	Extent or frequency of if the problem	Main problem area?	Recommendation for solving the problems
Technical factors	O High, O Medium, O Low, O Not available		
Administrative factors	O High, O Medium, O Low, O Not available		
Natural/environmental factors	O High, O Medium, O Low, O Not available		
Social factors	O High, O Medium, O Low, O Not available		
Economic factors	O High, O Medium, O Low, O Not available		
Political factors	O High, O Medium, O Low, O Not available		
Geographical/territory factors	O High, O Medium, O Low, O Not available	O Local, O Urban, O National, O Int.	
Health factors	O High, O Medium, O Low, O Not available		
Drought factors	O High, O Medium, O Low, O Not available		
Ethnicity/race factors	O High, O Medium, O Low, O Not available		
Language factors	O High, O Medium, O Low, O Not available		
Other factors	O High, O Medium, O Low, O Not available		

Part 20: Other issues/factors

74) *Could you please list down the available local or traditional experience implemented during the last 5 years on water resources development, early warning methods and conflict management?*

Category of activities	*List of local activities performed by your institution*
Water resources development, operation and maintenance	
Early warning, communication and emergency response practices	
Conflict resolution, management and training related practices	

75) *Could you please recommend the three most important locations useful to study water resources development and conflict related aspects?[PSI]*

Proposed location Reason for selection

1. _____

	Proposed location	Reason for selection
2.		
3.		

76) *Are there any research activities in your local area supported by local, regional, national or international institutions and governments? If yes, does communities are participated in such activities and how do you rate their participation? – [RD]*

Water pollution control related researches	☐ High, ☐ Medium, ☐ Low, ☐ None
Water recycling researches	☐ High, ☐ Medium, ☐ Low, ☐ None
Search for extra water (desalination, rain water harvesting, from air, importing from other sources, other) specify please: _____	☐ High, ☐ Medium, ☐ Low, ☐ None
On water saving technologies	☐ High, ☐ Medium, ☐ Low, ☐ None
Any new concepts/knowledge /research on water sector development	☐ High, ☐ Medium, ☐ Low, ☐ None
Researches on local soil erosion control	☐ High, ☐ Medium, ☐ Low, ☐ None

77) *Does your institution have or knows the availabilities of any other water related intensions/plan/threats directly or indirectly related to the local water resources? If yes list them down please.*

1. _____
2. _____
3. _____

Thank you for taking the time to complete this questionnaire.

If you have any questions about the survey or any related questions, please contact Azage Gebreyohannes. Gebremariam, WEDC-Loughborough University, LE 11 3TU. Tel 01509 223780 or e-mail: a.g.gebremariam2@lboro.ac.uk

APPENDIX C: LIST OF SPSS DATA FILES

Appendix C 1: List of Local Communities SPSS Survey Data Files:

No.	List of SPSS Community Data Files
1	1 A-BasicData.sav
2	1 G-Basic-Social Group Participation.sav
3	1 H -Basic-Language spoken-BasicData.sav
4	1 J-Water- Role in water supply activity.sav
5	2 A and B - Basic- Household and Education info.sav
6	3 Vulnerable-Vulnerable people in the house.sav
7	4 and 6- Homeless People in the region.sav
8	5 Vulnerable-Categories of homeless people.sav
9	6 Vulnerable-Reason for homlessness.sav
10	7 EWS- Info sources.sav
11	8 Vulnerable-Exposure for Vulnerability.sav
12	9 and 10 - Water- Water Qualities & Ownership status.sav
13	11 Water Collection and storage units.sav
14	12-A Water- Community- Travel time in HOURS.sav
15	12-B Water- Who Fetches water.sav
16	13 Domestic and Non domestic Local Water uses.sav
17	14 -Water- -Water consumption satisfaction.sav
18	15-16-17 Water- -factors affecting water qualities and quantities.sav
19	18 Information need-awareness indication.sav
20	19 Hydro-climatic Information.sav
21	20 Hydro-climate-Effects of Climatic Change.sav
22	21 Info-NeighbourCommunities.sav
23	22 Information Source.sav
24	23 A and B- Info-Local Communication Type.sav
25	24 Info-Types of Relationships.sav
26	25 Info- Communication Style rate.sav
27	26 Cooperation and Communication.sav
28	27 Info- Languages Used for Cooperation and Communication_2.sav
29	28 Info- Communication Problems.sav
30	29 Hazard Exposure.sav
31	30 Hazard- Status and effects of development projects.sav
32	31 Hazard - Water Resources Protection techniques.sav
33	32 Hazard Current Water Resources Status.sav
34	33 updated-Hazard - Community Risk Exposure related to water conflicts.sav
35	34 and 35 Conflict- Main Sources Local Conflicts Water Resources.sav
36	36 Conflict- Main Causes of local conflicts-General.sav
37	37 Conflict- Boundaries and status of conflicts.sav
38	38 Conflict- Methods applied in resolving conflicts.sav
39	39 Conflict- Socio Economic Diversity Factors.sav
40	40 a and b- Conflict- List of Unresolved Conflicts.sav
41	41- Risk Reduction- Measures taken.sav
42	42 Conflict- Impacts of Conflict on family.sav
43	43 Conflict- Major global conflict areas.sav
44	44 a-Conflict- The use of gun and any protection tools.sav
45	44 b-Conflict- Types of gun used and purpose-incidents.sav
46	44 c-Conflict- Frequencies of gun hadling.sav

No.	List of SPSS Community Data Files
47	44 d-Conflict- Gun movement.sav
48	44 e-Conflict- Regulation for gun movemen.sav
49	44 f-Conflict- Recommendation for reducing conflicts.sav
50	44 g-Conflict- Local or traditional tools used for conflict resolution.sav
51	44 h-Conflict- Involvement in conflict resolution.sav
52	45 & 7 EWS- Practices of EWS.sav
53	46 EWS-Awareness on Costs of Conflict.sav
54	47 EWS-Awareness WRM-Environment-Flood control activities.sav
55	49 Transparency-Level of opnness.sav
56	50 Local information flow those sharing common resources.sav
57	51 Communication- Information flows between groups.sav
58	52 Communication-Interaction and communication.sav
59	53 and 54 Communication-Conflict appeal court or organization.sav
60	55 Sustainability- Contribution to sustainable development.sav
61	56 Other- experience for conflict resolution.sav
62	57 Other-Recommendation for local conflicts in the are.sav
63	58 Other- Any Research activities in the area and communities participation.sav
64	59 Other- Intentions, Plans, and Threats on Water Resources.sav

Appendix C 2: List of Local Institutions SPSS Survey Data Files:

No.	List of Local Institutions SPSS Data Files
1	1 Ins-BasicData.sav
2	2 and Part 7 of 21- Stakeholders Institution Infrastructure.sav
3	9 Key Conflict and water proffesionals.sav
4	10 Cooperation-Institutions.sav
5	11 Vulnerability Information.sav
6	12-13 Vulnerable populations.sav
7	14-15 Homelessness Status.sav
8	16 Vulnerability exposure info-instituition.sav
9	18-Information-Water Quality monitoring system.sav
10	19 Information-Water resources info in your instituition.sav
11	20 Information Responsible body for collection and management_1.sav
12	21-Part 6 Water Resources-Effective Plan.sav
13	21-Part 7 Institutions on Hydroclimatic information.sav
14	22 Prediction Program- modern and traditional.sav
15	23 Livestock and local agricultural products status.sav
16	24 Climate change-effects on local communities.sav
17	25 Communication and Networking-Institutional.sav
18	26-27Communication Networking-To Achieve Organizational Objective.sav
19	28 Motto - contacting to local people.sav
20	29 Communication problems with other institutions.sav
21	30-A- Rate Communities with your instituitions.sav
22	31-32 Information-on Water Resources-EWS-Conflict.sav
23	33 Water Collection and storage units.sav
24	34 Main sources ‘of water supply.sav
25	35 Travel time in HOURS.sav
26	36 WS quantity satisfaction rate.sav
27	37 WS QUALITY satisfaction.sav

No.	List of Local Institutions SPSS Data Files
28	38- Water Quality and Quantity status.sav
29	39-Information-Wanted to know about local water resourcs.sav
30	40 Local water resources ownership.sav
31	41-Information Collection and analysis boundaries.sav
32	42 Hazards Exposure-Factors that affect water resources.sav
33	43-Hazard Exposure- Exposure to water resources, bodies and WS systems.sav
34	44-Hazard Exposure- Projects in the basin and Cooperation with local communities.sav
35	45 Ins opinion on EMPOWERING the COMMUNITY.sav
36	46 Early warning on water resources utilization.sav
37	47 Water and sanitation coverage.sav
38	48- Conflict Root Cause-conflict come across by institution.sav
39	49- Conflict Root Cause- Sources of Conflicts over Water.sav
40	50- Conflict Root Cause- Institution Opinion on WRD activity.sav
41	51- Conflict Root Cause- Institution Opinion on CONFLICT over different issues.sav
42	52 a and b - List of resolved and unresolved conflicts.sav
43	53- Conflict Root Cause-Cause of local CONFLICT between communities.sav
44	54- Conflict Root Cause-Conflict Level Identification at local level.sav
45	55- Risk Reduction- Measures taken.sav
46	56- Risk Reduction- Further recommendation.sav
47	57 Community Risk Exposure related to water conflicts.sav
48	58- Availability of water security plan-short and long term plan.sav
49	59- Policy Identification-availability of policy, strategic plan and regulations recommendation.sav
50	60- Policy Identification-IWRM approach evaluations.sav
51	61 Efficiency and mandate of diff Institutions.sav
52	62 Institution participation in reducing violence and human crises.sav
53	63 Traditional practice in reducing conflict related problems.sav
54	64 Security situations-number of arrest.sav
55	65- EWS-Progress of awareness and timely consideration.sav
56	66 Adequacy of information and participation on water tariff setting.sav
57	67- EWS-Institutional awarness.sav
58	68 - Forecasting Availability.sav
59	69- Transparency-institutional-traditional and modern.sav
60	70 Local information flow those sharing common resources.sav
61	71- Transparency-Interactive communication.sav
62	72 Institutions satisfaction on Legal system.sav
63	73- Sustainability-Factors that affect Sustainable development.sav
64	74 Local experience on WRD-EWS-Conf.sav
65	75 Proposal for studying WRD and conflict in the region.sav
66	76- Other Factors or Issues- Any research activities.sav
67	77 General Comment.sav

D

APPENDIX D: INSTITUTIONS WORKING ON CONFLICT/WATER CONFLICT MANAGEMENT, WORLDWIDE

Appendix D 1: List of Organizations Working on Conflict/Water Conflict/War Management Related Activities

No.	Country	Institution/Organizations	Categories of Main Activities													
			Advisory and advocacy	Negotiation	Conflict Prevention and Management	Peace and Development	Capacity or Fund Building	Policy, Law and standard setting	Research	Strategic Setting and Planning	Technical services	Networking	Information and Publication	Training and Education	Conference	Others
1	USA	Harvard Negotiation Project (HNP) at Harvard Law School		Yes	Yes							Yes	Yes	Yes		Yes
2	UK	Cambridge University - Law School		Yes		Yes			Yes	Yes	Yes		Yes	Yes	Yes	
3	USA (Head Office)	Global Policy Forum (GPF)	Yes			Yes		Yes	Yes				Yes			Yes
	Germany (European Office)	Global Policy Forum (GPF)	Yes			Yes		Yes	Yes				Yes			Yes
4	USA	UNDP Bureau for Crisis Prevention and Recovery	Yes		Yes	Yes		Yes		Yes						Yes
5	USA	UN Water					Yes	Yes		Yes		Yes	Yes			
6	USA	Resolving Conflict Institute, LLC	Yes		Yes											Yes
7	USA	Pacific Institute California (*Dr. Peter H. Gleick, President*)	Yes					Yes	Yes		Yes	Yes	Yes			Yes
8	USA	Oregon State University (*Dr. Aaron Wolf, Project Director*)			Yes			Yes	Yes			Yes	Yes			Yes
9	USA	Association of Conflict Resolution (ACR)		Yes	Yes			Yes			Yes	Yes				Yes
10	USA	The Negotiation Institute: Training & Seminars	Yes	Yes										Yes		
11	USA	The Yale Centre for the Study of Globalization (YCSG)										Yes	Yes			Yes
12	USA	**Common Bond Institute (CBI)**			Yes		Yes			Yes		Yes		Yes	Yes	Yes
13	UK, USA, Singapore	The International Institute for Strategic Studies (IISS)	Yes		Yes			Yes				Yes	Yes			
14	UK	University of Dundee (UNESCO Centre for Water Law, Policy and Science)	Yes					Yes	Yes			Yes		Yes	Yes	Yes
15	UK	Institute for Conflict Research (ICR)	Yes						Yes					Yes		Yes
16	UK	Foreign & commonwealth Office			Yes	Yes				Yes	Yes	Yes	Yes			Yes
17	UK	BBC	Yes									Yes	Yes			Yes
18	UK	Overseas Development Institute-Water policy Programme (WPP)	Yes			Yes		Yes	Yes							Yes

No.	Country	Institution/Organizations	Categories of Main Activities													
			Advisory and advocacy	Negotiation	Conflict Prevention and Management	Peace and Development	Capacity or Fund Building	Policy, Law and standard setting	Research	Strategic Setting and Planning	Technical services	Networking	Information and Publication	Training and Education	Conference	Others
19	UK	The Water, Engineering and Development Centre (WEDC) - Loughborough University	Yes			Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	Uganda	Nile Basin Initiative (NBI)	Yes							Yes						Yes
21	Switzerland	Green Cross International	Yes		Yes							Yes	Yes			Yes
22	Sweden	Swedish Water House				Yes		Yes		Yes	Yes	Yes	Yes			Yes
23	Sweden	Peace and Development Research Department at Göteborg University							Yes	Yes				Yes		
24	Sweden	PRIO-International Peace and Research Institute, Oslo			Yes	Yes			Yes							Yes
25	Philippines	ADB-Asian Development Bank				Yes	Yes	Yes			Yes					Yes
26	Norway	Water Research Network										Yes	Yes			Yes
27	Northern Ireland	International Conflict Research (INCORE)						Yes	Yes	Yes	Yes			Yes		Yes
28	Kenya	Resource Conflict Institute (RECONCILE)	Yes					Yes	Yes						Yes	Yes
29	Japan	International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of UNESCO					Yes		Yes			Yes	Yes	Yes		Yes
30	Italy	FAO Water and Food Security					Yes	Yes					Yes			
31	Germany	Berghof Research Centre for Constructive Conflict Management							Yes		Yes					Yes
32	Germany	Bone International Centre for Convention (BICC)	Yes	Yes	Yes											Yes
33	France	UNESCO project: from Potential Conflict to Co-operation Potential (PCCP)	Yes		Yes	Yes	Yes							Yes		
34	Ethiopia	Ethiopian International Institute for Peace and Development (EIIPD)	Yes			Yes	Yes		Yes	Yes		Yes		Yes	Yes	Yes
35	Belgium	International Law Association (ILA)						Yes							Yes	Yes
36	Rwanda	Nile Media Network(ILA)										Yes	Yes			
37	UK	Institution of Civil Engineers (UK)											Yes		Yes	
38	USA	John Ford and Associates, Workplace Conflict Management Services											Yes	Yes	Yes	
39	UK-Birmingham	Responding to Conflict (RTC)												Yes		
40	Northern Ireland	INCOR						Yes	Yes							
Total count			18	5	12	12	7	18	17	11	9	18	20	14	9	29
Percentage of Count			9%	3%	6%	6%	4%	9%	8%	6%	4%	9%	10%	7%	5%	14%

E

APPENDIX E: VARIABLES FOR FRAMEWORKS AND CATEGORIES OF SURVEY QUESTIONNAIRES

Appendix E 1: Frameworks and Categories of Survey Questionnaires:

Categories of survey questionnaires	Main Unit of measurement	Whom to Ask?				Minimum no. of requests	Remarks (justification)	Type of questions
		1	2	3	4			
Criterion 1: Collection, Analysis and Communication of relevant and effective Information (CACI)-published and unpublished information- (how to value published and unpublished info?)								E.g. Multiple choice, numeric open & text open end (see p7 of RP for detail)
1.1. Demographic data (People and livestock)	*Per./location*	*Population office*	*Planning bureau*	*Agricultural office*	*Statistics Office*			*Numeric open*
1.2. Population and water use (water coverage)	*%*	*Communities*	*Water office*	*Environment*				*Numeric open*
1.3. Water collectors population	*Per/amount*	*Communities*	*Water Office*	*NGO*	*Environment*			
1.4. The vulnerable population	*Per/type of vulnerability*	*Community*	*Water Office*	*NGO*	*Conflict departments*			
1.5. Water resources information								
• *Water bodies (by basins &sub basins, local, national, international*	Amount/ area/type	*Communities (local understanding)*	*Water Office*	*Basin authority*	Environment			
• *Water resources*	Amount/type /location	*Communities*	*Water Office*	*Basin*	Environment			
• *Water consumption/over-consumption info.*	Qty./person/ location/year	*Communities*	*Water Office*	*Basin*	Environment			
• *Water pollution information*	Qty./person/ location/year	*User communities*	*Water office*	*Health centres*	*Environment office*			
• *Technical and natural factors that affect resources*	*Type*	*User communities*	*Water office*	*Environment office*	*Basin authority*			
• *Traditional or local understanding/definition of water*	*Type/person*	*User communities*	*Water office*	*Environment office*	*Basin authority*			
• *Main user community views, stories, quotations, and songs on water*	*type*	*Communities*	*Water office / basin authority*	*Traditional Elders*	*Culture & Information Office*		Commodity, human right, others	Option buttons
• *Traditional & current views of neighbour user community who shares water*	*type*	*Communities*	*Water office / basin authority*	*Traditional Elders*	*Culture & Information Office*		Commodity, human right, others	
1.1. Water resources facilities (modern, traditional, life time, maintenance facility, ownership, method of utilization, safty)	*Unit/location*	*Communities*	*Water office*	*Private sectors*	*Defence/military office*			
1.2. Hydro-climatic information								
• *Availability of climate prediction program*	*Unit/location*	*Water office*	*Metrology office*	*Environment office*	*Trade & industry officer*	*EWS & disaster prevention Office*		
1.3. Communication/networking								

Categories of survey questionnaires	Main Unit of measurement	Whom to Ask?				Minimum no. of requests	Remarks (justification)	Type of questions
		1	2	3	4			
• *Communication media (modern , traditional)*	Media /person	*Ministry of information*	*Statistics office*	*Traditional institutions*	*Culture & Information Office*			
• *Access to water resources information*	Info./type/ location	*Communities*	*Water office*	*Investment Office*	*Planning Office*	*Basin Authority*	EWS Office	Yes/no
• *Does communication a problem?*	Yes/no	*Communities*	*Water office*	*Culture & Communication Office*	NGO's			
• *Level of cooperation among communities*	Type of cooperation	*Communities*	*Community representatives*	*Culture & Communication Office*	NGO's	Planning Office		
Criterion 2: identification of individuals exposed to hazards,								
1.4. Hazards and risks (e.g. Risks on water bodies)	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.5. Risk events coverage	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.6. Root causes of conflict	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.7. Cause and effects of local water conflict (RCA)	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.8. Dimensions of conflict	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.9. Any unresolved conflict between conflicting parties (trend, how it relates to water, why not resolved, effects, etc.)	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.10. Level/status of conflicts	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			(semi structured)
Criterion 3: identification of actions taken to provide or reduce risks,								
1.11. Risk causes related to resources	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
1.12. Preliminary assessment of any local water conflict related factors	*Type*	*Community*	*Water Office*	*Environment*	*Disaster and risk prevention*			
Criterion 4: Identification of stakeholders/institutions/ infrastructures that helps to take actions in reducing risks,								
1.13. Stakeholders/Institutions working on water (list, type, structure)	*List by type*	*Communities*	*Water offices*	*Rural dev't offices*	*Trade & industry offices*			
1.14. Who supports the water sector (list)	*BIRR (Currency)*	*Communities*	*Water Bureau*	*NGO's*	*Private sector*			
1.15. Availability of any collaborations among stakeholdrs	*Type/duration*	*Communities*	*Water offices*	*Rural dev't offices*	*Trade & industry offices*			
Criterion 5: identification of local water conflicts and effective responses and preparedness towards the problem								
1.16. Local/traditional understanding of water conflicts or conflict in general	*Type*	*Community*	*Water Office*	*Disaster and risk prevention*	*Conflict magmt. office*			
1.17. Types of conflicts that occurs and/or affecting the local people	*See conflict anatomy*	*Communities*	*Disaster and risk prevention*	*Disaster and risk prevention*	*Legal, police, admin, water, mediators, trad. leadres*		*Police*	*Check box*

Categories of survey questionnaires	Main Unit of measurement	Whom to Ask?				Minimum no. of requests	Remarks (justification)	Type of questions
		1	2	3	4			
1.18. Growth rate of armies within the community Analyse: war is the parent of armies- James Medison, Political Observation, 1795-internet belogs)	Type/person	Communities	Police	Gov. Admins.	Legal office		Probably both at local, regional & national lvel	
1.19. How often conflict occurs (slowly, suddenly, frequently)	Type/time	Communities	Disaster and risk prevention	Disaster and risk prevention	Legal, police, admin, water, mediators, trad. leadres			
1.20. Signs of conflict (see conflict anatomy chart)	Per/type	User communities	Conflicting bodies	Legal, police, admin, water, mediators, trad. leadres				Open & multiple choice
1.21. Conflict expectation rate between disagreeing parties	Per/type	Communities	Disaster and risk prevention	Disaster and risk prevention	Legal, police, admin, water, mediators, trad. leaders			(semi-structured)
1.22. Water conflict in relation to other factors	Type	Communities	Water Office				Sequential arrangement	(semi-structured)
1.23. Putting today's local/global conflict /war problems sequentially by relating to local, regional and national (Financial war, Internet war, Water war, and war on health-Aids)	Type/person	Communities	Gov. admins	Police & military.	Legal office		Probably both at local, regional & national lvel	
1.24. Exposure to international water conflicts	Yes/no	Community	Water Office		Conflict process			Open
1.25. Causes and effects of conflict	Fish Bone analysis	Community	Water Office	Water Prof. Organ.				Fish bone analysis
1.26. How local people responds/reacts towards conflict and water conflict in general (tradition)								Semi-structured
• Towards water conflict	Types/person	Community	Water office, Police	Legal office	Culture & tradition office			
• Towards conflict in general	Types/person	Community	Water office, Police	Legal office	Culture & tradition office			
1.27. Conflict tolerance level/status	Type/person	Community	Water Office	Gov. admins			Local & regional	
1.28. Local water conflict mgmt. practices/approaches/views/ methods/tools (modern, traditional)	Type/location	Community	Water Office	EW and disaster prevention Organ.	environment			
Criterion 6: identifications of conclusions to policy-makers to make strategic choice,								
1.29. Water security plan (short-term, medium-term & long-term)	Type	Community	Water Office	Planning Office	Other institutions			
1.30. Water resources management	Type	Community	Water Office	Planning Office	Other institutions			
1.31. Policies	Type	Community	Water Office	Planning Office	Other institutions			
1.32. Availability of strategies and planning	Type	Community	Water Office	Planning Office	Other institutions			
1.33. Rules and regulation (water resources management)	Type	Community	Water Office	Planning Office	Other institutions			
1.34. Level, efficiency and mandate for water resources management	Type	Community	Water Office	Planning Office	Legal institutions			

Categories of survey questionnaires	Main Unit of measurement	Whom to Ask?				Minimum no. of requests	Remarks (justification)	Type of questions
		1	2	3	4			
1.35. Availability of integrated water resources management practices (WRM)	Type	Community	Water Office, Basin Authority	Planning Office	Legal institutions			
• Availability of favourable conditions (polices, legal frameworks, finance/capacity building)	Type	Community	Water Office, Basin Authority	Planning Office	Legal institutions			
• Availablity of institutions useful for implementing IWRM (flood control, dam management, drought control, health safety, soil manag., etc.)	Type	Community	Water Office, Basin Authority	Planning Office	Legal institutions			
• Enabling environment (planning, training …)	Type	Community	Water Office, Basin Authority	Planning Office	Environment institutions			
• Ensuring the continuity of the process (IWRM audit body)	Type	Community	Water Office, Basin Authority	Planning Office	Legal institutions			
Criterion 7: consideration of timely warning (EWS and lead time)								
1.36. Early warning on water resources utilization (eg. status of water shortage-scarcity - Malin Falknmark)	Type	Community	Water office	EWS & Disaster prevention office				
1.37. Awareness on costs of deliverable services and conflicts	Birr/type	Community	Water office	Planning, Finance & Economy Office				
1.38. Awareness on availability of conflicts (timely warning)	Type	Community	Water office	EWS & Disaster prevention office				
1.39. Awarness on water sector development at local level	Type	Community	Water office	Planning, Finance & Economy Office	Trade & investment Office			
Criterion 8: the aim that helps to avoid or reduce violence and human crises								
1.40. Forecasting (availability)	Type	Community	Water office	EWS & Disaster prevention office	Meteorology			
1.41. Availability of preparedness	Type	Community	Water office	EWS & Disaster prevention office	Meteorology			
Criterion 9: contribution to sustainable development								
1.42. Sustainability of conflict diversity factors	Type	Community	Water office	Reginal & local admins	Basin , environment Authority			
1.43. Sustainability of resources	Type	Community	Water office	Reginal & local admins	Basin , environment Authority			
Criterion 10: the issue of transparency								
1.44. Transparency (search out for key components of a transparency??)	Type							?
• Level of openness (availability of local based thinking, believes or tradition for openness)	Unit	Community	Legal office	Water Office	Corruption Prevention Office			Agreement scale
• Level of Interactivity and communication	Unit	Community	Legal office	Water Office	Corruption Prevention Office			Agreement scale
• Availability of the system/tradition of accountability	Unit	Community	Legal office	Water Office	Corruption Prevention Office			Agreement scale
• Availability of independent legal system (tradition)	Unit	Community	Legal office	Water Office	Corruption Prevention Office			Agreement scale
Criterion 11: Other issues/factors								

Categories of survey questionnaires	Main Unit of measurement	Whom to Ask?				Minimum no. of requests	Remarks (justification)	Type of questions
		1	2	3	4			
1.45. Traditional/local experiences (developing countries)	*Type*	*Community*	*Water Office*	*Local admins.*				
1.46. Identification of pilot sites (setting criterion) - sources od data	*Type*	*Community*	*Water Office*					
1.47. Research and development (national, international, local)								
• Pollution control	*Type*	*Community*	*Water Office*	*Universities & institutions*	environment			
• Water recycling	*Type*	*Community*	*Water Office*	*Universities & institutions*	Environment, rain water harvesting Prof. groups			
• Search for extra water (desalination, rain water harvesting, from air, importing from other sources, other)	amount/type	Communities	Water offices	Environmental office				Option & open Ques. (amount to be filled)
• On water saving technologies	*Type*	*Community*	*Water Office*	*Universities & institutions*	Environment, rain water harvesting Prof. groups			
• Any new concepts/knowledge /research on water sector development	*Type*	*Community*	*Water Office*	*Universities & institutions*	Environment, rain water harvesting Prof. groups			
1.48. Any other water related intensions/plan/treats	*Level of Activity/Type*							
Criterion 12: Caution variables: that should be considered during developing the questionnaire							*Private use for caution*	
1.49. Ethical issues (in developing countries)	*Prepare guideline*	*Federal/ Regional Water office*	*Local government*				*Private use for caution*	
• Issues/approaches that initiates/provokes conflicts							*Private use for caution*	
• Issues that are not suitable for political/traditional stability of the country							*Private use for caution*	
• Approaches for interviewing this questionnaires							*Private use for caution*	
• Request for formal letter for interviewing (Loughborough, National, Regional and local)								
• Translating in to Amharic								

APPENDIX F: EXPOSURE TO VULNERABILITY ANALYSIS

Appendix F 1: Age Group * Family Vulnerability Category * Gender Cross tabulation

Gender and age group			Gender*Age* Based Vulnerability		
			Not Vulnerable	Vulnerable	Total
Male	Infants-below a year	Count	0	45	45
		% of Total	.0%	10.2%	10.2%
	Children: 2-14 years	Count	0	172	172
		% of Total	.0%	38.9%	38.9%
	Youth: 15-24 years	Count	100	0	100
		% of Total	22.6%	.0%	22.6%
	Adults: 25-40 years	Count	85	0	85
		% of Total	19.2%	.0%	19.2%
	Adults: 41-56 years	Count	33	0	33
		% of Total	7.5%	.0%	7.5%
	Adults: 57-65 years	Count	0	4	4
		% of Total	.0%	.9%	.9%
	Seniors: 65+ years	Count	0	3	3
		% of Total	.0%	.7%	.7%
	Sub total	Count	218	224	442
		% of Total	49.3%	50.7%	100.0%
Female	Infants-below a year	Count		14	14
		% of Total		4.2%	4.2%
	Children: 2-14 years	Count		125	125
		% of Total		37.3%	37.3%
	Youth: 15-24 years	Count		90	90
		% of Total		26.9%	26.9%
	Adults: 25-40 years	Count		92	92
		% of Total		27.5%	27.5%
	Adults: 41-56 years	Count		11	11
		% of Total		3.3%	3.3%
	Adults: 57-65 years	Count		2	2
		% of Total		.6%	.6%
	Seniors: 65+ years	Count		1	1
		% of Total		.3%	.3%
	Sub total	Count		335	335
		% of Total		100.0%	100.0%

Appendix F 2:: Trends of vulnerable people in a family

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not sure	9	6.3	12.5	12.5
	Stable	1	.7	1.4	13.9
	Decreasing	3	2.1	4.2	18.1
	Increasing	25	17.4	34.7	52.8
	Fluctuating	7	4.9	9.7	62.5
	Not available	27	18.8	37.5	100.0
	Total	72	50.0	100.0	
Missing	System	72	50.0		
Total		144	100.0		

Appendix F 3:: Local institutions observations on trends of homeless people

Trend		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Increasing	8	25.0	33.3	33.3
	Decreasing	5	15.6	20.8	54.2
	Fluctuating	3	9.4	12.5	66.7
	Stable/constant	1	3.1	4.2	70.8
	I don't know	4	12.5	16.7	87.5
	Not applicable	3	9.4	12.5	100.0
	Total	24	75.0	100.0	
Missing	System	8	25.0		
Total		32	100.0		

Appendix F 4: Institutions response on vulnerability on unemployment, finance and water supply services:

Vulnerability Category	Vulnerability Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Not comment /applicable	Total
Unemployment	Unemployment rate is decreasing	1	7	5	12	1	2	28
	Homelessness rate is decreasing	2	2	10	8	1	3	26
	Sub total	3	9	15	20	2	5	54
Income and expense	Satisfied by daily or monthly income	2	1	3	18	3		27
	Expense or debt is less than respective income	1	3	6	11	6		27
	Sub total	3	4	9	29	9		54
Clean, adequate and affordable water supplies	Access to clean and safe water	0	11	5	7	4		27
	Access to adequate water supplies	0	3	6	13	4	1	27
	Affordable water supplies	1	11	4	7	4		27
	Easily Accessible water supplies	0	2	5	12	7	1	27
	Sub total	1	27	20	39	19	2	108
	Total	7	40	44	88	30	7	216
	Percent	3	19	20	41	14	3	100
	Combined percent	22		20	65		3	

Appendix F 5: Institution's awareness about local vulnerable population

No.	Age Category	Vulnerability Trends			
		Decreasing	Stable	Increasing	Not sure
1	Infants-below a year	1	0	7	4
2	Children: 2-6 years	2	1	7	2
3	Children: 7-14 years	3	0	7	2
4	Youths: 17-24 years	0	0	1	0
5	Women in general	2	1	7	2
6	Householders headed by women	0	2	7	3
7	Senior (old people)	2	2	5	3
8	People with disability (Physically and mentally)	1	2	6	3
9	Immigrants	1	1	7	3
10	Displaced people	0	0	7	2
11	Food insecure population	1	1	7	2
	Total	**13**	**10**	**68**	**26**
	Percent	**11%**	**9%**	**58%**	**22%**

APPENDIX G: WEC INFORMATION ANALYSIS

Appendix G 1: Comparing information request and purpose by local institutions

Fig-A: What type of information needed?

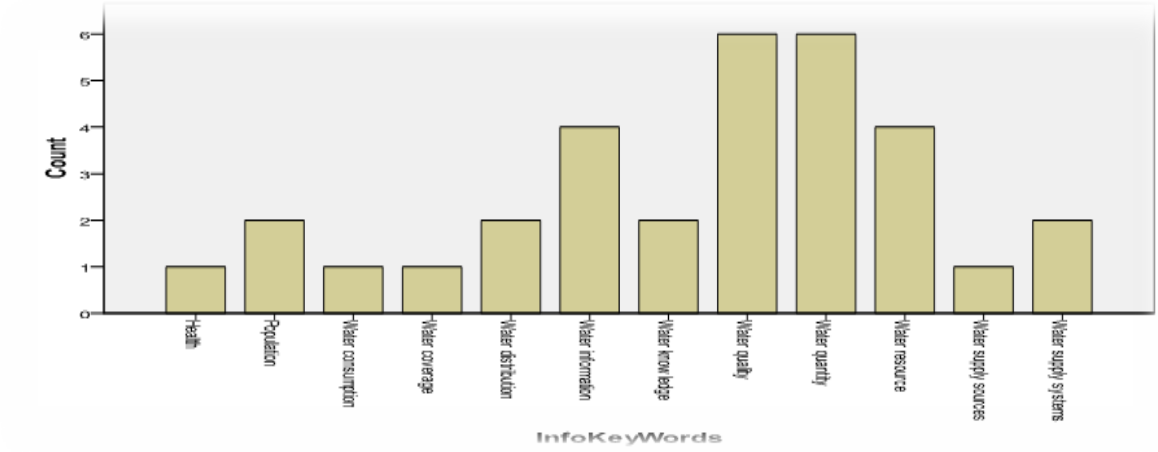
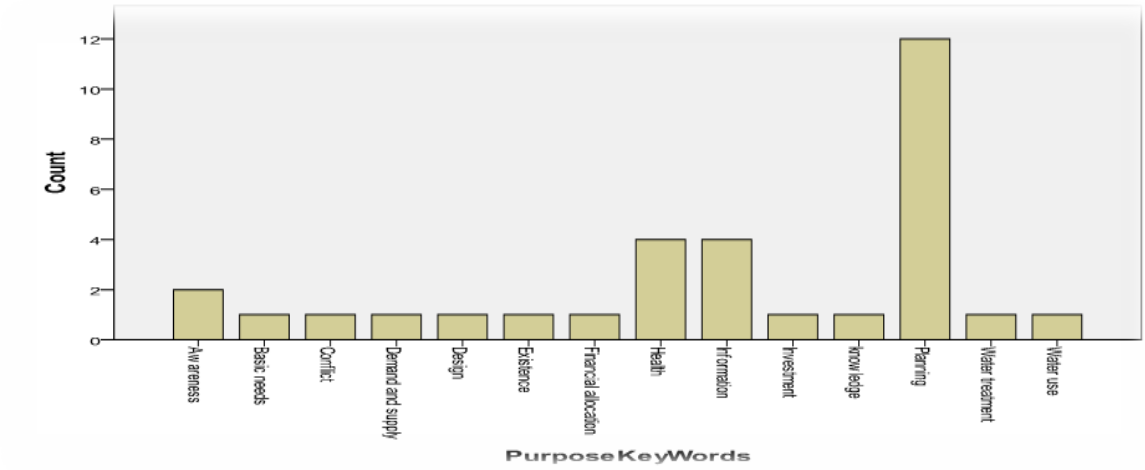


Fig-B: Why they need information?



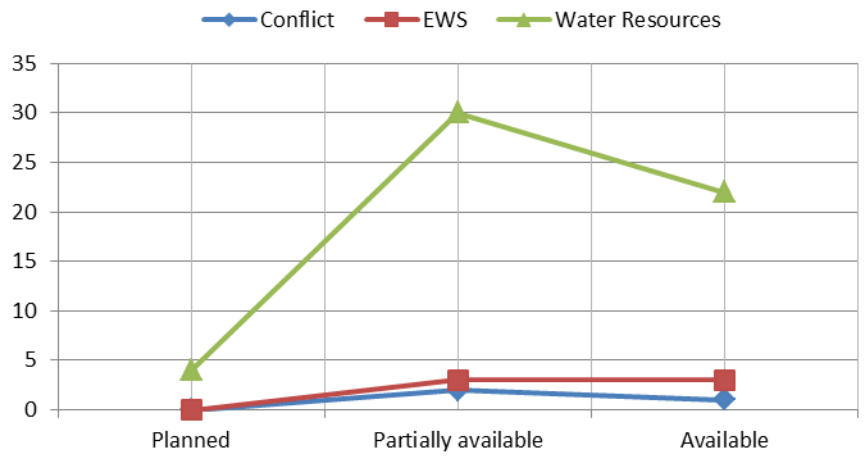
Appendix G 2: Institutions Opinion on Awareness on Resource ownership

Ownership of Resources	Water resources	Strongly agree	Agree	Total	Rank
Public (Community)	Pipe water	1		1	
	Ground water/wells	1		1	
	Ponds and small dams	1		1	
	Sub Total	**3**		**3**	**2nd**
Gov and Community	Urban & rural potable water supply schemes	0	1	1	
	Ground water/wells	1	0	1	
	Hand dug wells	0	1	1	
	Sub Total	**1**	**2**	**3**	**2nd**
Gov and NGO	All water sources		1	1	
	Sub Total		**1**	**1**	**3rd**
Government	Ground water/wells	2	0	2	
	Awash river/tributaries	0	1	1	
	Dam/surface water	1	0	1	
	Irrigation Scheme Dam	0	1	1	
	All water sources	0	1	1	
	Sub Total	**3**	**3**	**6**	**1st**
	Total	7	6	13	

Appendix G 3: Communities Opinion on Awareness on Resource ownership

Ownership of Resources	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	No comment	Total	**Percent**
Community/Public	22	62	13	14	10	4	125	47
Municipal/Gov	2	45	6	4	5	7	69	26
Private	2	31	12	5	0	5	55	21
Others	0	4	2	1	0	0	7	3
No ownership	0	1	1	1	0	0	3	1
NGO	0	1	0	0	0	1	2	1
Military	0	1	0	1	0	0	2	1
Water and Sewerage Authority	0	1	0	0	0	0	1	0
Total	26	146	34	26	15	17	264	100

Appendix G 4: Pictorial illustration of information availability



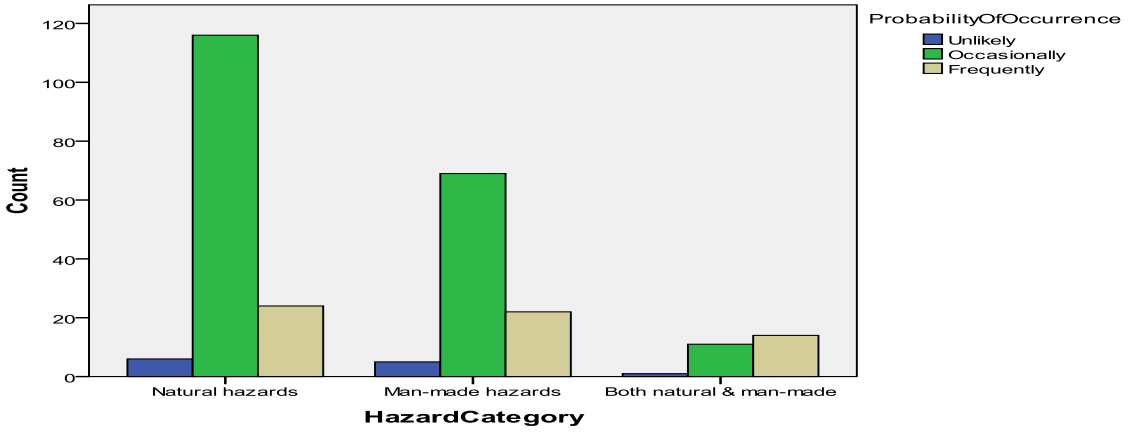
Appendix G 5: Accuracy: Information accuracy rating for local community

No.	Local Community Information Sources	Information Accuracy Rate					Total
		Accurate	Partially accurate	Not reliable and needs to cross check	Not available /applicable	No comment	
1	Traditional-*Dhaaguu*	110	14	1	0	1	126
2	Meeting (e.g. Agricultural extension, political, religious, etc.)	24	30	8	21	44	127
3	Family and Friends	23	82	1	1	20	127
4	Radio	12	64	11	4	37	128
5	Television	4	24	10	31	59	128
6	Newspaper	3	12	8	45	59	127
7	Flyer	1	0	7	60	59	127
8	Any other	3	0	0	0	0	3
	Total	180	226	46	162	279	893
		20%	25%	5%	18%	31%	

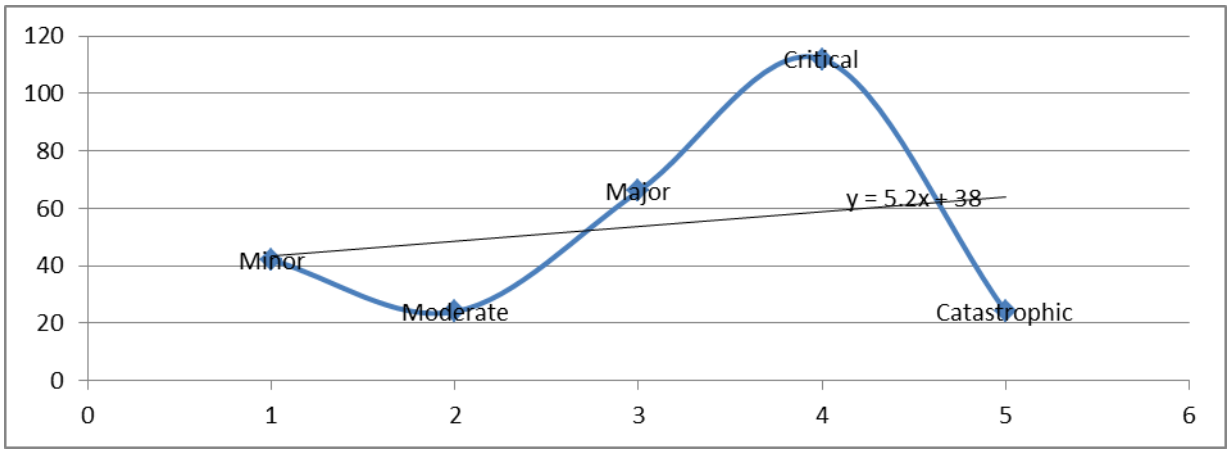
H

APPENDIX H: RISKS AND HAZARD STATUS ANALYSIS

Appendix H 1: Categories of Risks in the basin and probability of occurrence

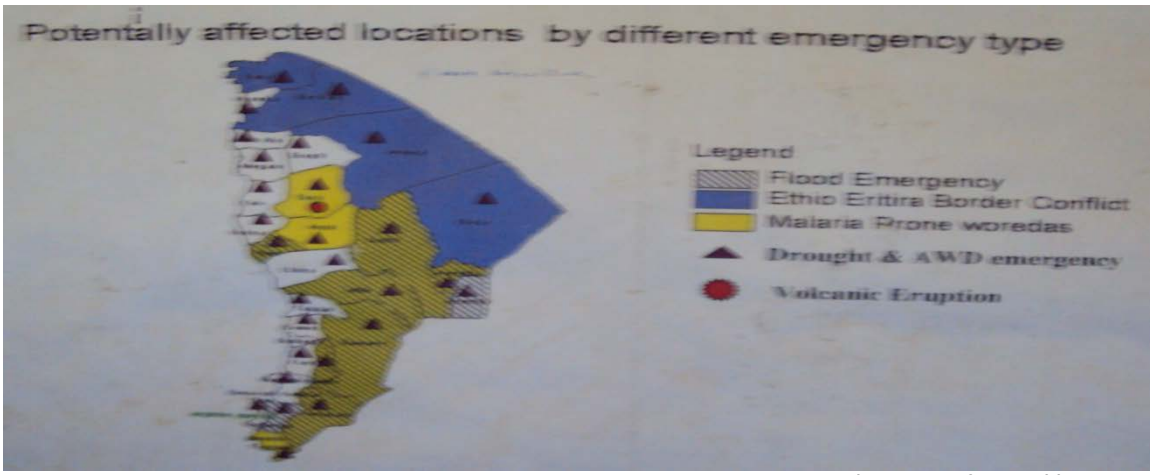


Appendix H 2: Numerical Prediction of hazard and its Severity Status



Note: The number of hazards are increasing at critical rate of the function of y=5.2x +38.

Appendix H 3: Potentially affected locations by different emergency type in Afar Region



(Source: Afar Health Bureau)

Appendix H 4: Communities response on effects of climate change and its level of severity

No.	Effects of climate change	Level of Severity				Total	Percent
		High	Medium	Low	Not available /comment		
1	Drought	15	1	1	0	17	21
2	Change in temperature	11	2	0	0	13	16
3	Death of animals and human	9	0	0	0	9	11
4	Water shortage	9	0	0	0	9	11
5	Flooding	5	1	0	0	6	7
6	Dislocation of people	4	0	0	0	4	5
7	Health related problems	4	0	0	0	4	5
8	Failure in crop production	2	0	0	0	2	2
9	Poverty	2	0	0	0	2	2
10	Tornado	2	0	0	0	2	2
11	Decrease in food supply	1	0	0	0	1	1
12	Decrease in hydro power supply	1	0	0	0	1	1
	Subtotal-1	**65**	**4**	**1**	**0**	**70**	85
13	No change	0	0	0	12	12	15
	Subtotal-1	**0**	**0**	**0**	**12**	**12**	15
	Total	**65**	**4**	**1**	**12**	**82**	100
	Percent	79	5	1	15	100	

The table indicates 85% of the local community believes that they have been affected by climate change mainly causing drought, death of human and animals, change in temperature, water shortage and flooding problems. 15% believes there are no climate change effects.

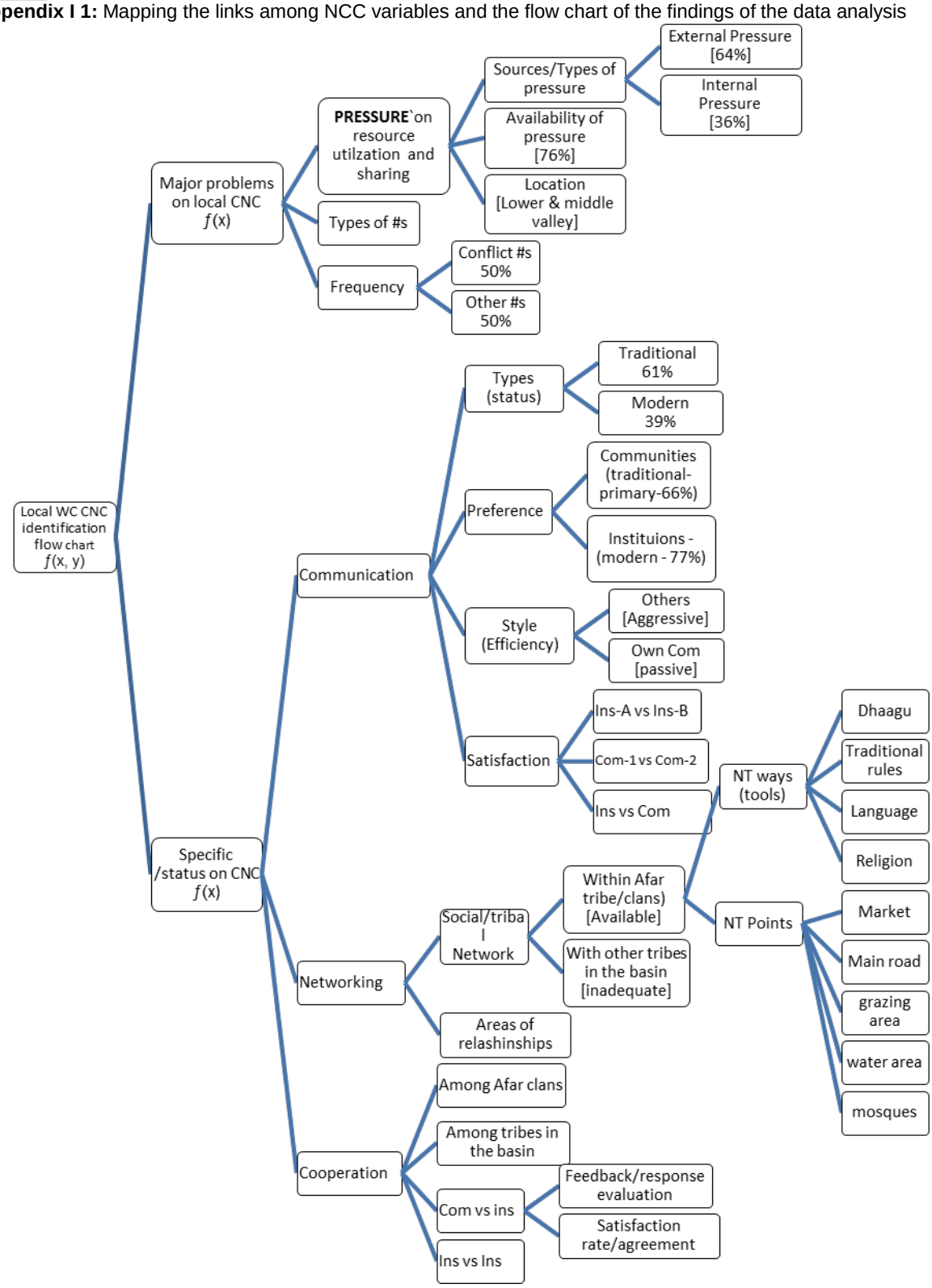
Appendix H 5: Institution's response on Effects of climate change-Summary

No.	*Problems related to (effect area)*	*Frequency*	*Percent*	*Summary Percent*
1	Flooding	23	17.8	
2	Drought	22	17.1	
3	Water supply	21	16.3	51
4	Health	15	11.6	12
5	Forest	14	10.9	
6	Wild life	13	10.1	
7	Vegetable & animal species	12	9.3	30
8	Agriculture	8	6.2	6
9	Any opportunities	1	.8	1
	Total	129	100.0	100

Table 5-45 shows flooding, drought and shortage of water are major problems caused by climate change. Effects on forest, vegetables, and wildlife and animal issues are secondary problems caused as a result of climate change. Health related problems are falls in the third category.

APPENDIX I: COMMUNICATION, NETWORKING AND COOPERATION ANALYSIS

Appendix I 1: Mapping the links among NCC variables and the flow chart of the findings of the data analysis



Appendix I 2: Major list of local people rational on communication and networking

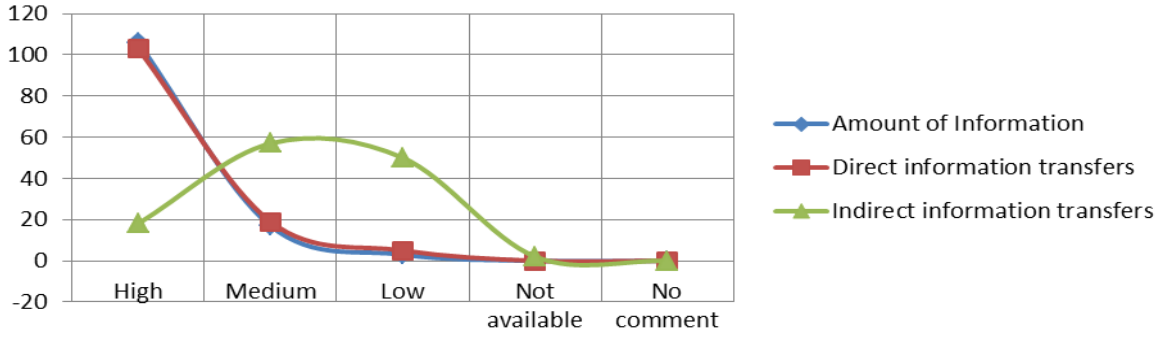
Categories of rationale	Selected list of respondents comment on communication and networking
Tradition (*9 comments*)	Communication and cooperation is parts of our tradition Traditionally, we dine and live together Working, sharing and dining in common is parts of our tradition Afar people are nomadic people and sociable people Helping each other is parts of Afar tradition Since we have strong relationships through our culture and tradition We do have a great respect to any outside of the local person who visits us traditionally which is our culture Communal ways of working and living together is parts of our tradition We respect outsides and welcome them by serving food and milk and also request them their willingness to come again.
Social relationships (7 *comments*)	In Afar tradition socialization is very important Socialization (sharing food and living together) is parts of Afar's tradition I have good relationships with the tribe members I have a good relationship with the local community I have very good social relationships with others Anyone who lives in the region have strong relationship with the community In my area there is a good social relationships so that we discuss on many issues related to social, economic and politics
Problem solving (*3 comments*)	I would like to work and cooperate with others during the time of problem or without problem through discussion in a meeting we come across decision in resolving problems Unless their problem is resolved, they may be a cause of problem on members of my community.
Humanity (*3 comments*)	I have a good humanity and very concerned and support as long as he is Ethiopian I do not want to think and see bad things would happen on human being I have a good communication with all human beings
Information and awareness (2 *comments*)	To gather necessary information by making *Dhaagu* While more attention was given for serious and immediate issues
Conflict (2 *comments*)	cooperation with local people groups within the region not including Issa Communication with local people groups within the region not including Issa
Personal behaviour (2 *comments*)	I am positive thinker and I am always ready to help others, I can help them as much as I can I do not give time for such matter because of my low level of attitude/thinking
Language and religion (2 *comments*)	My communication is good because I am a member of the clan having the same religion and language I do speak different languages and easily communicate with others
Work conditions: *(1 comment)*	My work place is far away from residential area so I have little or no contact and cooperation with people in my residential area
Water supply (1 comment)	I respect the local Afar community's tradition; There is lack of knowledge within the Afar community and I cooperate with them diplomatically by providing them water while I was driving on the main rural road
Respectfulness *(1 comment)*	Because we respect him and welcome him by food and drink milk and ask him willingness to come again.
Participation *(1 comment)*	I did participate on any activities going on in my local area
Cooperation *(1 comment)*	The level of my cooperation with local people is good
Underdevelopment *(1 comment)*	The local area is not developed and not easy to communicate and cooperate
Common natural resources *(1com.)*	Provision of adequate labour and privately owned natural resources such as wood and soil helps for the development of local communities

APPENDIX J: LOCAL TRANSPARENCY STATUS ANALYSIS

Appendix J 1: Ranking communities view on transparency, continued from the above table

Ranks	Transparent		Partially transparent		Not transparent	
	Categories of openness	**keywords**	**Category**	**keywords**	**Category**	**keywords**
1st	Availability of accountability system or tradition	*Accountability*	Individual experience on accountability	Experience	Financial institutions performance	*Finance*
2nd	Traditional decision making practice	*tradition*	Individual day to day decision making process	decision making process	Gov. organizations functioning	*Government*
3rd	NGOs service provision-see notes on local and international NGO comments	*NGO*	NGOs service provision-see notes on local and international NGO comments	NGO	Activities of the press	*Press/media*

Appendix J 2: Comparing the rate of direct and indirect information transfer rate among communities



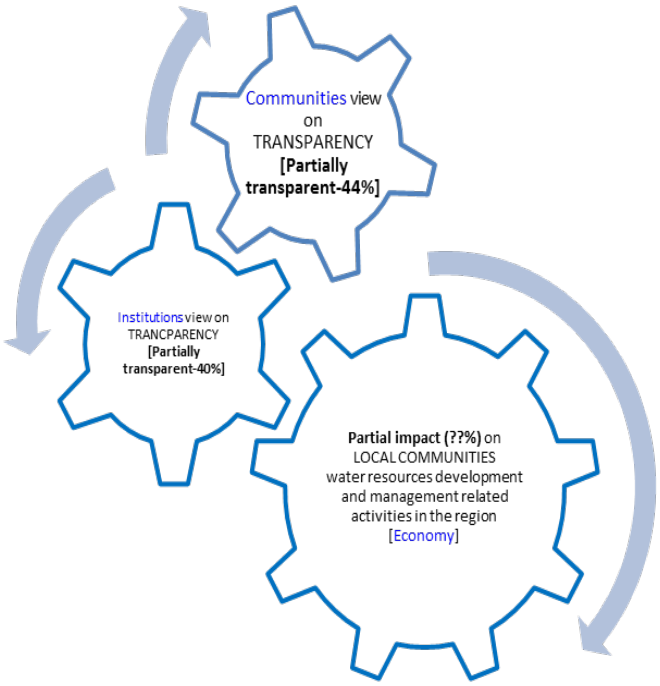
Appendix J 3: Institution respondents view on local WR institutions transparency

No	Respondent institutions	Transparency Level				Total
		Transparent	Partially transparent	Not transparent	No comment	
1	INS-1	2	5	1	1	9
2	INS-10	2	1	6	0	9
3	INS-11	1	6	1	1	9
4	INS-12	2	4	3	0	9
5	INS-13	2	0	**7**	0	9
6	INS-14	3	1	2	3	9
7	INS-15	2	3	4	0	9
8	INS-16	**4**	4	0	1	9
9	INS-17	0	0	0	9	9
10	INS-18	2	0	**6**	1	9
11	INS-19	0	4	4	1	9
12	INS-2	1	1	**6**	1	9
13	INS-3	1	5	3	0	9
14	INS-4	**4**	4	1	0	9
15	INS-5	1	3	5	0	9
16	INS-6	**5**	2	1	1	9
17	INS-7	1	**8**	0	0	9
18	INS-8	1	1	4	3	9
19	INS-9	3	6	0	0	9
20	LWCE-3	1	4	4	0	9
21	LWCE-4	0	4	5	0	9
22	LWCE-5	0	**9**	0	0	9
23	LWCE-6	0	**7**	2	0	9
Total		38	82	65	22	207
Percent		**18%**	**40%**	**31%**	**11%**	**100%**

Appendix J 4: Ranking from top to bottom

Ranks	Transparent		Partially transparent		Not transparent	
	Institutions	Category	Institutions	Category	Institutions	Category
1st	Lower Awash Basin Office	*Water (Gov)*	Addis Ababa/Ministry of Federal Affairs	Security, federal and inter regional issues (Gov)	Semera-Logya Urban Water Supply Services	*Water (Gov)*
2nd	Afar Water Works Construction Enterprise	*Water (Gov)*	Disaster Prevention & Food Security Bureau	Early warning (Gov)	Trade, Industry, Transport and Investment Bureau	*Trade and investment (Gov)*
3rd	Afar Water Resources Bureau	*Water (Gov)*	Addis Ababa/Ministry of Water Resources	Water (Gov)	Afar Pastoral, Agricultural and Rural Development Bureau (PARDB)	*Pastoral (Gov)*

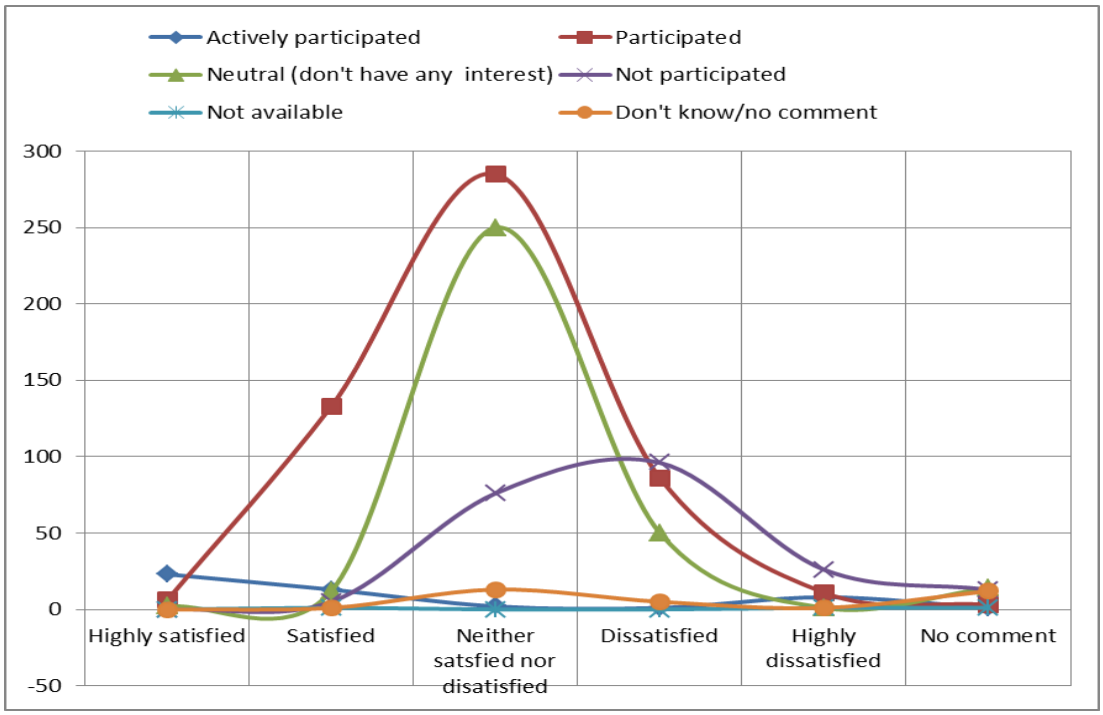
Appendix J 5: mapping local transparency, interaction and its effects on development



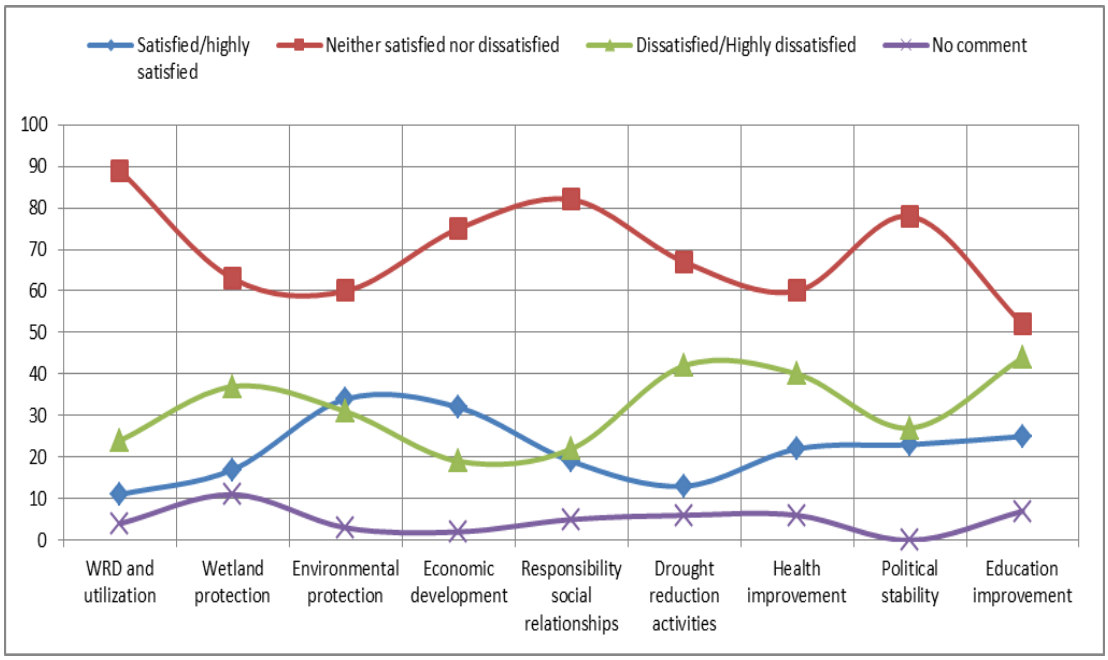
K

APPENDIX K: SUSTAINABILITY STATUS ANALYSIS

Appendix K 1: Correlation among SCDF activity list, participation and satisfaction rate



Appendix K 2: Illustrating the local communities SCDF



Appendix K 3: Major problems identified by institutions towards SRCDF

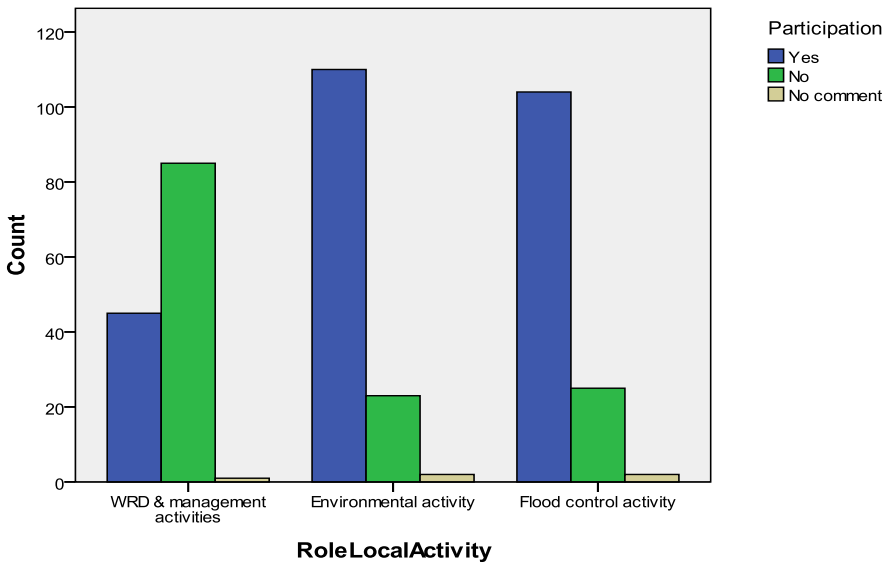
Category	List of problems that affect sustainable water resources development
1. Weather conditions	High temperature due to lack of conservation of natural resources
2. Water supply resources	Flooding Dry land and salty water Due to newly established projects Delta river type Lack of pure underground water Problem in selecting appropriate water points/sites Rivers and ground water resources have started drying and it needs construction of dam everywhere Some water points don't give water during dry seasons Some water points are very salty Some areas don't have enough water due to the dry nature of the area Unavailability of technical materials and water pipes
3. Transparency	Significant problems of transparency, accountability and administration problems at rural and urban areas
4. Technologies	High cost of technologies Lack of water drilling machines with the necessary installation materials
5. Settlement	Scattered people, uneducated people, lack of awareness
6. Planning	Lack of vision and planned activities
7. Operation and maintenance	Lack of technical personnel for maintenance of machineries and water pumps
8. Infrastructure	Infrastructural problems at rural area Lack of provision of particular emphasis to those rural areas which don't have properly constructed road
9. Finance	Lack of adequate budget in improving the quantity & quality of the water supply
10. Education	Lack of adequate knowledge in implementing policy prepared at national level Lack of resources and skilled man power for providing training Lack of educated experts
11. Politics/democracy/good governance	Lack of free and periodic elections
12. Conservation	Inadequate protection and consideration of natural resources The region is exposed for repetitive natural problems
13. Conflict	Inadequate mediation between regions Lack of tolerance among the people
14. Administration, management and man power	Lack of commitment and the practice of incompatible leader The person who are appointed in a position to administer have no commitment and not accountable

APPENDIX L: EARLY WARNING SERVICES ANALYSIS

Appendix L 1: Data types and summary of data analysis on local early warning services

Early warning services Variables	What to analyse? [Status of maximum/the most frequently occurring]
1. Communities:	
1.1. Local Prediction Acceptability	Status of Traditional practice on Early Warning
1.2. Types of local Early Warning Practices	The most frequent types of local EWP Practice
1.3. Who participates on local Early Warning Prediction Practices	Who participates on local Early Warning Prediction Practices
1.4. Awareness on COSTS of CONFLCTS for Early Warning Prediction activities	Awareness on Costs of Conflicts
1.5. Awareness on WRM, environmental protection and flood control activities	Level of communities participation
1.6. Awareness on sponsor institutions in the region	Activities Sponsored by
1.7. Local communities' participation area	Local community participation status
1.8. List of local plan, intention, threats forwarded by communities	Water supply, irrigation dam, flood control, wetland protection and pastoral development
2. Institutions:	
2.1. Water resources utilization and identified problems	
2.1.1. Water Supply Status	Water Supply Status
2.1.2. Water Supply problems	Water Supply problems
2.2. Water and sanitation coverage	
2.2.1. Water supply coverage	Water supply coverage
2.2.2. Sanitation coverage	Sanitation coverage
2.3. Awareness and consideration of timely warning [EWS-LT]	% of institutions expressed their practice on EWS
2.4. Status and acceptability of traditional knowledge and practices on EWS	Status and acceptability of traditional knowledge and practices on EWS
2.5. Local security situations related to disputes over water or any other natural resources	Local security situations related to disputes over water or any other natural resources
2.6. Awareness on costs of deliverable services and conflicts	Awareness Gap analysis
2.7. Views on stakeholders' participation on setting water services tariffs	Rate of agreement
2.8. Institutions awareness on EW - projects related to water resources management, environmental protection and flood control activities	
2.8.1. Level of awareness	Level of awareness
2.8.2. Activity sponsored by	Activity sponsored by
2.9. The aim that helps to avoid or reduce violence and human crises	Availability of tools, plans or methods

Appendix L 2: Pictorial comparison of the rate of communities' participation



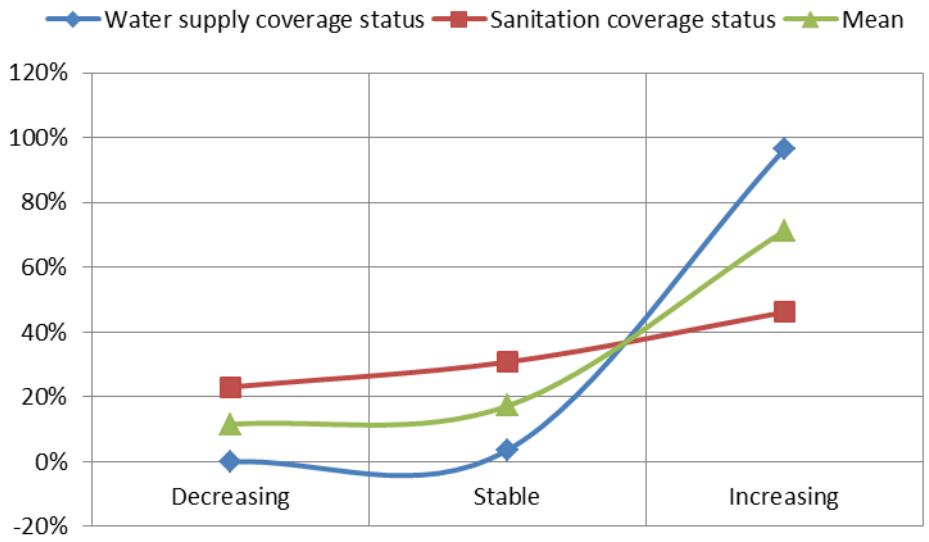
Appendix L 3: List of local plan, intention and threats forwarded by communities

No.	Category	Plan, Intention, treat forwarded by communities
1	Water supply, irrigation dam, flood control, wetland protection and pastoral development	Keep sustainable social development by keeping sustainable WRs
		Controlling un necessary water demands
		Development of grassland for pastoral community so that river water will be used properly
		Drilling water at different locations so that pastoralist will use it easily
		Existing water point may not serve for long time
		Expanding the use of water saving by using traditional 'Basaka'
		Flood control activity
		If people store water in 'Bazaar' and when they need it could be useful if they would boil and drink the water in it.
		Implement water trucks so that they will distribute to all people whenever necessary In some areas people are collecting water from the same tanker-It would be healthy for the community if chlorine will be added in it every 3/6 months It is very difficult to live in a place where there are no adequate water supplies. Hence someone must find some kind of solution for the problem
		Proper utilization of water by constructing an irrigation dam
		Respecting about regulations of water resources utilization
		Salt contents of water
		Storing water fetched from river in Basaka; Boiling this water and adding purification chemical before drinking and cooking
		The pastoralists drink impure water having algae Water resource developments should be seriously considered by government, NGOs and local communities to keep sustainable
		Water shortage is the main problem in Afar Region. It would be good if everyone gets water at their closest locality Water that are not useful for cooking Wetland protection
	Sub count	20 (49%)

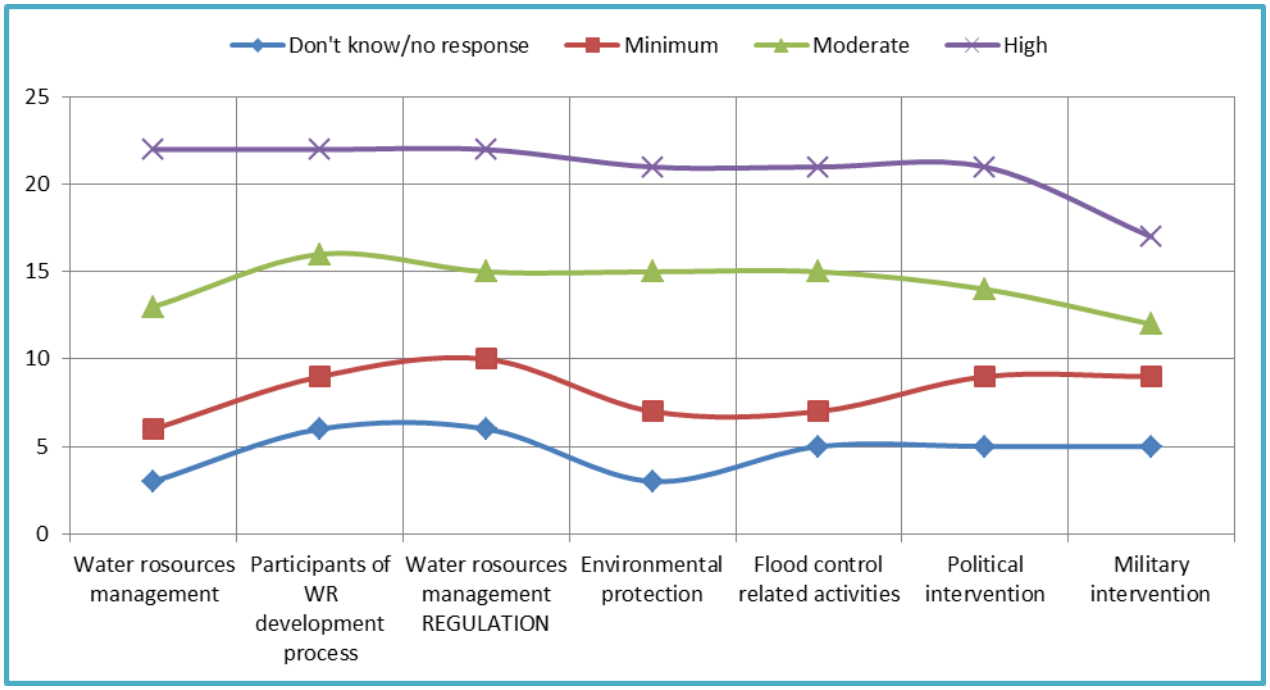
No.	Category	Plan, Intention, treat forwarded by communities
2	Sanitation	Pollution of water points by chemicals and salinity problems
		Water pollution protection
	Sub count	2(5%)
3	Agriculture	There are plenty of fertile lands so that it is good if we construct a dam for agricultural production
	Sub count	1(2%)
4	Development projects	Development projects in the region are not feasible and effective to the benefit of the local people
	Sub count	1(2%)
5	Community participation	Consultation is required with local community in studying the identification of water sources.
	Sub count	1(2%)
6	Public education, skill development and awareness training	Educating the community about water harvesting methods and proper utilization of water resources Educating the people about water pollution control and the use disinfectant chemicals, and efficient use of water supply without wasting
		It would be good if the public will thought about boiling drinking water and the use of 'Wuha Agar'
		It would be very good if government provides an awareness training for local community regarding water supply protection from bacteria
		Provide training in water harvesting using 'Basaka'
	Sub count	5(12%)
7	Research and development	Many researchers are coming to study to the region but there was no any feedback
	Sub count	1(2%)
8	Good governance	Behind the conflict over water resources in the region, there is poor management and administration problem. Therefore, by improving the administration system it is possible to achieve in providing adequate services for pastoralists and other community members so that it might resolve the problem.
		Wereda administrative bodies (government) should provide a solution for water shortage problem of our area
	Sub count	2(5%)
9	Health care	Almost in many health care posts there is shortage of water
		Establishing veterinary facility and vaccination areas for pastoralist livestock's
	Sub count	2(5%)
10	Livelihoods	Afar people should be transformed from pastoral life to a better life that provides alternative job opportunities
	Sub count	1(2%)
11	Politics and security	Lack of confidence among each other hampers development activity of the region and the country in general
		Fear in responding to this questions and requested to delete his name Creating favourable environment for development other than ethnic politics Lost national feelings due to government ethnic politics, which is not good Whenever conflict occurs, government securities arrives late after many accidents, which is not good
	Sub count	5(12%)
	Grand Count	**41(100%)**

Appendix L 4: Water supply and sanitation coverage in Afar region

Correlations		Water supply coverage status	Sanitation coverage status
Water supply coverage status	Pearson Correlation	1	.060
	Sig. (2-tailed)		.775
	N	28	25
Sanitation coverage status	Pearson Correlation	.060	1
	Sig. (2-tailed)	.775	
	N	25	26



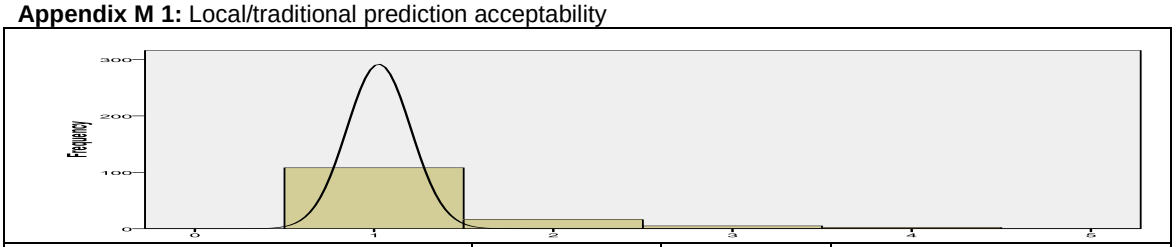
Appendix L 5: Comparing Institutions Awareness on EW



M

APPENDIX M: AVAILABILITY OF PREPAREDNESS ANALYSIS

Appendix M 1: Local/traditional prediction acceptability



High	Moderate	Minimum	Not acceptable

Appendix M 2: Percentage and level of awareness on costs of effects of conflicts by Sex

No	Categories of Awareness	Awareness on Costs of Conflicts			Total
		Yes	Partially	No	
1	Fees and service charges awareness (DC)?	27	65	35	127
2	Time spent due to conflicts (PC-DL)?	32	66	28	126
3	Opportunities due to local conflicts (PC-OC)?	34	50	44	128
4	Effects on relationships with local communities (CC)?	58	51	18	127
5	Effects on health due to local conflicts (EC)?	60	50	17	127
	Total	**211**	**282**	**142**	**635**
	Percent	**33%**	**44%**	**22%**	**100%**

Appendix M 3: Awareness on costs of deliverable services and conflicts.

No.	Stakeholders	Awareness Gap analysis										Total
		Not informed-Ignorant		No comment		Less informed		Partially informed		Fully informed		
		N	%	N	%	N	%	N	%	N	%	
1	Local communities	3	3%	0	0%	4	4%	5	5%	3	3%	15
2	Traditional leaders	2	2%	0	0%	5	5%	4	4%	4	4%	15
3	Local administrators	2	2%	0	0%	2	2%	6	6%	5	5%	15
4	Local politicians	2	2%	1	1%	1	1%	7	7%	4	4%	15
5	Local professionals	7	7%	0	0%	4	4%	3	3%	1	1%	15
6	Students	10	11%	0	0%	1	1%	3	3%	1	1%	15
7	Others (women)	1	1%	0	0%	2	2%	0	0%	1	1%	4
	Total	27	29%	1	1%	19	20%	28	30%	19	20%	94
	Percent	29%		1%		20%		30%		20%		100%

Appendix M 4: Frequencies of opinions on availabilities and types of preparedness experience on education

Category of traditional Experience, Education or training		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Water development**, operation and maintenance practice	50	28.1	44.6	44.6
	Conflict resolution practice and training related practices	42	23.6	37.5	82.1
	Not available/ No comment	20	11.2	17.9	100.0
	Total	112	62.9	100.0	
Missing	System	66	37.1		
Total		178	100.0		

Appendix M 5: Local people participation and awareness on Local research related activities

Appendix M 6: Local community's views on future preparedness on WRM related activities

No.	Other comments Summary	Frequency	Percent	Valid Percent	Cumulative Percent
1	Water shortage, saving, harvesting, distribution and quality	15	10.5	34.9	34.9
2	Good government, securities and politics	8	5.6	18.6	53.5
3	Education	5	3.5	11.6	65.1
4	Sustainable development	4	2.8	9.3	74.4
5	Proper construction of irrigation dams	2	1.4	4.7	79.1
6	Alternative jobs for transformation of pastoral life	1	0.7	2.3	81.4
7	Community participation	1	0.7	2.3	83.7
8	Flood control activity	1	0.7	2.3	86
9	Grazing land protection and development	1	0.7	2.3	88.4
10	Lack of feedback from researches	1	0.7	2.3	90.7
11	Poor sanitation	1	0.7	2.3	93
12	Respecting water resource utilization regulation	1	0.7	2.3	95.3
13	Veterinary facility and vaccination	1	0.7	2.3	97.7
14	Wetland protection	1	0.7	2.3	100
	Total	43	30.1	100	
Missing		100	69.9		
Total		143	100		

Appendix M 7: Status and opinions on institutions efficiency and mandate on WRM

Rate of Mandate Adequacy	Reason for rating (why??)	Frequency	Percent
Yes, always	…"However there is implementation problem, frequent change of Water Bureau's organizational structure based on BPR and political instability" is the major problems.	1	
	Agreed on YES-always but no comment on why	1	
	Total	**2**	**17%**
Yes, occasionally	.."Because some institutions have enough amounts of skilled manpower and budget."	1	
	Agreed on YES-occasionally but no comment on why	1	
	.."The mandate given is not supported by capacity and difficult to implement."	1	
	Total	**3**	**25%**
Not at all	…"In my perception, because there is a high water investments which requires high investment cost"	1	
	…"Capacity and system of implementations and the role ultimate beneficiaries of the system such as the community at the grass root level, etc. are poorly considered"	1	
	.."Due to poor organizational structure and availability of insufficient manpower, finance, knowledge and structure"	1	
	….."Nobody has responsibility to manage the proper use of river water resources at the regional level"	1	
	…"There is no clear mandate; besides the organizational structure is frequently changing"	1	
	Agreed on Not at all but no comment on why	1	
	Agreed on Not at all but no comment on why	1	
	Total	**7**	**58%**

Appendix M 8: Communities opinion for recommendation of locations for further study/research:

Categories	List of reasons for proposals	Count	List %	Category %
1. Central location for many tribes	Central area for many tribes	1	0.5%	
2. Conflict	Conflict area between two regions	1	0.5%	
	Conflict between Afar and Amhara tribes	2	1.1%	
	Conflict between Afar and Arguba tribes	3	1.6%	
	Conflict between Afar and Issa tribes	22	11.9%	
	Conflict between Afar and Oromo tribes	3	1.6%	
	Conflict between ethnicities	3	1.6%	
	Conflict between tribes	1	0.5%	
	Conflict exposed area	6	3.2%	
	Conflict over Awash river	1	0.5%	
	Conflict over boundary	1	0.5%	
	Conflict over grazing land	2	1.1%	
	Conflict over water supply, grazing land and illegal trade (contrabandists)	1	0.5%	
	Conflict over water, grazing and rangelands areas	1	0.5%	
	Conflict problems	4	2.2%	
	Conflict within local communities	1	0.5%	
	Potential conflict area	2	1.1%	**29.7%**
3. Displacement and settlement	Displaced people area due to drought and conflicts	1	0.5%	
	Settlement areas	2	1.1%	**1.6%**
4. Ethnic boundaries areas	Ethnic boundaries areas	2	1.1%	**1.1%**
5. Grazing	Grazing problem	1	0.5%	
	Shortage of grazing lands	2	1.1%	**1.6%**
6. Livelihood and population	to fulfil the need of the people in urban areas	1	0.5%	
	Urban population growth	2	1.1%	**1.6%**
7. Water	Clean water supply shortage problems	7	3.8%	
	Favourable weather for water harvesting	1	0.5%	
	Lack of water in the rangelands areas	1	0.5%	
	The town was established at the edge of a river	1	0.5%	
	There plenty of ground water if digged properly	1	0.5%	
	Water quality problems	1	0.5%	
	Water resources development	7	3.8%	
	Water shortage and water quality problems	1	0.5%	
	Water supply shortages	81	43.8%	**54.6%**
8. Water supply and grazing	Shortage of grazing land and clean water supply	15	8.0%	
	Shortage of watering, grazing and rangelands areas	3	1.6%	**9.7%**
	Total/percent	**185**	**100%**	**100%**

N

APPENDIX N: MISCELLANEOUS INFORMATION

Appendix N 1: Types of Local Conflict by Mamo, A. (1976) Basics Skills of Writing a Novel (A local novelist)

የግጭት ዓይነቶች

MONDAY, 21 JANUARY 2008

በሰው ላይ የሚደርሱ ብዙ ግጭቶች አሉ። መሠረታዊ ናቸው የሚባሉት የሚከተሉት ናቸው።

ሰው ከአምላኩ ጋር ይጋጫል።
ሰው ከሰው ይጋጫል።
ሰው ከጎብረተሰቡ ጋር ይጋጫል።
ሰው ከአካባቢው ይጋጫል።
ሰው ከራሱ ጋር ይጋጫል።
ሰው ከጎብረተሰቡ የጉሮ ሥነ ሥርዓት ጋር ይጋጫል።
ሰው ከአንድ ዓይነት ርሙተ ዓለም ጋር ይጋጫል።

እነዚህ መሠረታዊ የሆኑ የግጭት ምንጮች ናቸው። አያንዳንዳቸው ሥፍር ቁጥር የሌለው የግጭት ዝርዝር ሊይዙ ይችላሉ። ከእዚህ የግጭት ውቅያኖሶች ውስጥ ጨልፎ ማቅረብ የደራሲ ተግባር ነው።

(አማረ ማሞ፣ የልብ-ወለድ ድርሰት አፃፃፍ መሠረታዊ 1968 ዓ.ም)

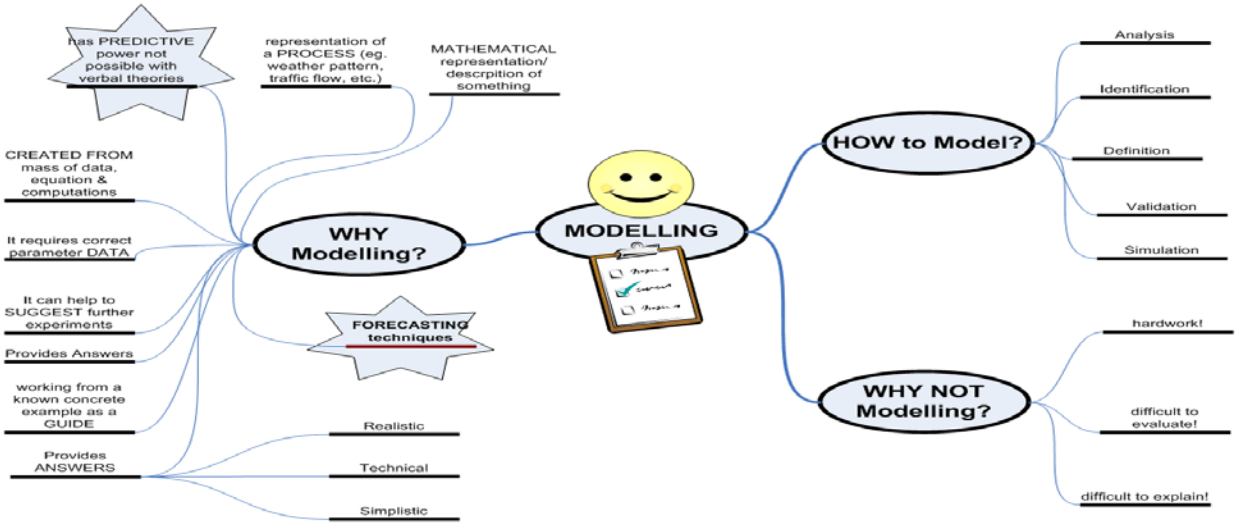
Source: Mamo, A. (1976) Basics Skills of Writing a Novel (Amare Mamo a local writer in Amahric language)

Appendix N 2: The Process of Building Grounded Theory - METHODOLOGY

Major and sub phases/ steps		Tasks for elements of grounded theory
RESEARCH DESIGN PHASE		
Step 1:	Review of technical literature	- Definition of research question - Setting goal of the grounded theory
Step 2:	Selecting cases	- Concept-basic unit of analysis - Categories-means by which theories can be integrated (the corner stone) - Propositions- generalised relationships between a category and its concepts and between discrete categories (hypothesis)
DATA COLLECTION PHASE		
Step 3:	Develop rigorous data collection protocol	- Create case study database: Increases validity (reliability & construct validity) - Use multiple data collection methods: Strengthens grounding of theory by triangulation of evidence. Enhances internal validity - Qualitative and quantitative data: Synergistic view of evidence
Step 4:	Entering the field	- Overlap data collection and analysis: Speeds analysis and reveals helpful adjustments to data collection - Flexible and opportunistic data collection methods: Allows investigators to take advantage of emergent themes and unique case features
DATA ORDERING PHASE		
Step 5:	Data ordering	- Arraying events chronologically: Facilitates easier data analysis. Allows examination of processes - Developing key points and codes from the data in Case Study/survey - Identify categories within a set of data
DATA ANALYSIS PHASE		
Step 6:	Analysing data relating to the first case - Find relationships within these categories - Identify core concepts that describe these relationships	- Use open coding : Develop concepts, categories and properties - Use axial coding: Develop connections between a category and its sub-categories - Use *selective coding*: Integrate categories to build theoretical framework **(All forms of coding enhance internal validity)**
Step 7:	Theoretical sampling	- Literal and theoretical replication across cases (go to step 2 until theoretical saturation): Confirms, extends, and sharpens theoretical framework
Step 8:	Reaching closure	- Theoretical saturation when possible: Ends process when marginal improvement becomes small
Step 9:	Compare emergent theory with extant literature	- Comparisons with conflicting frameworks: Improves construct definitions, and therefore internal validity - Comparisons with similar frameworks: Also improves external validity by establishing the domain to which the study's findings can be generalised

Source: Adapted from (Pandit, 1994)

Appendix N 3: Conceptual understanding of modelling concept map



Appendix N 4: Examples of research methods - METHODOLOGY

Survey, grounded theory and case studies are selected approach for this research. The detail analysis of the selection will be justified. In general, some of most common types of research methods defined by (Jankowicz (2005) are the following:

Explicatory method:	In which you direct your questions at people and at written sources, concerning issues and events in the past in order to understand the present and predict the future, making judgements about the data using historical review, drawing conclusions based on the themes you recognize in interview and observational material by means of ethnographic techniques or variety of bibliographical analysis techniques. **Ethnographic method**: associated with anthropology and sociology that systematically describes the culture of a group of people. The goal of ethnographic research is to understand the native's/insiders view of their own world.
Case studies method:	In which you use a variety of techniques in the workplace setting to explore issues in the present and in the past; as they affect a relatively complete organizational unit (single case study)[17] or group of organizational units (comparative case study); which represent different possibilities or stances for the organization concerned; and in which you look to the future by means of the recommendations you make. Laws *et al*. (2003) states that case studies are widely used in development work.
Survey method:	In which you direct your questions at relatively large groups of people who represent some lager population, in order to explore issues largely in the present.
Experimental method:	Used to establish cause-and effect relationships between the independent and dependant variables by means of manipulation of variables, control and randomization.
Grounded theory method:	Used to develop conceptual categories/theory about social processes inductively from real-world observations (data) from a selected group of people. The researcher may subsequently make further observations to test out the developed categories/theory.
Phenomenological studies methods:	It has roots in philosophy and focuses on the lived experience of individuals. Holroyd (2001), moreover, he states that phenomenological method attempts to explicate the meaning structures developed through the researcher's experience.

[17] Jankowicz (2005) lists the following four stages of work that should be considered during planning a case study and which will be used in this research work too: (1) determining the present situations, (2) gathering information about the background to the present situation, (3) gathering more specific data to test alternative hypothesis about the important factors in the present situation, (4) presenting recommendations for action; and, where you have the time and the power to have influenced events, evaluating the outcomes of these recommendations after they have been implemented.

Appendix N 5: A few Quotes Related to Water and Conflicts

WATER/RIVERS

1. *"Water links us to our neighbor in a way more profound and complex than any other."*
   John Thorson, Indian Water Rights p. 21(http://www.sahra.arizona.edu; 2005)
2. *"To the lost man, to the pioneer penetrating a new country, to the naturalist who wishes to see the wild land at its wildest, the advice is always the same -- follow a river."*
   Edwin Way Teale (http://www.sahra.arizona.edu; 2005)
3. *"Pumping groundwater is like making constant withdrawals from a bank account without ever paying anything into it."*
   (Alex Kirby; BBC, 2006)
4. *"No, no, we are not satisfied, and we will not be satisfied until justice rolls down like waters and righteousness like a mighty stream."*
   "Martin Luther King, Jr." Ebid

WATER AND CONFLICT/WAR

5. *"Wars will be fought between nations over water"*
   UN Secretary General Kofi Annan ((Mendis, I.D.; 2004)[18].
6. *"If the wars of the twentieth century were fought over oil, the wars of this century will be fought over water."*
   The World Bank (The Atlas of Water, 2004)
7. *"Anyone who solves the problem of water deserves not one Nobel Prize, but two one for science and the other for peace."*
   President John F. Kennedy (Grigg, 2005)
8. *"When Kansas and Colorado have a quarrel over the water in the Arkansas River they don't call out the National Guard in each state and go to war over it. They bring a suit in the Supreme Court of the United States and abide by the decision. There isn't a reason in the world why we can't do that internationally."*
   President Harry S. Truman, speech in Kansas, 1945
9. *"The quickest way to kindle a fire is to rub two opposing opinions together."*
   http://www.teambuildinginc.com/article_conflict.htm
10. *"Argument seldom convinces anyone against his inclination."*
    http://www.teambuildinginc.com/article_conflict.htm
11. *"First they ignore you, then they laugh at you, then they fight you, then you win."*
    "Mahtama Gandhi"
12. *A weak man is just by accident. A strong but non-violent man is unjust by accident.*
    Indira Gandhi (http://creativequotations.com/one/14s01.htm)

CONFLICT RESOLUTION AND PEACE

13. *Mental violence has no potency and injures only the person whose thoughts are violent. It is otherwise with mental non-violence. It has potency which the world does not yet know.*
    Indira Gandhi (http://creativequotations.com/one/14s01.htm)
14. *"If you are afraid of something, become interested in it!"*
    Source unknown
15. *You have to learn to recover from disappointment*
    Sir Alex Ferguson
    (http://news.bbc.co.uk/sport2/hi/football/teams/m/man_utd/6618279.stm)
16. *There can be no deep disappointment where there is not deep love.*
    "Martin Luther King, Jr." (http://www.creativequotations.com/one/51s02.htm)
17. *It is useless for the sheep to pass resolutions in favor of vegetarianism while the wolf remains of a different opinion.*
    Dean Inge (http://www.creativequotations.com/one/51s02.htm)
18. *Wise to resolve and patient to perform.*
    Homer (http://www.creativequotations.com/tqs/tq-resolutions.htm)
19. *"Peace cannot be kept by force. It can only be won, through understanding. Our longing for understanding is Eternal"*
    Albert Einstein (http://members.aol.com/Altdisres/ADR.html)
20. *Peace we want because there is another war to fight against poverty, disease and ignorance.*
    Indira Gandhi (http://www.beyondintractability.org/)
21. *Nonviolence is a powerful and just weapon, which cuts without wounding and ennobles the man who wields it. It is a sword that heals.*
    "Martin Luther King, Jr." (http://www.creativequotations.com/one/51s02.htm)
22. *"We must accept finite disappointment, but never lose infinite hope."*
    "Martin Luther King, Jr." (http://www.creativequotations.com/one/51s02.htm)
23. *You have to learn to recover from disappointment*
    Sir Alex Ferguson

OTHER RELATED QUOTES

24. *"If a man hasn't discovered something that he would die for, he isn't fit to live."*
    "Martin Luther King, Jr." (http://www.creativequotations.com/tqs/tq-resolutions.htm)

NOTE: Many traditional elders or professionals working on conflict management, commonly use quotations as a key conflict resolution processing tools.

[18] The-south-asian.com (2004). < http://www.the-south-asian.com/March2004/waterforthefuture1.htm> [Accessed on 2.2.07].

APPENDIX O: SUMMARY OF THE PAST, PRESENT AND FUTURE SITUATIONS IN AFAR REGION

Appendix O 1: Summary of the key DIPTI parameters for the possible causes, predictions and pre-preparedness for local water conflicts

Local water conflict Pre-identification and preparedness parameters (DIPTI Variables)	*Core point of the findings (Possible causes of the patterns)*	*Major conflicting parties*	*Past, present and future status of the problems (Predictions on local water conflict patterns)*			*GAP*
			Past status (5 years ago) **[Overall-'C']**	*Present situations* **[Overall-'D']**	*Future predictions or direction (during the next 5 years)* **[Overall-'D']**	
1. Information			(D)	The problem is increasing (D)	(D)	
1.1. Awareness:	Lack of awareness on having adequate water quality and quantity; partial awareness on effects conflict; there was disagreement on the status of resources ownership; less participation of communities in water tariff setting; and lack of adequate awareness about boundaries of WEC information analysis (mainly based on political boundary instead of river basin boundaries).	Local communities vs government; Afar vs Issa tribes; Farmers vs pastoralists	Inadequate level of awareness (D)	Minimum level of awareness (D)	Slight increase in awareness (local institutions are in need of more information mainly on water quantity and quality for the purpose of planning activities.); The number of local media are increasing slightly though it is fully controlled by government; the communities feel unhappy about resource control by government and a cause for increased tension internally with government and externally with neighbouring Issa tribe.	***Odd circumstances:*** • The findings show that there was an awareness and concern gap/difference among local men and women in the region. • There are totally opposite views regarding water resources ownership between the community and government institutions. Government institutions believe that communities interests are secondary when it comes to resource ownership.
1.2. Transparency	Non transparency of financial institutions; Partially transparent ways of individual decision making and activities of government, NGO, Media/press, and Justice; and availability of transparent traditional decision-making and accountability processes.	Local communities vs government; Afar vs Issa tribes; Farmers vs pastoralists	There was a tradition of transparency and traditionally the level of transparency was somewhat better than the present situations (C)	Partially transparent (C)	Partially transparent (because the situation is decreasing - decrease in tradition of transparency)	***Odd circumstances:*** Modern institutional or practices of transparency was by far less than the locally available traditional ways of transparency due to the use of Dhaguu communication system
1.3. The WEC data availability	Inadequate information, partial preparedness among communities and institutions; local government institutions have lower awareness as compared to federal institutions and private sector; less information on conflict and EWS; communities are affected by effects of climate change such as drought; and communities are divided in to two on the use and validity of prediction information	Local communities vs government; Afar vs Issa tribes;	Inadequate information (D)	Inadequate information (D): The findings of data analysis shows the location is exposed to conflicts due to lack of adequate or significant WEC information based on 8 analysis criterion	Minimum level of awareness and preparedness information (The location is EXPOSED to conflicts)	***Odd circumstances:*** Local communities were divided into two views on the use and validity of prediction information as a result of traditional and religious influences.
1.4. Theoretical and practical foundations (modern and traditional)	There were tribal political structures in government organizations. However, it is not fully ruled by traditional systems. The traditional system has higher levels of communication and transparency as compared to government organization working environment. There was structural conflict of interest among the communities, politicians and professionals on providing information on WHC ready.	Infrastructural problems	Co-existence of traditional and modern frameworks for different purposes. However, there were frequent structural adjustment changes due to internal political instability and pressures from international organizations such as IMF	Communities and stakeholders representatives are highly dissatisfied The process of merging modern and traditional practices makes things more complicated.(the use of tribal politics in modern government organization). There were frequent structural changes continued from past	High level of strategic planning activities work that is going on in all government institutions highlights in having positive framework in the future. However, the political unpredictability, instability and the continuous frequent changes of structures make the situation unpredictable and more difficult.	***Odd circumstances:*** Frequent change of structures and unpredictability of Ethiopian politics

Local water conflict Pre-identification and preparedness parameters (DIPTI Variables)	*Core point of the findings (Possible causes of the patterns)*	*Major conflicting parties*	*Past, present and future status of the problems (Predictions on local water conflict patterns)*			*GAP*
			Past status (5 years ago) **[Overall-'C']**	*Present situations* **[Overall-'D']**	*Future predictions or direction (during the next 5 years)* **[Overall-'D']**	
2. Interactions (availability or status)			(C)	(D)	(D)	
2.1. Networking	Minimum Communication, networking and the level of problems in the basin within communities sharing the **resources**. (Encouraging communication but low level of networking and high **intensity of conflict** problems among different tribes in the region) There were no adequate **NT points** like water, grazing land, market and road among conflicting parties. There are inadequate NT tools.	Afar vs Issa tribes	Low level of networking as compared to the present situations	(D) Minimum NT due to negative relationships. Only traditional ways of NT lines are available (*Dhaagu*)	The findings indicate there was no progress in increasing NT among conflicting parties. Hence, There will be steady growth or no improvement in the future.	***Odd circumstances:*** The figure shows women are almost in all networking points as compared to men and children. Men are secondary networking stakeholders who have the primary role in participation in conflicts occurring in the region. One can question about the level of conflict in the region if men would have as many networks as women
2.2. Communication	2 out of 3 people in the region (90% of the communities are pastoralist) show/prefer and are satisfied with *Dhaagu* traditional ways of communication among themselves. Water supply, grazing land and other natural resources are the major motivating factors for communications among communities and stakeholders in the region. However, communication in the region was highly affected by problems related to poverty, healthcare, politics, trade, conflict, illiteracy and administrative problems. The local communities see others as an aggressor.	Afar vs Issa tribes, Among different government institutions 76% of respondents agreed that communities in lower and middle Awash valley faces a HIGH pressure over resource utilization and conflict related problems	Communication among stakeholders was better than the present situations. The level of confidence among stakeholders for communication was better than the present situations	(D) The level of communication is increasing irrespective of the its type of communication. Inclined to NEGATIVE within different tribes (there was no means of communication system among different tribes in the river basin); and within different institutions. Inclined to POSITIVE within same tribe; and between an institution and a community	Increasing (The trend for communication is increasing. However, the boundary of future communication among stakeholders indicates that it lies between positive and negative communication)	***Odd circumstances:*** The local communities see others as an aggressor and regard themselves as passive during the process of communication.
2.3. Cooperation	There was positive cooperation within members of the community in the same region as well as cooperation between communities and institutions. However, there was a negative cooperation with neighbouring communities mainly with Issa tribes. The level of cooperation level among institutions was also negative. ***[Unsustainable and average level of cooperation within stakeholders in the basin due to low level of networking]***	Afar vs Issa tribes Disagreement among different institutions	Better level of cooperation as compared to the present one	C (Average) There was positive cooperation within members of the community in the same region as well as cooperation between communities and institutions. However, there was a negative cooperation with neighbouring communities mainly with Issa tribes. The level of cooperation level among institutions was also negative.	**UNSATISFACTORY** Cooperation within different stakeholders in the region was fragile due to unsatisfactory level of networking and communication among the neighbouring people in the region. Local institutions have relatively better cooperation as compared to intra-cooperation within different tribes of the community.	***Odd circumstances:*** Availability of balanced level of positive and negative level of cooperation among communities and institution (why? natural? policy?) Requires more discussions and references for scientific investigation)
3. Tolerance/capacity			(C)	(D)	(D) Conflict as a problem 50%	
3.1. Exposure to Vulnerability	63% of respondents agreed that the vulnerability status is increasing due to problems related to 8 local vulnerability factors: • Unemployment/occupation, • Location stay (localization of residence),	• Majorities of 90% of vulnerable residents (pastoralist) vs 10% of non-vulnerable community in the region; • Afar vs Issa tribes in	The situation was better than present. The problem was prevalent but has less intensity as compared to now.	Level of vulnerability is increasing (D)	Increasing [There was no locally acceptable and adequate plan and activity in reducing the problem related to 8 vulnerability factors.]	***Odd circumstances:*** The findings show that people with special needs or disabilities are less vulnerable as compared to infants, women and seniors. Do communities give priority for supporting the disabled people or because their

Local water conflict Pre-identification and preparedness parameters (DIPTI Variables)	*Core point of the findings (Possible causes of the patterns)*	*Major conflicting parties*	*Past, present and future status of the problems (Predictions on local water conflict patterns)*			*GAP*
			Past status (5 years ago) **[Overall-'C']**	*Present situations* **[Overall-'D']**	*Future predictions or direction (during the next 5 years)* **[Overall-'D']**	
	• Education, • Demographics (Age and gender status), • People with special need, • Homelessness, • Financial status (Income and expense), • Water supply (Clean, adequate and affordable water supplies services),	the River basin; • Afar community vs government representatives in the region.				number is small? It requires further support data or research.
3.2. Exposure to hazards/Risks	Though there are average levels of traditional and modern ways of awareness on risk reduction methods, the region is critically exposed to natural and man-made hazards occurring occasionally. (Expansion of Lake Basaka located in the middle Awash River Basin engulfed the main land transportation route)	Afra vs Issa Afar vs government	The situation was better than the present problem	(D) High level of exposures to risks There are positive risk mitigation awareness factors in the region but people are exposed and highly affected by strong severity of risks due to availability of high level of vulnerability and lack of adequate capacity.	The trend shows the problem is increasing unless some kind special and immediate measures are implemented.	***Odd circumstances:*** The levels of natural hazards in the region were more than the manmade problems.
3.3. Awareness for risk reduction (risk mitigation factors)	The findings based on the assumption that respondents have to know at least three ways of risk reduction method, one from each category of water, conflict and early warning shows positive results. In this case, the mean awareness shows 2 out of 3, which means people have 67% of awareness on local risk reduction methods	Afra vs Issa	In the past people had less awareness as compared to the present situation.	Have more than average awareness of about 67% but local people and institutions have inadequate capacity to mitigate the problems.	The trend towards awareness points in the positive direction but the problem of capacity still remains open due to the reality that some problems are natural and other are complex man-made problems.	***Odd circumstances:*** Most of the awareness are based on traditional ways of information and requires more information and further investigation on modern support practices.
4. Preparedness availability			(D)	(C)	(C)	
4.1. Local early warning services availability	It deals with the status of local based early warning services implemented by communities and concerned institutions There was a preparation of 5 years strategic plan among institutions in the region at different levels on EW and any development related activities. However, there was inadequate availability of data and prediction tools for efficient strategic planning activities	• Traditional predictors vs religious leaders/practitioners • Pastoral communities (traditional) vs government institutions (modern) approaches • Afra vs Issa conflicts	Positive awareness about EWS but weaker than the present situations	(C) 54%-Exposed to slowly occurring disputes) Moderate level of local communities (59%) and institutions (49%) awareness on local water resources development practices, early warning services, understanding of cost-effects of pre and post conflict problems. (Medium)	Moderate (Relatively positive trend though disputes are occurring slowly) (Improved situations are expected in terms of modern practice but traditional practices in this aspect are diminishing without adequate alternative options)	***Odd circumstances:*** Public mostly relay on traditional ways of prediction activities; Inadequate tools for providing modern prediction services
4.2. Local preparedness availability	The level of local preparedness is based on the availability and awareness local Experience, Location Identification, Community Participation, Water Security Plans, Policies And Strategic Plan, IWRM, and WRM	Afar vs Issa	Weaker than the present situations	(C) Moderate (ranges from 45% to 54%) Both local communities and institutions have inadequate level of modern and traditional	Moderate Communities agreed that water conflict and grazing related problems require more future preparedness	***Odd circumstances:*** Lack of communities' participation and awareness on WRD activities (74%)

Local water conflict Pre-identification and preparedness parameters (DIPTI Variables)	*Core point of the findings (Possible causes of the patterns)*	*Major conflicting parties*	*Past, present and future status of the problems (Predictions on local water conflict patterns)*			*GAP*
			Past status (5 years ago) **[Overall-'C']**	*Present situations* **[Overall-'D']**	*Future predictions or direction (during the next 5 years)* **[Overall-'D']**	
				ways preparedness on alleviating the water conflict related problems. The work of water security plans in local institutions is relatively moderate and encouraging. However most of the activities are done at federal level and local participation is minimum which left the plan in question		
5. Contribution to sustainable development	Communities and institutions views, contribution, participation and satisfaction on sustainable development of water resources (Sustainability of Resources and Conflict Diversity Factors -SRCDF)		Normal (C)	(D) Not sustainable (Conflict Occasionally)	(F) Exposed to high level of conflicts	
5.1. Local communities contributions	The findings show that local communities are neither satisfied nor dissatisfied regarding their contribution on sustainable development of the resources in the region while they are not actively participating in the state farm projects. However, the pastoral communities in the region have chosen not to speak openly about their dissatisfaction on unsustainable ways of significant increase of deforestation activity mainly held for state agricultural purposes. The communities didn't fully engage in the development activities areas of SRCDF of the region. Local people contributions were relatively high on environmental protection area only due to a nationwide campaign on plantation of tree seedling activities.	• Afar vs Issa tribes on water resources and grazing land utilization; • Afar pastoral community vs government on development projects in the region • Afar pastoral communities vs local, private and state-farms due to deforestation and land grabbing	Relatively normal situations due to a minimum level of development related projects in the region	**(C)** 54% of respondents were found to be *neither satisfied nor dissatisfied* on the status of sustainable development mainly on local WRD and utilization Pastoral communities are not actively participating in state-farm plantation projects. Increase in deforestation and decrease in pastoral land	**NEGATIVE VIEWS (Exposed to Conflicts)** the pastoral communities showed their fear about the future due to the fact that the existing development related activities in the region did not adequately accommodate their interest. The findings of the study also indicate the situation in the region is not sustainable In general, there is no hope for pastoral communities unless the current approach is modified in such a way it fully engages the communities	***Odd circumstances:*** The communities are fearful to comment on activities related to government construction and development projects; Deforestation, sugarcane plantation, and widely spread of the growing of 'woyane tree' increased more fear on local communities
5.2. Local institutions contributions	At the same time local institutions expressed their views on the availability of high level of problems that affect the sustainable development of the region. There was negative correlation between the views of communities and institutions. On the other hand, there was a positive correlation between communities' activity vs satisfaction or satisfaction vs participation. However, communities' activity vs participation has a negative correlation in the region	• Afar pastoral community vs government on development projects in the region • Afar pastoral communities vs local, private and state-farms due to deforestation and land grabbing	Relatively normal situations due to a minimum level of development related projects in the region	**(D)** 44% of respondents are *highly concerned and dissatisfied about the extent of the problems* in the Region. Local Institutions contribution (Concerned about frequently occurring high level of conflicts on local resource development mainly by government projects)	**NEGATIVE VIEWS due to UNCERSTAINITY (Exposed to Conflicts)**	***Odd circumstances:*** The level of uncertainty is increasing

KEYS:

Normal situations	*Less problems*	*Average/Intermediate problems*	*Increasing/more than average problems*	*Highly increasing problems*
No disagreement	*Simple disagreement Slowly*	*Disputes Slowly*	*Conflict Occasionally*	*violent Occasionally*
A	***B***	***C***	***D***	***F***