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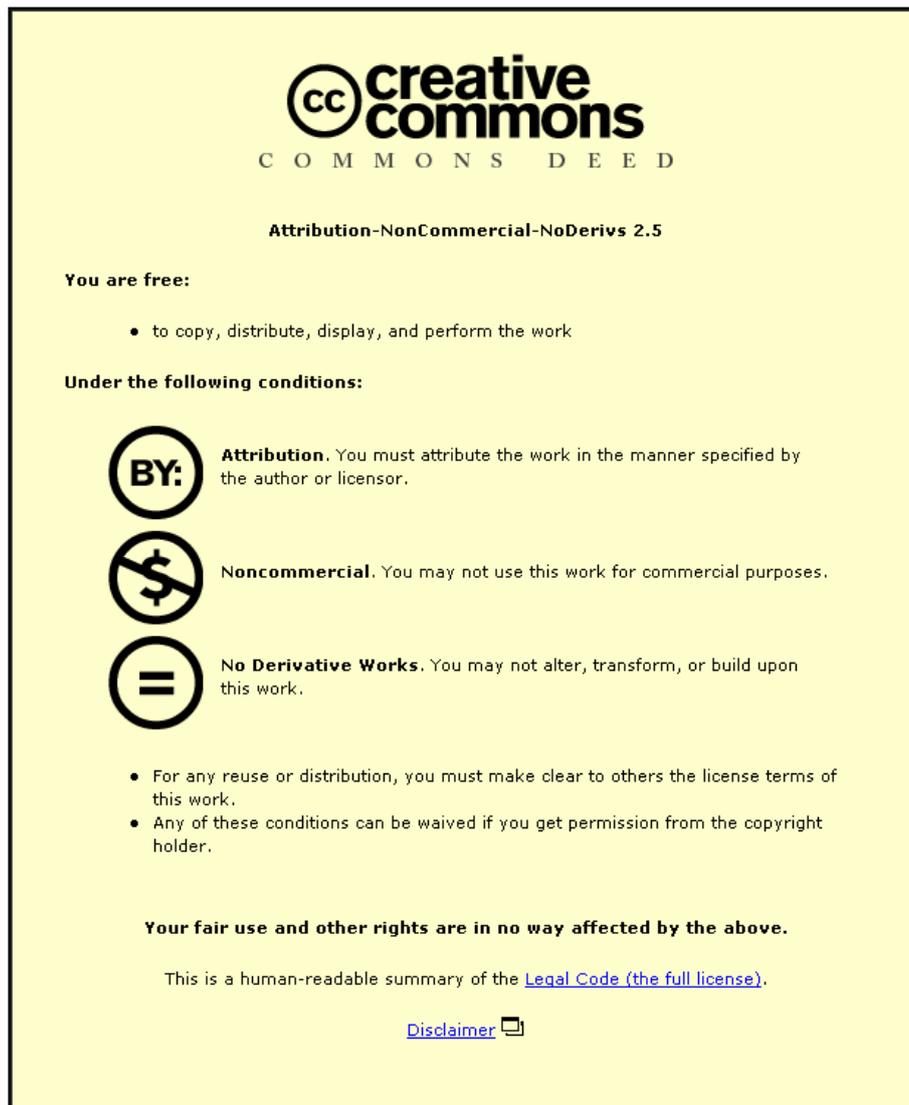
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THE PLACE OF TRADITIONAL ECOLOGICAL KNOWLEDGE IN WATER RESOURCES MANAGEMENT IN THE CENTRAL NIGER DELTA

*Tamuno, P. B. L. and Smith, M. D.

Water, Engineering and Development Centre (WEDC), Institute of Development Engineering (IDE), Loughborough University, LE11 3TU, United Kingdom

Email: pbltamuno@hotmail.com and M.D.Smith@lboro.ac.uk

Abstract

Long term scientific data and comprehensive information (base-line data) of water resources in most developing countries such as Nigeria are lacking, inadequate or completely non-existent. The dearth of baseline data has constituted one of the major constraints to meeting the demands for sustainable water resources management. However, residents of most rural communities of the developing world have extensive knowledge about their environment. Such knowledge acquired from experience and residency is termed traditional ecological knowledge (TEK). A questionnaire survey was carried out in two rural communities in the Central Niger Delta whose river sections have been dredged. A total of 108 and 103 respondents from Otuogidi and Otuoke respectively participated in the survey that was designed to testing the reliability of TEK in the Central Delta. The results show that there is rich TEK in these communities, which is inversely proportional to time post dredging but directly proportional to the level of participation of residents of the sample communities in the respective projects. The thesis of this paper is that the incorporation of TEK in rural communities of developing countries with “hard scientific” knowledge is one viable option to accessing environmental information that can be used in planning for sustainable development.

Key words: Sustainable development; Central Niger Delta; traditional ecological knowledge (TEK); water resources management

1. 1 Introduction

Geographically, the Central Niger Delta is presently occupied by Bayelsa State, which is located on Longitude 6° East, and Latitude 40° 30 minute North and covers an area of about 12, 000 square kilometres about 70% of which is riverine (Alagoa, 1999; Abam, 2001). Bayelsa State have the longest coastline among the maritime states in Nigeria, measuring approximately 200 km and occupies a greater proportion of the deltaic region of Nigeria, and rich in biodiversity, but ecologically fragile (Alagoa, 1999).

The rich biodiversity and the network of surface water in the Central Niger Delta have continually played significant role in local livelihoods sustenance, hence engineering construction works should take into consideration the local and ecological significance surface water resources plays in such areas in the developing world. Therefore, there is the need to explore water resources strategies in planning for sustainable development that is aimed at conserving ecological systems as well as reducing the localised consequences of development projects. However, the absence, inadequacy and dearth of long term scientific

* Corresponding Author: pbltamuno@hotmail.com

information or baseline data have constituted one of the major limitations to planning for sustainable development. This implies that there is the need to explore other options for accessing baseline data that could be used in planning for sustainable water resources management.

Traditional ecological knowledge (TEK) is emerging as a reliable knowledge source that can be used in accessing baseline data, and used with available “hard scientific” knowledge in planning for sustainable development in areas such as the Central Niger Delta. This paper is aimed at testing the validity of TEK in relation to two inland river dredging projects that has been carried out along the Otuoke and Kolo Creek. In addition, it is the aim of this paper to demonstrate that TEK is a reliable knowledge source that can bring the localised dimension into water resources management particularly in rural areas of the developing countries, where livelihood often depends on surface water resources.

2.1 Dredging as an environmental stressor

The main cause for the decline of many species is the continuing loss of riverine littoral habitats due to river engineering. River dredging has been identified as one of the factors that has resulted in the environmental deterioration of Danube Delta (Pringle, *et. al.* 1993), the Okavango Delta (Ellery and McCarthy, 1994), and the Niger Delta (Nwankwo, 1996; Abam, 2001; Ohimain, *et al.* 2005). Generally, changes in hydrological regime, wetland / floodplain loss, sediment release and increased turbidity, adverse impact on aquatic biota, and livelihood consequences have been identified as the common impacts of dredging. In the Niger Delta channel construction in the Apoi-Gbauraun flooded Gbauraun town, displaced over 25 thousand people and disrupted fishing activities, which implies a significant localised livelihood consequences in the Niger Delta (Abam, 2001). Dredging of the Niger River may cause widespread hydrological changes in the Niger Delta, such as salt water intrusion into freshwater swamps (Nwankwo, 1996). Specifically, such impacts on fisheries could have localised livelihoods consequences, hence this implies that there is the need to explore the knowledge base of those that may bear the impacts of development projects.

Currently, ecosystem management is a developing approach that integrates human, biological and natural dimensions, aimed at achieving long-term ecosystem protection and sustainability. One of the most difficult tasks in achieving this integration may be to create a framework for research and planning that views science and TEK as complementary forms of knowledge (Pavlikakis & Tsihrintzis, 2000). Ecosystem management is one viable option that could be explored in the sustainable management of water resources in the developing world, such as the Niger Delta region in which most of the residents of the rural communities depends directly or indirectly on surface water resources for livelihood sustenance.

Generally, the adverse consequences of development projects are localised and are often borne by the local communities, particularly rural communities in developing countries. Despite the above premise, in most developing countries development projects executed locally brings about national economic growth that are often not transferred to the local people that bears the adverse consequences of these projects. It is very unfortunate that the concerns, experience and knowledge of local indigenous and traditional people have often been ignored in the formulation of environmental and water resource policy; rather most development policies and projects has solely relied on data from “hard science”.

3.1 What can TEK offer in water resources management?

TEK is a relatively recent area of academic research, the concept and associated theorising and research have been around since the mid 1970s (Berkes, *et al.* 2000); but the main feature of TEK is long term residency and interaction of people with their local environment, which is not a recent concept (Paci, *et al.* 2002). TEK constitutes a cumulative body of knowledge, understanding, practices, and beliefs about the relationships of living beings (human inclusive), to one another and the abiotic components of the environment and is culturally intra- and inter-generational exchanged (Gadgil, *et al.* 1993; Fernandez-Gimenez, 2000). TEK represents cumulative experience (CE) of local people about their environment (Fernandez-Gimenez, 2000). Therefore, experiences, skills and locally adapted knowledge acquired by professionals such as fishermen, hunters and farmers that have been acquired by living in close contact with the environment are regarded as TEK. In the context of this paper the concept of TEK refers to the knowledge held by people that are resident in a specific geographical location with a long standing experience, understanding and knowledge about their local environment.

Huntington (2000), described TEK as the knowledge and insights acquired through extensive observation of an area, which has been successfully used to understand and predict environmental events. The interest in the relevance of TEK has been growing since the early 1990s, partly in recognition that such knowledge can contribute to the conservation of biodiversity, rare species, ecological processes, and environmental management (Gadgil, *et al.* 1993; Berkes, *et al.* 2000). For example, the Canadian Arctic Resources Committee (CARC) advocated that the incorporation of traditional knowledge (TK) in decision making will help to implement principles of sustainable development and has been enshrined in various international agreements that the Canadian government is a party (Fenge, 1997). Furthermore, the increasing recognition in the United Kingdom (UK) of the significance of public awareness, and attitudes towards environmental resources for equitable management has been a welcome development (Tunstall, 2000). Generally, TEK is an integrated method of resource and ecosystem management, which is adaptive to environmental complexity and the dynamic environmental attributes that brings localised priorities into water resources management.

The analysis of TK in Nepal confirms the existence of the vast body of knowledge possessed by the local people has been used for developing appropriate biological and ecological research for the purpose of resource management (Ghimire, *et al.* 2004). Increasingly, the published scientific literature and the convening of conferences and workshops reflect the growing awareness that there is a legitimate field of environmental expertise known as TK (Freeman, 1992). On a global perspective, the 1992 Earth Summit in Brazil, through the Convention for Biological Diversity (CBD), acknowledges the role that TK could play in biodiversity conservation.

The value of TEK in scientific research, the design of people-centred resource management approaches (Huntington, 2000; Ghimire, *et al.* 2004), environmental assessment, and conservation monitoring has become more apparent and accepted, but the wider application of TEK-derived information is still very elusive (Huntington, 2000). For example, the neglect of the culture and social organisation of local communities may be one of a number of reasons for the failure of the resource management strategy imposed by central legislature between 1945 and 1958 in Tanzania (Kikula, 1999). Therefore, this paper is aimed at testing the validity of TEK and justify that this knowledge system has a place in water resources management to facilitate sustainable development in the Central Niger Delta.

mple communities; knowledge they have acquired based on residency and interaction with the local environment in relation to the respective dredging projects that have been executed along river sections of the sample communities. For the purpose of this study inland river dredging has been used as the environmental issue for testing the validity and level of reliability of TEK in the Central Niger Delta. The river sections along Otuogidi and Otuoke has been dredged for the purpose of land reclamation and road construction. The Global Seaways was responsible for the dredging project that was carried out in 2002 along the Otuoke section of the Otuoke Creek that was for six months duration, while the Ballast Ham dredging company was responsible for the dredging of the Otuogidi section of the Kolo Creek and the duration of the dredging operation was 18 months between 1999 and 2000.

5. 1 Results and Discussion

Table 1 contain a profile of the respondents from Otuoke and Otuogidi. From Table 1, it could be seen that an average of 32% of respondents has lived in the Study Area for 35 years or more. People that have lived in a community know a lot about their communities as well as most likely to remember historical environmental and other localised issues. Hence, the involvement of an average of 32% of the respondents that have resided for a minimum of 35 years in the Study Area shows that it is most likely the TEK accessed in this study is of relatively high quality. Similarly, in the middle Majakam Peatlands, East Kalimantan, Indonesia, Chokkalingam *et al.* (2005) choice of respondents in the their study that investigated the effect of fire on livelihoods and local environment was based on the long-term knowledge of respondents about their local ecosystem.

Table 1 Profile of respondents

Description	Percentage respondents	
	Otuoke	Otuogidi
Gender		
Male	75.5	65.7
Female	24.3	34.3
Educational Qualifications		
None	10.7	13.0
First School Leaving certificate	31.1	28.7
Secondary School Certificate	47.6	52.8
National Diploma / NCE	8.7	4.6
Degree / HND	1.9	0.9
Higher Degree	0.0	0.0
Age (In years)		
20 – 29	32.0	37.0
30 – 39	32.0	27.8
40 – 49	19.4	15.7
50 – 59	6.8	12.0
60 years and above	9.7	7.4
Years resident		
Less than 5 years	1.9	2.8
Between 5 and 19 years	19.4	29.6
Between 20 and 34 years	44.7	37.0
Between 35 and 49 years	20.4	18.5
50 years	13.6	12.0

The respondents have been divided into five age groups as shown in Table 1. The five age groups used in this study have been compared to the age range profile from the national population census conducted in 1991 (See Table 2). Correlation coefficient and independent sample t-test has been carried out to compare the age range profile of the respondents and the 1991 national population census result. The results shows that there is a significant positive

linear correlation between these age profiles at 0.01 (2-tailed) $p = 0.961$, and there is no significant difference between the age profiles ($p = 0.991$) based on the t-test. The results show that the age profile of respondents of this study is statistically not significantly different from the actual age structure of the Central Niger Delta; hence this implies that the result of this study is representative of the Study Area.

Table 2 Comparison of age distribution

Age range (in years)	Percentage (Census 1991)	Percentage (Social survey)
20 to 29 years	34	34.5
30 to 39 years	24	29.9
40 to 49 years	17	17.5
50 to 59 years	12	9.9
60 years and above	13	8.6

The actual year the dredging project was carried out along the Otuogidi section of the Kolo Creek has been compared to the TEK of Otuogidi respondents for the purpose of testing the validity and reliability of the TEK in this sample community. The result shows that: 44.4% of the respondents of Otuogidi have a very good knowledge (very precise) of the year the dredging project was carried out (between 1999 and 2000); 35.2% have good knowledge of the year of dredging (1999 – 9.3% and 2000 – 25.9%); 10.2% of the respondent have a fair knowledge of the year of dredging (1998 - 0.9%, between 2000 and 2001 – 6.5% and 2001 – 2.8%); and 10.2% of the respondents have forgotten when the project was carried out.

Similar comparison has been made between the actual year the dredging operation was executed and the TEK of Otuoke respondents. The result shows that 73.8% have a very good knowledge of the year of dredging (2002); 6.8% have a good knowledge of the year of dredging (2001 – 5.8%; and between 2002 and 2003 – 1.0%); 14.5% have a fair knowledge of the year of dredging (2000 – 1.9% and 2003 – 12.6%); 1.9% have a poor knowledge of the year of dredging (1999); and 1.9% cannot remember the year of dredging was carried out.

Comparing the actual duration of the dredging and the TEK of respondents show that in Otuogidi: 12.1% of the respondents have a very good knowledge of the duration of dredging (those that of the opinion that the dredging project was executed between 17 and 20 months); 17.9% of the respondents have good knowledge of the duration of the project (13 to 16 months – 10.2% and 21 to 24 months – 7.4%); 41.7% of the residents have a fair knowledge about the duration of the dredging project (9 to 12 months); 18.5% have poor knowledge of the duration of the dredging (5 to 8 months); and 0.9% of the residents have very poor knowledge about the duration of the dredging (1 to 4 months); 9.3% do not know or cannot remember the duration of the dredging project of these 2.8% of the resident have been resident in Otuogidi for less than 5 years.

Similar comparison of the duration of the dredging project at Otuoke shows that: 27.2% of Otuoke respondents have a very good knowledge about the duration of the dredging project (between 5 and 6 months); 53.5% have good knowledge of the duration of the dredging project (between 3 and 4 – 32.1% and 7 and 8 months – 21.4%); 7.7% of the respondents have a fair knowledge of the duration of the dredging (between 1 and 2 month – 4.8% and between 9 and 10 months – 2.8%); 2.9% have poor knowledge of the dredging duration (between 11 and 12 months); and 8.7% of the residents cannot remember the project duration.

The trend in the validity of the knowledge of residents of the sample communities on the time and duration of the respective dredging projects are dependent on the time between dredging and time of the survey. In both communities the dredging projects were recent, although one of the projects was carried out between 1999 and 2000, and the other in 2002. There was about two years difference between the projects, which could explain why 73.8% of Otuoke residents had a very good knowledge about the time of the dredging project compared a fewer Otuogidi's respondents (44.4%). It is likely that information about environmental issues or events may deteriorate over time, and TEK is a factor that is dependent on the duration of residency of informants in the Study Area.

Generally, despite the differences in the degree of validity of TEK in the sample communities based on duration and time the dredging projects was carried out, and the name of the companies responsible for executing the projects, there is strong positive linear relationship between the educational qualification of respondents in Otuoke and Otuogidi ($p = 0.99$ 2-tailed; significant at 0.01) and independent sample t-test shows that there is no statistically significant difference in the education qualifications of respondents from the sample communities ($p=1$), this implies that the TEK is independent of academic qualification. TEK is on the contrary dependent on the localised relevance of the impacted resource, residency in the Study Area and time lapse between project execution and recording TEK.

6.1 Conclusions and Recommendations

Interest in TK has been growing in recent years, partly due to the recognition that the participation of local people and the application of their knowledge could help resolve environmental problems, such as loss of biodiversity, imperatives for restoration of degraded lands and environmental conflicts (Berkes, *et al.* 2000; Turner, 2000). TK offers rich environmental insights, and its usage favours communities participation in the management of local resources, such as water resources.

The result from this study shows that there is a high quality of local peoples' knowledge about their environment, and that the level of validity of TEK reduces with time if not documented. Therefore, TEK can be used in developing environmental baseline and in planning for sustainable water resources management particularly in such an area that there is dearth of baseline data. However, TEK should be promoted and used to its merits, scrutinised as other information is scrutinised, and applied in situations in which it makes a difference in the quality of research, and water resources management.

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