User Guide

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EPSRC
Engineering and Physical Sciences Research Council

Preface

This is the first edition of the toolbox associated with the PartiSim approach. This toolbox is aimed at both academics and practitioners and especially novice modellers who may require materials, in the form of guidance and tools, to assist them in the process of undertaking facilitated and participative simulation modelling. However the toolbox materials can also be used in teaching facilitative and participative simulation modelling.

The PartiSim approach was developed as part of an EPSRC funded project, which developed tools to support facilitated conceptual modelling. The project team included Kathy Kotiadis as Principal Investigator, Christos Vasilakis as Co-Investigator and Antuela Tako as Research Fellow. The ideas developed as part of the project on facilitated conceptual modelling were further developed to include all the stages of simulation modelling. The development of this toolbox is a post project effort to promote and disseminate the whole PartiSim approach.

This dissemination effort provides a practical account of the participative and facilitative process rather than a theoretical account of facilitated simulation modelling. The theories and methodologies underpinning the approach are not the focus of this dissemination effort. Therefore, the reader should not view this as an academic exercise but a compilation of guidance and tools.

The material included in this edition of the toolbox has been developed as a result of our experience and reflections of undertaking facilitated simulation modelling with real stakeholders. With time, we hope to improve the current edition of the toolbox (user guide and toolsets), based on our experience of applying it in further case studies or the experience of other users, who may find the PartiSim approach suitable. Hence, any feedback from third parties (users, participants or students) will be appreciated.

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1 Introduction

The PartiSim approach has been developed to provide structure as well as practical guidance to participative and facilitated discrete event simulation (DES). The approach has been trialled in real simulation studies in health care, but it can be adapted and used in non health care contexts. The core values underpinning the approach are:

- Provide stakeholders with a platform of open discussion and communication to air facts and opinions that could impact the success of the study,
- Enable stakeholders to engage in a simulation study from problem structuring through to implementation in just four workshops which could last as little as two hours,
- Put forward a comprehensive yet simple approach supported by toolsets (tools, manuals and scripts) to guide less experienced modellers,
- Support the workshops with existing tools, with a proven track record such as Soft System Methodology (SSM) tools, or adaptations of existing tools or new tools which enable undertaking a simulation study in a facilitated environment,
- Blend in aspects of modelling as well as project management for the accomplishment of a simulation study.

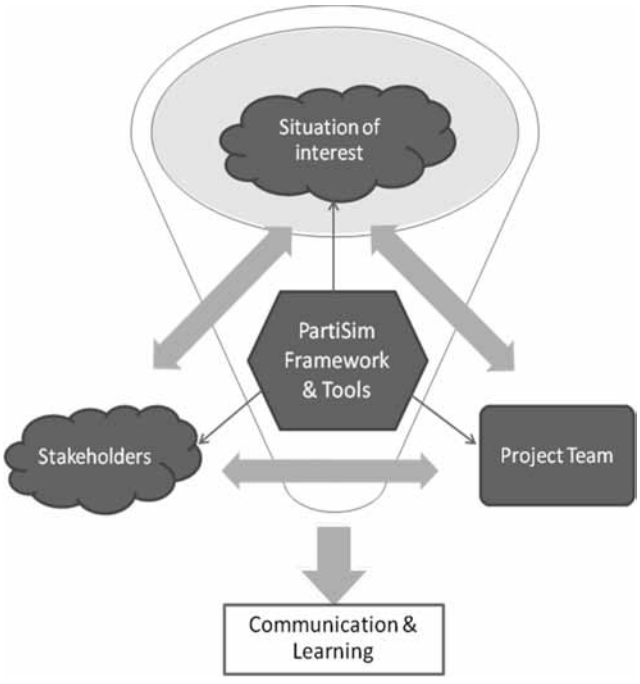
The PartiSim approach is motivated by a belief that stakeholder participation in key stages of simulation modelling can lead to successful study outcomes such as generating learning and implementation of their findings. Stakeholder participation has the potential to enhance the sense of model ownership and confidence in the results of the study. The PartiSim approach to simulation modelling requires input from the simulation modeller as well as active stakeholder participation.

The acronym **PartiSim** *stands for* **Participative Simulation in Healthcare.** *The key feature of the PartiSim approach is the development of simulation models involving facilitated workshops with the participation of stakeholders.*

The PartiSim study takes a structured and stakeholder-focused approach to modelling that enables communication among project team members and interactive learning about the situation of interest.

This User Guide provides an introduction to the PartiSim approach to modelling, describing the stages of the framework. The user guide is accompanied by a toolset (tools, manuals and scripts) for each key stage of the framework. A manual accompanies each PartiSim tool, which the user should consult in order to find detailed advice as to how to use each tool. The key concepts identified in a PartiSim study are the situation of interest, the stakeholders and the project team. The PartiSim study takes a structured and stakeholder-focused approach to modelling that enables communication among project team members and interactive learning about the situation of interest (Figure 1).

Figure 1: The philosophy of the PartiSim approach



1.1 Overview of the PartiSim framework

The PartiSim framework consists of a set of consecutive, but iterative modelling stages to the process of participative modelling (Figure 2). Pidd (2004) suggests that there are three parts in a simulation study: problem structuring, modelling and implementation; where modelling consists of conceptual modelling, model coding, validation and experimentation. According to Robinson (2004), a typical simulation study consists of four stages: conceptual modelling, model coding, experimentation and implementation. Taking these frameworks into consideration, the PartiSim modelling framework introduces six modelling stages (as shown in Figure 2) that aim to blend aspects of simulation modelling and project management (Pidd, 2004). Stages 2, 3, 5 and 6 involve a facilitated workshop.

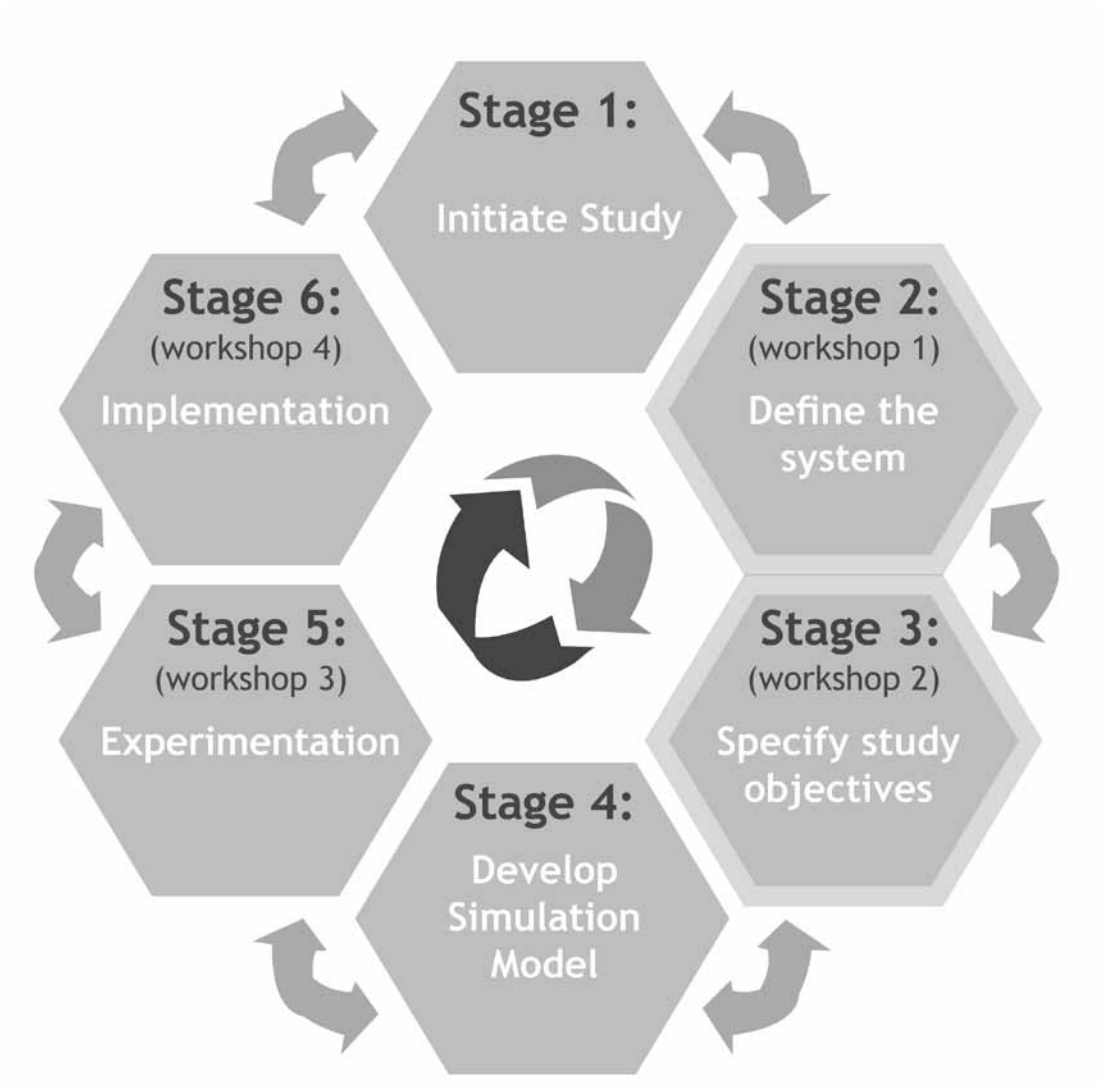


Figure 2: Stages of the PartiSim modelling framework based on the stages of a typical simulation study, adapted from Tako et al (2010).

Stakeholder participation is a core element in the PartiSim study, which is established by incorporating facilitated workshops as part of the modelling process.

The PartiSim study starts with the Study Initiation (stage 1), where the modelling team collates some preliminary information about the system to be studied and the stakeholder team is decided. Stage 2 involves a facilitated workshop environment (Workshop 1), where the modelling team works with the stakeholders to define the actual system and to gain a shared understanding about the problematic situation in that system. Stage 3 (Workshop 2) aims to determine the modelling objectives, model inputs and outputs and to abstract a communicative model of a specific part of the system, which becomes the focus of the simulation study. Relevant information and outputs gained during the first three stages of the study, are used during Model Coding (stage 4), where the modeller develops the code of the simulation model in the computer. It should be noted that in the PartiSim framework model coding is not carried out in a participative workshop environment, because it is a technical aspect of the study. However, stakeholders are approached to supply data for the model. In stage 5, stakeholders explore the computer model in a facilitated workshop (Workshop 3) to determine if it is valid for its use and to establish the solution space, which are the relevant scenarios. In this stage, the parameters (inputs and outputs) of the model are discussed and rated in their importance, as they are subsequently linked to decisions to improve the situation of interest. After workshop 3, the modelling team undertakes any further experimentation and prepares a report outlining the model results and findings which is subsequently sent to the stakeholders. Stage 6 (Workshop 4) aims to establish an action plan of changes and improvements to be implemented in the real world system. Each stage, with the exception of stage 4 (model coding) is supported by a toolset. Also, each stage may or may not involve a workshop. The user should note that each workshop is divided into sessions, with each session focussing on a key workshop objective. Different activities may support a session that may involve the use of a tool or script from the PartiSim toolset.

It is not compulsory to follow all the stages described in the PartiSim framework. The user can decide to use the PartiSim framework and/or the tools provided separately, or choose tools for a specific stage only. One can even pick and/or mix the tools and stages without following the PartiSim framework. We believe that each study has its own idiosyncrasies so tailoring the approach to the needs of the stakeholders or problem situation may be necessary. A list of the tools and manuals associated with each PartiSim stage is provided in Table 1, while the actual tools and manuals can be found in the toolset for each stage. The subsequent sections of this user guide describe each PartiSim stage.

The desired outcome from a PartiSim study is stakeholder learning about the problematic situation and/or an agreed action plan, consisting of changes to be implemented in the real system, where the stakeholder team takes ownership of the implementation plan.

Table 1: The stages of the PartiSim framework & associated tools

PartiSim stages	Assisting materials and tools
1. Study Initiation (Stage 1) 1.1. Understand situation of interest 1.2. Identify stakeholders and roles 1.3. Collect reading materials	Manual for Study Initiation Tool 1 Study Initiation Tool 1 Study Initiation Script:
2. Define System (Stage 2) 2.1. Problem statement 2.2. Defining the system of interest 2.3. Design a care system model	Manual for Conceptual Modelling Tool 1 Conceptual Modelling Tool 1 Example 1: CATWOE and Root Definition Manual for Conceptual Modelling Tool 2 Conceptual Modelling Tool 2 Example 2: A complete Care System Model
3. Specify Conceptual Model (Stage 3) 3.1. Brainstorming objectives 3.2. The Performance measurement model (PMM) 3.3. Extracting simulation study objectives 3.4. Develop communicative model	Example 1: Write study objectives Manual for Conceptual Modelling Tool 3 Handout Form for Conceptual Modelling Tool 3 Conceptual Modelling Tool 3 Manual for Conceptual Modelling Tool 4 Example 2: Final PMM diagram Conceptual Modelling Tool 4 Manual for Conceptual Modelling Tool 5 Example 3: From CSM to PFD Conceptual Modelling Tool 5
4. Computer model development (Stage 4)	
5. The experimentation stage (Stage 5) 5.1. Simulation model validation 5.2. Rating the performance measures 5.3. Debating the desirable and feasible solution space	Experimentation Tool 1 Manual for Experiementation Tool 2 ExperiemntationTool 2 Manual for Experiementation Tool 3 Experiementation Tool 3 (includes Form for Facilitators and Form for Stakeholders)
6. The implementation stage (Stage 6) 6.1. Review learning 6.2. Identify changes already implemented 6.3. Risks and feasibility of change 6.4. Determine action trail.	Implementation Script Manual for ImplementationTool 1 Implementation Tool 1 Manual for ImplementationTool 2 Implementation Tool 2 Manual for ImplementationTool 3 Implementation Tool 3

2 The initiation stage (Stage 1)

The initiation stage involves the initial activities that take place in preparation for the simulation study. There might not be a particular starting point for this stage, however there will be a vague recognition that a simulation study is required (for more details see Manual for the Study Initiation Tool 1), the simulation analyst (a modeller or a modelling team) is commissioned and a project team is being identified. Three are the main tasks pursued by the modelling team in this stage:

- gain a preliminary understanding of the situation of interest,
- identify the project team and more specifically the stakeholder team and modelling team and
- collect relevant reading materials.

During the Study Initiation stage a simulation study project is being formulated during which a preliminary understanding of the situation of interest is gained, the stakeholder team is identified and relevant reading materials are collected.

Optional tasks are also identified for this stage such as deciding whether on-site visits are necessary. The information collected during this stage is captured in the Study Initiation Tool 1. A project timeline can be also developed to plan the activities and to arrange the workshops with the stakeholder team. The three key tasks involved in this stage are next described.

2.1 Understand the situation of interest

The main objective of this task is to establish communication with the stakeholder team with the view to gaining a preliminary understanding of the situation of interest. The main sources of information available to the modelling team are: informal meetings, one to one interviews with various stakeholders, observations and existing reading material. Initial communication will involve the study initiator (s), who will have made contact with the modelling team, to communicate the specific issue. When contacting the study initiators (or stakeholder team), it is important for the modeller to have prepared some questions about the situation of interest. Three main types of information are required at this stage: the problem/ situation of interest, internal views expressed about what can/should be improved and roles of people in the system of interest. A list of potential questions is provided in the Study Initiation Script: Bank of questions, found in the Study Initiation Toolset. The relevant information collected can be captured in the Study Initiation Tool 1 also found in the toolset. Although, communication with the study initiators can provide useful information about the situation of interest we suggest that these meetings are kept to a minimum as the aim should be to elicit information from the workshops. The number of meetings can vary from around one to three, but this is left to the discretion of the modelling team, depending on: stakeholders' availability, complexity of the problem, project timescales, etc.

Observation of the situation of interest (Optional task)

An optional task that can be undertaken by the modelling team during the initiation stage is to make first-hand observations of the situation of interest. This task provides added benefits especially in the case that the modelling team has little experience or knowledge of the particular healthcare system under study. A sensible number of visits should be made so that the stakeholder organisation is not overburdened and their services are not disrupted. The details of the observations can be captured in the observations part of the Study Initiation Tool 1.

2.2 Identify stakeholders and roles

The second task of this stage is to identify members of the project team to be involved in the next stages of the PartiSim project, as workshop participants, providers of information or as content developers. The PartiSim approach distinguishes between two main teams: the stakeholder and the modelling team.

The stakeholder team includes an important group of people, those who have a stake or an interest in the outcomes of the project. The stakeholders of an organization should cover a wide range of roles, including, health care practitioners, managers and patients, who benefit somehow from the study. Some crucial roles identified amongst the stakeholder team, according to the PartiSim approach are: the project champion, the key stakeholders and stakeholders. Please note that some of these roles may overlap. A brief explanation of each role follows:

- *The Project Champion* is the person who will carry internal responsibility for the project within the organization, but will also work closely with the modelling team. He/she should be energetic and enthusiastic about the project, but has also authority and influence within the organisation. The Project Champion carries the project forward during more advanced PartiSim stages. This person may have also identified the problem and initiated the study. The Project Champion becomes the communication liaison between the two teams (stakeholder and modelling team), by speaking within the organisation about the modelling study and by also collaborating with the modelling team as a representative of the stakeholder team. Apart from coordinating the communication between the stakeholder and the modelling team, the project champion helps with the logistics and the preparations of the workshop.

The Project Champion plays a very crucial role throughout the study, carrying internal responsibility within the organisation, but also working closely with the modelling team. It is hence important that this role is undertaken by an energetic person, enthusiastic about the project.

- *Key Stakeholders* are members of the team who have a direct association with the simulation study and its outcomes and may have initiated the study. They will normally be key decision makers, pay for the study or be keen to solve existing problems in the system or improve it. Key Stakeholders should include those that sit in steering boards and have a say in implementing change in their organization. Their role is rather crucial in later stages of the simulation study, especially in the implementation stage.

- *The workshop participants* are selected within the organisation, as Stakeholders of the PartiSim study. The Key Stakeholders are normally in a position to identify workshop participants. Stakeholders should be knowledgeable of the part of the situation of interest they represent. This approach to selection of workshop participants is helpful because views from different parts of the system can be represented in the facilitated sessions, so that the study and findings are more likely to be embraced across the organisation.

The modelling team should consist of those that will help develop the simulation model and those that will facilitate the workshops and record information. A member of the modelling team can undertake more than one role; however, it is advisable that the modelling team is comprised of at least two people. The main modelling team roles are briefly explained:

- The *Modeller* is an expert in developing simulation models on the computer. During the workshops, the modeller focuses on the models formulated by the facilitator and the PartiSim group, keeps relevant notes, creates his own models and reflects back to the team. One of his/her key roles is to make sure that the conceptual model formulated in the first workshops is transferrable to a working simulation model.

- The *Facilitator* is a person with facilitator skills capable of driving the knowledge elicitation process during the PartiSim workshops. The facilitator utilizes appropriate techniques to support group work and to ensure that everyone's views have been heard and incorporated in the conceptual model discussed. While in depth knowledge of the problem situation discussed in the workshops is not necessary, the facilitator should have some preliminary knowledge of the situation.

- The *Recorder* is a member of the modelling team who keeps notes during the facilitated workshops. While, the use of recording equipment is suggested by the PartiSim study, the role of the recorder is considered important especially in cases where confidential information is discussed and hence not recordable by electronic equipment or in the case that electronic equipment fails or stops working.

The manual for the initiation stage gives brief guidelines that can help identify the people most suitable to perform the roles identified above. The Study Initiation Tool 1, found in the Study Initiation toolset, is used to capture the contact details of the team members and the roles assigned.

2.3 Collect reading materials

The third task of this stage is to collect relevant reading materials, so that the participants of the project may complement their understanding of the situation of interest with further reading. Reading material may include, for example, Department of Health reports and academic journals. These documents can be suggested by any project member (stakeholders or modelling team) and are captured in the Study Initiation Tool 1.

2.4 Reflections on the PartiSim Initiation Stage

After having undertaken some of the tasks described above, the modelling team should study the information and material collected in the Study Initiation Tool 1 with the view to developing an understanding of the situation to be explored in the project. The information collected at this stage can prove very useful when preparing for the workshops and can be used to develop preliminary outputs for workshop 1. Obviously, the information collected will not provide answers to all the questions and it may even contain contradictions and misinterpretations.

The amount of preliminary work is left to the modelling team's judgment as many factors will need to be taken into account such as the context of the study, the experience of the modelling team as well as the time the stakeholder team is willing to spend with the modelling team at this stage. It is however considered advantageous to start the facilitated workshops in the next stages with some already developed preliminary outputs. The main reason for developing these preliminary outputs is to help initiate discussion and debate during the PartiSim workshops. Developing these outputs from scratch during the workshops might be time-consuming and unproductive. Some preliminary outputs that can be created at this stage are: problem definition using SSM root definition(s) or a simple statement describing the situation. For more information and how to develop these outputs the user is referred to the following section and the corresponding toolset manuals.

3 Define the System (Stage 2)

The aim of this stage is to develop a common high level definition of the system studied and to gain an understanding of the problems/issues involved in that system. The second stage in the PartiSim framework takes the form of a facilitated workshop (Workshop 1) attended by the project team (the stakeholder and modelling team) that has already been identified in stage 1. The facilitator leads the session, making sure that stakeholders participate, but at the same time manages their expectations in terms of what the project can deliver. Workshop 1 can range from two hours to half a day. It can be also combined with workshop 2 stage 3 (section 4) if it is difficult to get the stakeholders together in two separate workshops on different days.

In Stage 2, Workshop 1 is organised in a facilitated and interactive learning environment. The aim for Workshop 1 is to develop a common understanding of the problem situation among project members and to agree on the overall study objectives.

In meeting the aims of this PartiSim stage, the workshop should be structured around three main sessions, which focus on problem statement, definition of system of interest and the design of a care system model. These are next explained.

3.1 Problem statement

This session aims to reach to a commonly agreed problem statement with the stakeholders through a process of brainstorming, discussion and negotiation. It can be organised in the form of an activity where everyone is invited to express their opinion. In initiating the activity, the facilitator can ask the following question: 'What are the major uncertainties or issues you would like quantitative information about to support your planning and decision making'. Summary points of issues (or problems) voiced can be written on a flipchart (visible to all) by the facilitator or any other member of the modelling team. An agreement should be reached as to which issue should be pursued through the project. The facilitator plays an important role in making sure that priorities are put forward as well as highlighting those problems that are unlikely candidates for a simulation study. If the stakeholders do not agree on the most important problem to be pursued by the study, then the facilitator should encourage negotiation or voting. At the end of this part of the session, the facilitator wraps up by providing a summary of the problem situation to be tackled by the simulation study.

In this session, the ownership of the problem (at least acknowledgement) moves away from the study initiator/ project champion into the hands of the workshop participants. It also serves as an opportunity for the facilitator to get to know the stakeholders and their opinions.

3.2 Defining the system of interest

This session should start with an activity that aims to define the system of interest, where the problem situation resides. This involves identifying the elements of the system and the main functions undertaken in that system (transformation of input to output). The SSM tools, CATWOE and root definition, can be used for this activity (Checland and Scholes, 1999). The CATWOE is a mnemonic, the first letters of which consist of the elements of the care system, namely Customers, Actors, Transformation process, Worldview, Owners and Environmental constraints. These tools are captured in Conceptual Modelling Tool 1 but adapted to defining healthcare systems (refer to the manual for Conceptual Modelling Tool 1). The elements identified are then assembled into a root definition that defines the key transformation process in the form of the key activity that takes place in the system. The root definition acts as a mission statement for the system and follows the format "do X by using Y to achieve Z". A sample statement to use for this purpose is provided in the second part of the Conceptual Modelling Tool 1. The benefit of using this tool is that it provides a structure to the discussion, focuses the participants' mind on what is important and makes it possible that a change in perceptions and learning occurs. For further advice on how to use the tool, the user is referred to the Manual for Conceptual Modelling Tool 1. An example (Example 1: CATWOE and Root Definition) is also provided in the Define the System toolset.

The CATWOE and root definitions of the system provide a common platform for the stakeholders to begin the process of exploring the problem situation.

3.3 Design a care system model

Following the problem statement and key system definitions the next session of the workshop focuses on developing an overall view of the activities that take place in the care system of interest. This is achieved by defining the long- and short-term clinical, managerial and research activities that support that care system in a graphical form called a Care System Model (CSM).

> *The Care System Model (CSM) is a graphical representation of the healthcare system, where the clinical, managerial and research activities that take place in the system are defined.*

The CSM is based on the SSM tool called the purposeful activity model (PAM), but adapted to fit specifically healthcare situations. A preliminary CSM model developed by the modelling team in Stage 1 can be presented here. In our experience, stakeholders rarely agree unanimously and as a result changes to the preliminary CSM are made. Debate and discussions should be encouraged by the facilitator so that the CSM matches the views of the stakeholders. Obviously, the discussions that take place build upon the thread of thinking made while devising the CATWOE and root definition.

The relevant information for the development of a CSM is captured through the Conceptual Modelling Tool 2. The process involves collecting the verbs that describe the activities that take place in the care system, which are structured based on the logical dependencies involved. However, the three generic categories of activities based on the aspects that concern health care systems are: the clinical, managerial and research activities. Obviously, if a non-health care problem situation is studied the categories will need to be adapted to fit the context of interest. An example of a CSM can be found in the Define the System toolset (Example 2: A complete Care System model). A brief explanation for each category of activities follows:

- The clinical activities consider the care system from an operational perspective, with regards to the flow of services and/or patients through the care system. The clinical part can be closer to the computer model, depending on the problem situation studied (Kotiadis and Robinson 2008). It is hence the most important part of the care system model, which is further abstracted to develop a more detailed representation of patient flows called patient flow diagram (section 4.4).
- The managerial activities refer to the activities required to design and support the management of that system.
- The research activities consist of activities that support the clinical research studies, which often are an additional requirement in health care settings. Most health care trusts undertake clinical research and audits, which help to provide high quality care, but to also advance knowledge and the procedures involved.

> *The process of developing a Care System Model involves collecting the verbs that describe the clinical, managerial and research activities that take place in the care system, structured based on the logical dependencies involved.*

During this session discussions are raised about the specific activities identified in the care system of interest. It is recommended that the activities for each category should be first identified in a brainstorming session and then proceed with completing the relevant forms in the Conceptual Modelling Tool 2 (in toolset Define the System). The facilitator should bear in mind that during the discussion about the research and managerial parts of the CSM, the intention is to collect relevant information for understanding the objectives of the simulation study. The reason for including all these categories is that operational problems in health care system can relate to more than just clinical activities.

Having developed a full CSM diagram, a discussion may next follow by asking the stakeholders to compare the system representation mapped so far with their views about the real world situation. The main aim is to identify activities that are not taking place or activities that need improvement. The facilitator should start from the clinical activities as these are the most likely to feature in the model and should steer discussions to those activities that relate the most to the problem situation stated at the start of the workshop. This coincides with the third methodological cycle in (Checkland and Scholes 1999), where for each activity in the CSM, it is considered whether:

a. this activity exists in reality, and if so

b. how is it perceived, as well as

c. what changes might be considered as both desirable and feasible.

This discussion serves as a means of validating the models developed so far, but also to identify existing problems in the real system, and to gain further understanding of the situation.

3.4 Reflections on PartiSim stage 2

During this stage, participating stakeholders and the modelling team have been working together in an interactive fashion towards defining the problem situation and the system where it resides. The main tasks carried out during this workshop are: the development of a problem statement, CATWOE and root definitions, the development of the CSM and identifying areas for potential improvement in the system. This process helps in achieving a common basis of understanding about the situation of interest, among the members of the project team. After this session the modelling team reports back the outputs of Workshop 1 (namely, CATWOE and root definition, CSM and the agreed aims of the study) to the stakeholder team for reflections. Changes to the already agreed outputs may take place as a result of this.

4 Specify the conceptual model (Stage 3)

The aim of this stage is to specify the key elements of the conceptual model, namely simulation study objectives, the inputs and outputs to the simulation model and the communicative model (model contents). This stage is performed in a facilitated workshop environment (Workshop 2). The key activities of this workshop are: 1) the development of the performance measurement model (PMM), which then leads towards specifying the simulation study objectives and to reaching an agreement on model inputs and outputs and 2) the development of the patient flow model (PFD), which helps towards identifying the model contents.

The aim of Workshop 2 is to further abstract the conceptual model, by identifying simulation study objectives, model inputs and outputs and model contents.

4.1 Brainstorming objectives

The workshop can start with a brainstorming session with the following question posed to the participants: "By the end of this study what do you hope to achieve?" (Robinson, 2004, pp. 80). This question provides the stakeholders with the opportunity to bridge the discussions and learning from workshop 1 into workshop 2. A form can be handed out (refer to Example 1 in toolset Specify the Conceptual Model) to support the participants in undertaking this warm up exercise individually. According to Robinson (2004), three are the main components that need to be included in order to define effective modelling objectives:

- The purpose: "what is it (improvement) that the stakeholder team wishes to achieve?" Some examples are: to increase the patient throughput in the system, to reduce the cost of using expensive ITU beds, etc.
- The target of performance: to identify a numeric value of the improvement to be sought in the system in the form of absolute targets. For example, to increase/ reduce the patient throughput by a specific percentage.
- The constraints: the limitations in the changes that can be made in the real world system for achieving the modelling objectives. These are usually a result of budget restrictions or of the rules and directives imposed on the healthcare department or unit concerned. For example, there can be a limitation in the number of additional beds that can be used, in line with the objective of increasing patient throughput.

It should however be noted that there might be cases in which the nature of the objectives may not follow the format explained above. The modeller needs to use his/ her intuition and experience according to the situation. In some cases less quantifiable modelling objectives may be derived such as: improving clients' understanding of the real world system, etc.

The facilitator can collect the output of this warm up exercise in order to compare it to the more detailed and thorough exploration of the simulation objectives achieved through the performance measurement model (PMM) in the next session.

4.2 The Performance measurement model (PMM)

The process of developing the PMM provides the participants an opportunity to explore in a structured, relatively thorough and non technical way, the performance of the system. This process can lead to determining the simulation study objectives. It is likely that some objectives will be obvious and will have been adequately captured in the previous activity but others will emerge from the interaction of the stakeholders as part of the activity. The input of the modeller is essential in this process as he/she can determine the compatibility of multiple objectives within a model. It may be necessary, depending on time and money, to build more than one model or put some objectives on hold for a future study.

The process undertaken to arrive at the PMM can be described by the following steps:

- Identify the performance measures
- Identify monitoring and control activities and
- Complete the PMM (can be optionally performed by the modelling team only)

The performance measurement model (PMM) consists of a group of activities that identify the actions that need to be taken to monitor the performance of the system of interest.

This session can start with an explanation of the three key performance criteria put forward in SSM, called 3Es, which consist of: Efficacy, Efficiency and Effectiveness, which will then need to be defined in the context of the situation studied. The performance criteria are the standards by which the system will be judged. In order to achieve this, the stakeholders are asked to brainstorm and contribute their ideas as to what could be the monitoring activities for their system. The handout form for Conceptual Modelling Tool 3 can be used to capture information during the brainstorming session. The PMM consists of a group of activities that identify the action that needs to be taken for the continuous monitoring of the performance of the care system. A preliminary PMM can be optionally used to start the session. In this session the Conceptual Modelling Tool 3 can be used to capture the performance measures and monitoring activities suggested by participating stakeholders. These are then grouped into: measures of performance, monitoring activities (activities to monitor/examine the performance measures identified), determine if activities (questions that identify whether action is needed) and take action activities. These are subsequently linked in a logical order using arrows and rectangles. The resulting diagram is then appended at the end of the CSM developed in Workshop 1. This procedure is further explained in the Manual for Conceptual Modelling Tool 3. Once the PMM has been developed, in the next session the simulation objectives are extracted. This is described in the following section.

4.3 Extracting simulation study objectives

The simulation study objectives are extracted based on the PMM developed so far. This can be either undertaken in an interactive session with the stakeholders in workshop 2 or it can be optionally undertaken by the modelling team after the completion of the workshop. The Conceptual Modelling Tool 4 can be used to extract the information needed. The modeler's input has a high impact in the identification of the study objectives, hence if undertaken in a facilitated session, the modelling team should convene before starting in order to group and re-format the PMM, but to also discuss which activities in the PMM can be modelled using simulation. Two are the key activities that should be achieved, identifying model inputs and outputs and determining study objectives.

As part of the activity of identifying model inputs and outputs, the monitoring and determine if activities in the PMM diagram are distinguished into: Inputs (Is) data entered into the model in the form of experimental factors and Outputs (Os) the results collected from the model as system performance. Some of the activities that could be initially listed as either Inputs or Outputs may subsequently be reclassified as model content. Next, from the list of changes identified in the PMM, which the modelling team has identified as possible to be explored in a simulation study, further information about the inputs and outputs is collected. The information is relevant to identifying:

- How each change will be achieved?
- What is the range (minimum and maximum) of each input (I)?
- What is a good or bad performance for each output (O)?

The aim is to extract information about inputs and outputs (performance measures) that will be associated with the modelling objectives. If the participants are not knowledgeable of the answers to these questions, they should be asked to provide the name of a person that is responsible or that can provide this information. In the case that this stage is not undertaken in a facilitated session, and the modelling team has not previously come across the relevant information, the Project Champion and/or all stakeholders should be contacted to provide the relevant information.

The final PMM diagram agreed in the workshop should be sent back to the stakeholders for clarifications, in the case that some monitoring activities have been missed out.

As part of the activity of determining modelling objectives, the main components for the definition of the study objectives should be put together in working modelling objectives. These are: the purpose (what is it that the client wants to achieve), target performance (level of performance required) and constraints (limitations in the changes that can be made) (Robinson 2004) connected to the relevant change to be introduced.

In the majority of cases the format of the simulation study objectives should include the following: the purpose, target performance, constraints and change to be introduced.

4.4 Develop a communicative model

Once the simulation study objectives, inputs and outputs have emerged, it is useful to move on to producing a communicative model of the simulation model content. Through further abstraction, the Care System Model (CSM) can be transformed into a more detailed diagram of the clinical activities, relevant to the study objectives. The patient flow diagram (PFD) can be used (refer to the Manual for Conceptual Modelling Tool 5 in the toolset Specify Conceptual Model). Most often the flow of patients into the system is of interest, hence the clinical activities part of the CSM is usually extended into a PFD. The task of developing a PFD, serves as a means of further abstraction, where the facilitation process focuses towards defining in more detail the possible routes that patients follow in the care pathway, including the flow of activities and the rules involved. The ultimate aim is to decide on the level of detail and the content to be included in the simulation model.

The patient flow diagram (PFD) is a diagrammatic representation of the activities displaying the flow of patients (or entities) in the system. It is used as a means for identifying the contents of the simulation model.

The PFD is best drawn on a white board or on a computer visible by all participants in an open forum discussion, where all participating stakeholders are invited to make suggestions. The PFD represents stakeholders' mental models of the system. Hence, debate and discussion during this session is essential to capture the shared views. Obviously, various versions and alterations are developed during this session or after until participating stakeholders agree with the resulting diagram.

The Conceptual Modelling Tool 5 offers guidance on constructing the Communicative Model during this session. This tool consists mainly of a pro-forma that can be used to populate activities included in a PFD. The PFD is in fact a process flow diagram adapted to health care systems. One can start from the clinical activities part of the CSM and extend with a more detailed representation of the flow of the care services provided. A similar diagram can be developed for a non-health care system depicting the operational activities involved that relate to the problem situation and the agreed study objectives.

Other conceptual diagramming tools from DES can be also used, however this tool uses a format equivalent to a process flow diagram and is considered to be more simple and comprehensible for participants with little or no knowledge of simulation modelling (Robinson 2004). The PFD consists of a sequence of queues (represented in circles) and clinical activities (represented in boxes). A clinical activity or task is represented by a square whereas circles represent patients waiting for an activity to happen, i.e. patients queued in a waiting list for surgery. The squares and circles are connected with one-directional arrows, in a discipline of queues (circles) followed by activities (squares). Another reason for using process flow diagrams in this session is that a more straightforward connection between the CSM and the PFD can be established. This is in fact intentional because in the PartSim approach the possibility of going back and forward between the tools used is considered essential. For an illustration of the connection we refer the user to Example 3 in the Specify Conceptual Model Toolset.

The PFD represents a communicative model of the contents of the system to be modelled and serves as a starting point to coding the computer model. This session is concluded with a discussion about data availability and data collection. The PFD developed can be used to drive the discussion, where the facilitator asks for information whether the data are already available or accessible and if not to identify the person who can provide or help with data collection. In the case when data is not attainable, estimates can be also agreed with participating stakeholders.

4.5 Reflections on PartiSim stage 3

In the third stage, further model abstraction takes place in a workshop environment, where the objectives of the simulation model are specified and a communicative model in the form of a patient flow diagram is captured based on the shared views of the participating stakeholders. Other aspects considered during the facilitated session are model inputs and outputs, and data availability. It is advisable that a report with agreed outputs is sent to stakeholders for feedback. The key points to include in the report are: study objectives agreed in the workshop, identify data needs and/or the range of variation of the experimental factors.

5 The model development stage (Stage 4)

This stage is mainly driven by the modeller. The conceptual model is converted into a computer model, using either specialist simulation software or a programming language (Robinson 2004). It is essential that routes to communication with members of the stakeholder team and especially the project champion are maintained. During this stage, the data collection process takes place, where the modeller liaises with the relevant stakeholders. It is advisable that before proceeding to Workshop 3, a complete version of the model is presented to the project champion for validation purposes. The scenarios to be used for the experimentation stage can be also reinstated or clarified with the project champion, especially because during model development, changes may have occurred in the organisation or stakeholders' thinking might have progressed.

During the modelling stage, further conceptual modelling may take place, which may result in modifications of the conceptual model defined in stages 2 and 3. Some performance measures may be downgraded to model contents or even not included in the model for simplification purposes or because they are not considered relevant anymore. For example, in the obesity model developed, after reflections, inpatient beds, while they were initially considered as inputs (experimental factors) were subsequently downgraded to model contents. Also patients that failed to attend a clinic (Do-Not-Attends DNAs) initially were classified as experimental factors, but were later downgraded to model content for simplification purposes. Consequently changes to the PMM diagram may still occur at this modelling stage.

6 Experimentation (Stage 5)

The experimentation stage should follow the development of the simulation model, and an initial computer model validation with the project champion. This stage takes the form of a facilitated workshop (Workshop 3) to enable a live presentation of the model and of the model results to the stakeholders. The key aims of workshop 3 consist of the following:

- Validating the simulation model,
- Rating the performance measures and
- Establishing the desirable and feasible solution space

6.1 Simulation model validation

This session aims to establish confidence in the model among the stakeholder team. Hence Workshop 3, should start with a review of the communicative model produced in workshop 2 followed by an explicit presentation of the computer model to the stakeholders. The structured 'walk through' of the computer model, should focus mainly on the model depicting the current situation (if that system exists). This will enable a clear understanding of the behaviour of the real system and its emerging problems. Participant engagement should be encouraged by checking often whether they believe that the real system has been adequately represented. Obviously, participants, who may be exposed for the first time to a simulation model, may need some time to familiarize themselves with the simulation model, how the logic works, etc. hence it is important to give them time to absorb the new information. During this session, any questions asked by the stakeholders about the model need to be dealt with effectively. For this reason the facilitator should provide some relevant information about the simulation model and how it works. Some key point that should be explained are:

- Model simplification, referring to the fact that models are simplifications of the situation, not 100% representation of the system. As a result only aspects of the system relevant to or impacting on the objectives are normally included.
- Variability and how it is represented in the model.
- The use of multiple runs representing more accurate model results.

The role of the champion who has already had a previous encounter with the model is important at this stage as he/she may also want to contribute insights or explanations to the stakeholders. It is also expected that errors may be found or modifications may be needed as a result of the conversations during this workshop. It is important to take suggestions on board and be positive about stakeholders' comments.

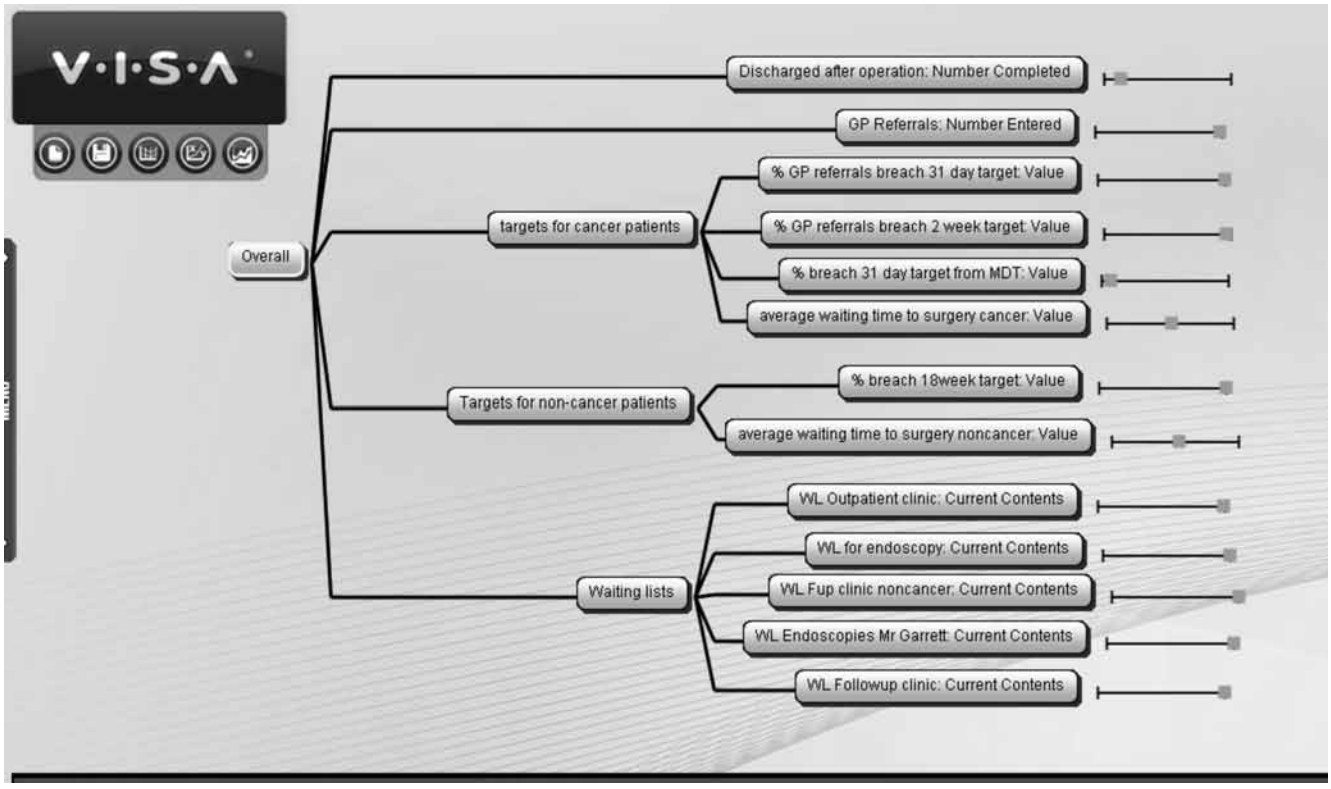
This part of the session should be normally led by the modeler, whereas a second member (facilitator) of the modelling team may lead any resulting discussions. It is important that a recorder (note keeper) is also appointed, to note the changes suggested. The use of Experimentation Tool 1 is suggested, either for the participants to individually reflect on or by a member of the modelling team to record any changes to the model.

After having presented the simulation model of the current situation and the results accepted, the model outputs or performance measures are next discussed. It should be noted that full acceptance of the model is not expected, but stakeholders should be assured that the changes discussed will be integrated in the model after the workshop. In the extreme case that the model behavior is fully rejected by the stakeholder team, the workshop should not proceed with the next sessions. This can be treated either as a natural end point for the workshop or a change of direction, where the workshop focuses fully on identifying ways to improve the simulation model and/or conceptual model. Alternatively, if further data collection or coding additional elements is required to increase confidence in the model, the workshop can be rescheduled. The modeling team should agree before the workshop what reaction from the stakeholders would constitute insufficient confidence in the model and how this would be handled by the facilitator during the workshop.

6.2 Rating the performance measures

The performance measures, identified in workshop 2, are further discussed in this session, in order to identify the importance that the stakeholder team attaches to specific model results. Stakeholders are asked to rate the importance of each performance measure, before looking at the behaviour of the system under different scenarios. The approach of completing this session of workshop 3 is influenced by multi-criteria decision analysis (Belton and Stewart, 2002). The facilitator leads the discussion by asking stakeholders to express their opinion about the importance of the performance measures. This can take the form of an open or secret voting. In some cases, it may become clear which performance measures are of high importance, during the validation step and then voting may not be required. This session can also serve as a means of identifying additional performance measures of interest that may not have been identified in earlier workshops. Many of the off-the-shelf simulation software offer extensive performance measures related to the queues and processes that may be of interest to the participants. Experimentation Tool 2 and its manual in the Experimentation Toolset can be used to facilitate and establish the most important performance measure(s). Alternatively, VISA **(http://www.visadecisions.com),** a multi-criteria decision analysis software can be used, where a decision tree with all the performance measures can be put forward for discussion. More specifically, the weight of each performance measure is discussed based on stakeholders' opinions about their importance (figure 3). This process will support the evaluation of each simulation scenario, as the aim is to find the most desirable and feasible one.

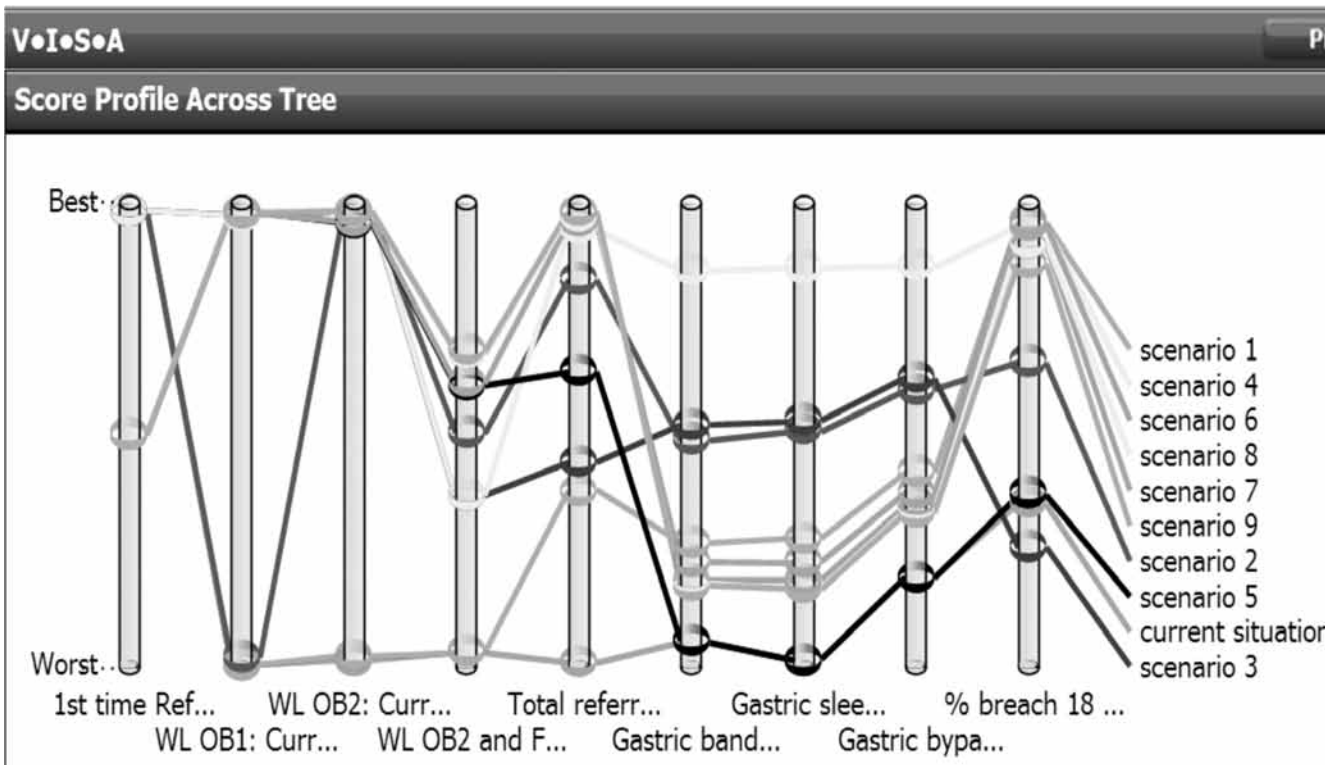
Figure 3: An example of rating the importance of each performance measure using VISA software



6.3 Debating the desirable and feasible solution space

In this session, the attention of the stakeholders should be turned towards debating the desirable and feasible solution space. We suggest that before coming to the workshop, the modelling team puts together a few scenarios (3-4) based on the information collected in workshop 2 or from the insights gained from the communication with the project champion in stage 4, where some pre-validation has taken place. These scenarios may not necessarily be the final ones; however presenting the relevant scenarios/models in front of the stakeholders helps build stakeholders' confidence in the model. The results from the simulation runs can be summarised in a table using Experimentation Tool 3 (Form for Facilitator) in the Experimentation Stage Toolset and projected to the stakeholders gradually. Stakeholders should be reminded of the modelling objectives already identified (from stage 3) to help them make use of the scenarios presented. Suggestions for further scenarios can be identified through brainstorming using Experimentation Tool 3 (Form for Stakeholders). From our experience of workshops, we found that stakeholders like to see the numerical results because it helps them participate in the sensitivity analysis. The scenario showing the most added improvement in the performance measures would be the best scenario from the ones shown in the workshop. Information on the comparison of scenarios, where t-tests are used to compare the statistical difference of performance measures for each scenario can be also added in this form. In order to make this easier for the stakeholders to compare the results, each scenario is ranked separately for a performance measure. The VISA software can be alternatively used to present the results of the scenarios developed (figure 4). VISA can be used to identify the most preferred scenario (if models are connected to VISA the results will be reported automatically and the best performing scenario will be obvious based on the most important performance measures agreed in the previous part of the session Figure 3). During this process, the facilitator flags up interesting/worrying results about the system.

Figure 4: An example of using VISA to rank each scenario on each performance measure



Having presented the model results, the facilitator should encourage the participants to suggest further scenarios to explore, the results of which can be reported back to the stakeholders after the workshop. We do not recommend modifying the model to run new scenarios in the workshop because the statistical elements of experimentation (multiple runs, warm up time, t tests etc) require time to run.

Another objective of the session is to reinforce the learning from the model. Hence, next the discussion should focus on generating learning about the behavior of the system. The facilitator may want to pose these questions (or similar):

- Do you find the information your have received so far (results of the model) useful for decision making?
- Do you feel they give you decision making power?
- Are there any other potential scenarios that could be added or removed in the solution space?

At the end, the session is wrapped up, where the new changes to the model, additional or improved scenarios are summarised.

6.4 Reflections on PartiSim stage 5

The aim of this workshop is to build confidence in the model and to explore scenarios of interest to the stakeholders so that they understand and imagine what might bring about an improvement to their system. Exploring the feasible solution space is essential as not many changes to the real system are actually plausible.

Following the workshop the modelling team should undertake further experimentation and a report outlining the results of the scenarios of interest should be drafted and sent to the workshop participants. It is not unusual for stakeholders to request further scenarios to be included in the report following the workshop. We believe that this is an indication of the ownership of the model being transferred into the hands of the stakeholders.

7 Implementation (Stage 6)

The Implementation stage encompasses the final facilitated workshop (Workshop 4), and aims to move the stakeholders away from the simulation model and its scenarios towards identifying an action trail for change. This stage builds on the identification of future scenarios from Stage 5 and the learning generated throughout the study. Robinson (2004) suggests that one of the main benefits of DES studies comes from the learning generated during the modeling process; yet the modelers/facilitator may need to intervene in creating awareness of the learning achieved. If the clients understand their problem situation and are given support in developing actions to address this, then they are more likely to implement the proposed solutions. However, other factors such as psychological perceptions may hinder the stakeholders from taking action (Ajzen, 1991).

The reader should note that for studies that only aim to generate understanding about the situation of interest rather than solve a particular problem, the focus should be even greater in this stage on getting the participants to report their learning from the process so far.

The Implementation stage moves away from the simulation model and the results. The main aim is to generate a participative discussion with the stakeholders leading to a future action plan of changes, based on the findings and learning generated throughout the PartiSim study.

Workshop 4 includes four structured sessions:

- Summarize and review learning and development achieved so far
- Identify any changes already implemented
- Discuss risks and feasibility of implementing proposed scenarios to the real system
- Discuss barriers to change & action trail.

7.1 Review learning

Before moving on to making decisions on future changes, the workshop could start with a reminder about the study, refreshing stakeholders' memory on what has been accomplished so far. This would be useful since it may have been a while since the last session, and it will provide understanding for those who might have missed any of the workshops. As part of the review, the problem statement, objectives, a visual display of the simulation model and the results can be briefly presented. The results can be presented in a table format using once again Experimentation Tool 3. The table can include the experimental factors (inputs), the current and future scenarios (updated with any changes suggested in workshop 3) and the performance measures.

This session should be brief because stakeholders are likely to have read the communications and report compiled after workshop 3. If the main focus of the study is on generating learning, one could ask the stakeholders or the Project Champion (with initial agreement) to review and summarize the study so far. This will have the benefit of identifying stakeholders' understanding and any areas that may still need clarification. Another benefit of this being presented by a fellow stakeholder is that he/she is more likely to use a more familiar language to the stakeholder group. This activity can be a step towards shifting ownership of the study to the stakeholder team by reviewing the effort that all team members (stakeholders and modelers) have put into the process whilst recognizing the learning gained.

7.2 Identify changes already implemented

Following the review of the PartiSim process so far, the stakeholders should be prompted to report on any changes that might have already occurred in the system since the study started. It is important for the modeling team to record relevant changes to the system, which could have emerged be as a result of the study. Learning and implementation can occur before the study ends and some stakeholders may have not informed the modeling team of the change(s) that might have occurred. The Implementation Script in the Implementation Stage Toolset puts forward some potential questions that could be asked in the session. These questions can help identify whether the study led to any new initiatives and whether these were planned before the study, and ultimately reveal whether any learning has occurred from the study so far. It is suggested that questions about planned change are asked at the first and last workshop and if possible

at every workshop, in order to record stakeholders plans or any additions in their knowledge/ learning. This is important as failure to recognize learning and implementation during the process may result in a project perceived by the modeling team as largely unsuccessful.

7.3 Risks and feasibility of change

Although in stage 5 (experimentation workshop) the stakeholders will have been asked to suggest feasible variation of the model inputs, in practice there may be barriers that have not been captured by the discussions. For example, in one of our implementation workshops when discussing the possibility of outsourcing a process, stakeholders pointed out that actually this would be unlikely (outsourcing this process) as the income generated by this process would be lost. However in the experimentation workshop this was suggested as a possible scenario to consider. On reflection the improvement of the related performance measures did not outweigh the lost income.

This session focuses on revealing implementation barriers of the most preferred scenario. This task should initially focus on the best performing scenario. The facilitator can ask probing questions referring to the Manual for Implementation Tool 1, if needed, to identify how the decision would fit in the real life system, taking into consideration other factors that might have not been included in the model. The facilitator brainstorms with the stakeholders, asking everyone in turn to suggest the risks or feasibility issues they perceive, in order to decide if the scenario that displays the best model results is indeed feasible. The Implementation Tool 1 can be used to generate in depth discussion. This tool can be used to bring into the open any positive or negative viewpoints, which are discussed to see if seemingly infeasible factors can be made feasible. This process may leave the participants with the realization that the favourite scenario may not be on balance feasible. This would mean that on balance the negative factors outweigh the positive ones. In this case, the next best scenario should be explored until a scenario is found to have more positives than negatives and generally considered as being feasible.

7.4 Determine action trail

Once stakeholders have reached agreement that a preferred scenario is on balance feasible the workshop can move on to consider the necessary actions related to the resources and process required. Despite the process followed earlier to assess the feasibility of the preferred scenario, it would be naïve to believe that any change is easy to implement. Therefore once again the stakeholders should be encouraged to reveal any further barriers.

The activity can start with listing the required changes distinguishing them in resources and processes; followed with a discussion about likely barriers. The Implementation Tool 2 (Barriers to change) can be used to help stakeholders to reflect and give ideas for discussion. Barriers to change can include physical and psychological barriers such as fears, doubts and lack of resources which may hinder future action. Then the Facilitator can ask stakeholders to challenge these barriers and to brainstorm actions to overcome them. This process of openly challenging barriers and discovering remediating actions makes the possibility of change (and actions to support change) more likely. Stakeholders can then be encouraged to suggest the expected benefits that could be achieved once barriers are overcome and changes successfully implemented. The benefits suggested by stakeholders can go beyond the improvements in the performance measures, to even consider benefits gained from the actions supporting change. Listing the benefits provides a purpose for the changes and ends on a positive note where stakeholders should feel the benefits are attainable and realistic.

The agreed action items for change are transferred into the action trail form of the Implementation Tool 3 (Action and Communication Plan) to develop the action trail that will support the change. The facilitator should encourage stakeholders to consider the following, while the form is completed simultaneously by the Recorder or another member of the modelling team:

- the sub-actions and communication tasks which may need to be carried out,
- the person who will be responsible for those tasks,
- anyone or group of people that need to be communicated to,
- the expected time the action tasks will be completed

Further instructions as to how to complete the form is provided in the Manual for Implementation Tool 3.

7.5 Reflections on PartiSim stage 6

Workshop 4 provides a way to support the stakeholders to organize initial planning, to appoint responsibility for tasks and to set deadlines for the changes to happen in their system. The key aim is to generate the necessary support leading to the changes that are more likely to be carried out if there is general understanding on the next steps required.

Finally the workshop ends with a summary of what was accomplished in the meeting and any learning that may have been pointed out by the stakeholders. Stakeholders are asked to inform the modelling team on the progress with the implementation of the changes discussed.

8 Further thoughts

The modelling process and the way in which a workshop is facilitated can contribute to the success or failure of implementation (Mingers and Rosenhead, 2004; Vennix, 1996). As facilitation and the workshop environment are key ingredients of the PartSim approach we will conclude the user guide with some advice that we found useful from the literature as well as some of our own experience.

- The facilitator should not project their own opinions (Mingers and Rosenhead, 2004) but simply be there to guide the conversation and ensure that all participants are able to contribute.
- The facilitator should be sensitive to the mood, power and politics as well as individuals personalities (Vennix, 1996). The facilitator should also be flexible to the needs of the study.
- The facilitator should keep conversations on track and be confident to politely end (park) discussions that are not directly relevant to the purpose at hand (Mingers and Rosenhead, 2004). A flipchart can be used to record conversations that may be picked up at a later date by the stakeholder team (parking lot).
- The facilitator should be friendly so that stakeholders feel relaxed (Mingers and Rosenhead, 2004). The facilitator and the modelling team should make an effort to build a good rapport with all the stakeholders.
- The workshop environment should be comfortable with the chairs positioned so that the stakeholders can see each other and engage in discussions (Mingers and Rosenhead, 2004). A U shape or horseshoe has been suggested by Andersen and Richardson (1997).
- Ideally the venue of the workshop should be away from the stressful workplace (Mingers and Rosenhead, 2004).
- The facilitator should keep things ‘fresh’ by using different methods and techniques as groups get demotivated if they find the process repetitive (Vennix, 1996).
- The facilitator should ensure that stakeholders have access to refreshments and comfort breaks.
- The facilitator should position health care stakeholders that are on call nearer to the door as they are likely to receive calls from junior staff.
- A schedule of the sessions planned for the day should be set up in advance and agreed with the project champion. Preferably a public and a detailed team agenda should be prepared. The detailed agenda should include smaller tasks that can be completed in small time slots (i.e. 15 minutes), in order to keep the group alert and focused (Andersen and Richardson 1997). This can be also distributed to the stakeholders so that they have a clear understanding of the objectives of the Workshop.

This edition of the PartiSim user guide and toolsets offers our first attempt at putting forward a practical guide to the approach but over time we expect that your feedback and further experiences may lead to alterations.

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PartiSim Facilitator Toolset for Stage 1

Study Initiation

Activities	Associated Tools, Scripts and Manuals
1 Understand situation of interest	**Manual for Study Initiation Tool 1**
2 Identify stakeholders and roles	**Study Initiation Tool 1**
3 Collect reading materials	**Study Initiation Script 1:** Bank of questions

Manual for Initiate Study Tool 1

This manual provides advice, mainly directed to the modeller, about the Initiation stage of the PartiSim study and guidelines as to how to use the Study Initiation Tool 1. Hence, this manual is divided into two sections:

- Overview of simulation modelling in healthcare studies, which is aimed at helping the modeller to establish whether simulation would be appropriate for the problem situation at hand.
- Explanation of the Study Initiation Tool 1.

1 Overview of simulation modelling and its use in health care

Discrete-event simulation (DES) modelling has been extensively used in health care. Simulation models can be used to reconfigure existing systems, by improving system performance or design, or to plan new systems, without experimenting with the existing system. Discrete-event simulation is a modelling approach developed in operational research that can help health care practitioners, administrators and managers in decision making. Simulation modelling involves the development of a simplified imitation of a real world (care) system, visually representing its processes and how they progress through time in a computer model. While the development of simulation models on the computer is a technical aspect that requires the knowledge of a simulation model, simulation models can be then used by people with limited experience of modelling to gain a better understanding of the real world system and to improve its performance. A list of the uses of DES modelling in health care is provided below based on Jun et al (1999):

- To assess the efficiency of existing health care delivery systems,
- To ask `what if?' questions,
- To design new systems,
- To forecast the impact of changes in patient flows,
- To examine resource needs (staffing or physical capacity),
- To investigate the complex relationships among the different model variables (for example, patient arrival rates, service rates).

During the study initiation stage, the modelling team may first need to consider the modelling approach(es) most suitable to study to the situation at hand. Even though the PartiSim framework focuses on DES modelling, a number of other modelling approaches should be considered, such as spreadsheet modelling, mathematical programming (including linear programming, dynamic programming, genetic algorithms, etc.), forecasting, queuing theory, statistical analysis, system dynamics, the balanced scorecard, etc. As a guide, in order to decide which modelling approach to use for the study, the modeller should carefully consider the main issues/problems in the care system, stakeholder expectations, resource and time availability for the study. As a rule of thumb, DES modelling is usually used to model systems that involve queues, where entities, in the form of patients, physical items or information are processed through a series of stages and queues are formed between each stage if there is insufficient processing capacity. To explain the reasons for choosing simulation modelling as a decision making tool, some of the benefits associated with it are described:

- Most health care systems are subject to variability, complexity and interconnectedness. Variability can be either predictable (change of the number of bed capacity in a ward to deal with increased patient levels) or unpredictable (the arrival rate of patients in a hospital Accident & Emergency (A&E) department). Interconnectedness occurs when a component of the system affects or is affected by another part of the system. For example, the processing time of the X-ray department affects patients' assessment time by a doctor in an A&E department. Complexity on the other hand, is distinguished in two types: combinatorial (the interconnections between different parts of the system to determine patient/services routing system) and dynamic (the interaction of various components in the system affecting either positively or negatively other parts of the system) complexity. Predicting the performance of highly variable, complex and interconnected systems is difficult using most of the other mentioned modelling approaches, whereas simulation models are specifically considered suitable to represent this kind of systems.
- Simulation models can assist managers, administrators, healthcare practitioners, who may have little knowledge of simulation modelling, to gain an understanding of the problem, which is transparently presented using animated displays of the system. Compared to mathematical equations and large spreadsheets, simulation models are preferable and can furthermore instil confidence in the model.
- Simulation models require few assumptions compared to

other modelling approaches, which may allow the use of limited distributions, data formats, inter-acting effects, etc.

For a more detailed overview of simulation modelling and its suitability, the user is referred to Robinson (2004 , Chapter 1).

Next, some guidelines to assist with the choice of suitable workshop participants and assigning appropriate PartiSim roles are provided in table 1. These guidelines are not exhaustive and provide some generic descriptions of the different roles and personal traits that would ideally suit to each PartiSim role.

2 Explanation of Study Initiation Tool 1

In this section advice as to how to complete the forms in the Study Initiation Tool 1 is provided. Each section of the tool is separately explained, according to the structure of the tool.

2.1 Contact details

The contact details of the project participants are captured in section 1 of the tool. The suggested maximum number of participants in a PartiSim study is 12 and hence the form includes an equivalent number of rows. For each participant an ID (A), name (B), job title and job category(C), contact details (D) and a specific PartiSim role (key stakeholder, project champion, workshop participant or analyst [E]) can be also assigned (Figure 1).

Figure 1: Screenshot of contact details - section 1 in tool.

ID	Name	Job title	Contact details	Role
A	B	*Job category:* Select job category … *Comments:* Enter comments C	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐ E

Table 1: Roles, descriptions and personal traits

Role	Description of role	Personal traits
✓ **Project champion**	▪ The project champion will work as a liaison between the stakeholders and the analysts and will organize the participants of the workshops. ▪ The project champion, together with the key stakeholder(s), will have knowledge of the situation of interest.	▪ Energetic and enthusiastic. ▪ Willing to devote time to the project. ▪ Carries authority and influence within the organisation. ▪ Good communication and inter-personal skills as this role will require effective communication with the stakeholders and the analysts.
✓ **Key Stakeholder**	▪ The key stakeholder will oversee the running of the project and make sure that the project is meeting its targets.	▪ Vision for improvement. ▪ Leadership qualities and well respected by colleagues in the settings where the simulation study is intended to take place.
✓ **Workshop Participants**	▪ The workshop participants will have a combined understanding of different parts of the system of interest. ▪ The workshop participant will ideally take part in all the workshops.	▪ Able to acknowledge the possibility that things could be done better and more efficiently.
✓ **Modeller**	▪ Develops simulation models and the aspects related to coding the model on the computer, but does not focus on the group processes. The modeller attends the workshops, listens to the discussions and aspects considered, keeps relevant notes, creates his own models and reflects back to the team, when required.	▪ Analytical skills ▪ Knowledge of different simulation modelling approaches and software. ▪ Communication skills
✓ **Facilitator**	▪ A person with facilitating skills capable of driving the knowledge elicitation process in a workshop	▪ Enthusiastic, motivated, good social interaction and communication skills.

2.2 Context

The context to the situation of interest is broken down into: the problem situation (A) and potential improvements/changes (B). Optionally the source of information can be recorded in the second column (C).

Figure 2: Screenshot of context of situation of interest – section 2 of tool.

Situation of Interest	
Problem situation **A**	Source **C**
Preliminary problem situation 1	Source 1
…….	……
Preliminary problem situation (Summary)	Source 4
Potential improvements/change **B**	
Change 1	Source 1
…..	Source 2

2.3 List of reading materials

Information pertaining to reading materials is captured in this section of the Study Initiation Tool 1. The name or title of the material is entered in (A), the material is assigned a type (B), the name of the person suggesting the material is recorded along with the PartiSim role she/ he belongs to (C), and finally the participants who would benefit from reading the material are indicated (D). A screenshot of this section is provided in Figure 3.

Figure 3: Recording of reading materials – section 3 of tool SI-1.

Material	Material type	Material Suggested by	Material to be read by
A	Material type … B	*Suggested by…* *(Please enter the name and role of the person suggesting the material):* *Name* Role … C	☐ *Key stakeholders* ☐ *Project champions* ☐ *Workshop participants* ☐ *Analysts* ☐ *Others (please specify below)* D

2.4 Observations

Recording observations about the situation of interest are added in section 4 of the tool (Figure 4). Undertaking this activity is an optional task because time may not permit or it may not be possible. However, if on-site observations are made then it should be limited in number. For each observation a narrative should be written (A), such that any project participant will get a sufficient overview of the observations made. The person who made the observation is also indicated along with his/her assigned PartiSim role (B). Furthermore, the date, place and the duration of the observation is recorded together with any comments (C).

Figure 4: Recordings of on-site observations

Observation		
A		
Person(s) involved in observing the situation of interest		
☐ *Key stakeholders*	☐ *Project champions*	☐ *Workshop participants*
☐ *Analysts*	☐ *Others*	*Name*
Date when observation was made (DD-MM-YYYY)		
Place where the observation was made		
Duration of the observation		
Comments		

References

Jun JB, Jacobson SH and Swisher JR. Application of discrete-event simulation in health care clinics: A survey. Journal of the Operational Research Society 1999;50:109-123.

Robinson S. Simulation: The Practice of Model Development and Use. John Wiley & Sons: Chichester; 2004.

Study Initiation Tool 1

This tool consists of a form which can be used to capture the relevant information about the system of interest at the initiation stage of the PartiSim Study. The form consists of four parts: contact details, context, list of reading materials and observations.

1. Contact details

Please use the form below to enter the contact details of project members, including key stakeholders, project champion, workshop participants, with whom the modelling team may have come in contact with. The name of the analyst involved can be also entered.

Tips:

✓ The maximum number of participants in a workshop should be around 12.

✓ For each participant enter a two or three letter abbreviation. Please make sure that the abbreviation is unique.

✓ Please enter the name, job title, contact details and the role for each participant.

✓ This list may be updated during the course of the project.

ID	Name	Job title	Contact details	Role
		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐
		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐

		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐
		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐
		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐
		Job category: Select job category … *Comments:* Enter comments	*Address:* *Tel:* *Fax:* *Email:* *Web:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐
		Job category: Select job category … *Comments:*	*Address:* *Tel:* *Fax:*	*Role within project:* Select role … To participate in workshops? (*tick if applicable)* ☐

2. Context

In the table below, please describe the situation of interest as discussed with various stakeholders. Recording the source, either name or role is considered useful.

Situation of Interest	
Problem situation	Source
Preliminary problem situation 1	Source 1
Preliminary problem situation 2	Source 2
Preliminary problem situation 3	Source 3
Preliminary problem situation (Summary)	Source 4
Potential improvements/change	
Change 1	Source 1
Change 2	Source 2
Change 3	Source 3
Change 4	Source 4

3. List of reading materials

✓ Please enter the name of the material (for example, title of a paper, web resource, book name, etc.), the material type (for example, journals, NICE guidelines, etc.), the name of the person suggesting the material and the key groups of people who could benefit from reading it.

Material	Material type	Material Suggested by	Material to be read by
	Material type …	*Suggested by… (Please enter the name and role of the person suggesting the material):* *Name* Role …	☐ *Key stakeholders* ☐ *Project champions* ☐ *Workshop participants* ☐ *Analysts* ☐ *Others (please specify below)*
	Material type …	*Suggested by… (Please enter the name and role of the person suggesting the material):* *Name* Role …	☐ *Key stakeholders* ☐ *Project champions* ☐ *Workshop participants* ☐ *Analysts* ☐ *Others (please specify below)*
	Material type …	*Suggested by… (Please enter the name and role of the person suggesting the material):* *Name* Role …	☐ *Key stakeholders* ☐ *Project champions* ☐ *Workshop participants* ☐ *Analysts* ☐ *Others (please specify below)*

4. Observations

Please record relevant information that might have been recorded as part of site observations. In the form below, indicate the name of who has made the observations, date, place and duration.

✓ On-site observations are an optional activity that could be undertaken.

Observation		
Person(s) involved in observing the situation of interest		
☐ *Key stakeholders*	☐ *Project champions*	☐ *Workshop participants*
☐ *Analysts*	☐ *Others*	*Name:*
Date when observation was made (DD-MM-YYYY)		
Place where the observation was made		
Duration of the observation		
Comments		

Study Initiation Script: Bank of questions

The Study Initiation Script provides a bank of questions for preliminary understanding of the situation of interest.

Three are the main topics that need to be covered in the preliminary conversations with the stakeholders:

- The problem situation
- Views about what can be improved/changed
- Roles of people in the system

Specific questions for each area are outlined below:

Aspects to understand	A sample of potential questions
Problem situation	What is the purpose of the current system? How many types of services are provided? Are there any specific targets that need to be reached? In a normal day, what is the progression of activities followed? Are there any bottlenecks? What do you think is the cause? Is everyone happy with the service provided?
Improvement	Is there room for improvement? What do you think could potentially improve the situation? Has a change been implemented in the past? What results did it have?
Identify roles of people in the system	Who does the system serve? Who is involved in the provision of service? Who is affected? Who makes decisions? Who would object change? Can you identify any people who would not be happy with this change?

PartiSim Facilitator Toolset for Stage 2

Define the System

Activities	Associated Tools, Scripts and Manuals
1 Problem Statement	**Refer to User Guide**
2. Define the System of Interest	**Manual for Conceptual Modelling Tool 1** **Conceptual Modelling Tool 1** **Example 1:** CATWOE and Root Definition
3. Design a Care System Model	**Manual for Conceptual Modelling Tool 2** **Conceptual Modelling Tool 2** **Example 2:** A complete Care System Model

Manual for Conceptual Modelling
Tool 1: Define the System of Interest

This manual accompanies the Conceptual Modelling Tool 1. The tool consists of two parts: 1) The CATWOE and 2) The root definition. Hence the advice provided here follows the same order.

Please note that during the process of developing these tools, debate and discussion occurs, which is essential for the successful completion of the session. Hence, this needs to be carefully managed by the workshop facilitator.

1. The CATWOE

In the first part of the tool, the CATWOE elements are captured in a table which can be completed in two steps:

- First, enter possible examples of each CATWOE element in the second column of the table. This can be undertaken as part of a brainstorming session with the stakeholders.

The order of completing the table is not important, however a good starting point to initiate the discussion in Workshop 1 is to consider the core purpose of the care system of interest. This coincides with the definition of the transformation process carried out in the system, the T component in the CATWOE.

Facilitators should encourage participants to come up with a range of ideas and then narrow these down to the most suitable ones.

- Next, in the corresponding cell in the third column of the table write a definition that represents each CATWOE element.

For help with generating each CATWOE element, some tips and ideas about what to think about are provided below:

C: Customers – the victims or beneficiaries that the system of interest serves.

In a healthcare study customers are normally the patients served by the particular healthcare organization or unit under study.

A: Actors – those who carry out the transformation process.

Normally this element will include a variety of staff employed by the healthcare organization or unit (healthcare practitioners, managers, etc.) directly or indirectly involved in the provision of services.

T: Transformation process – the core activity provided by the system that is represented in the form of the conversion of an input into a specific output.

Normally this refers to the patient care service provided to patients, by undertaking a range of activities. These activities depend always on the care system under study, but they normally involve clinical, managerial and research activities.

W: Weltanschauung – the worldview taken which makes the transformation process meaningful in context.

Normally this will include the established organisational belief that the activities taken by the care service ensure an efficient, effective and efficacious delivery of service to the Customers.

O: Owners – those who could stop the transformation.

These are normally the key stakeholders or health authorities at any level.

E: Environmental constraints – elements outside the system that are taken as given.

This normally consists of the available resources (financial, human, knowledge, technological advances, etc.), but also government or organisational targets.

Tips for identifying the CATWOE elements:

- Be creative
- Be specific, for example when defining the customers, identify the geographic area they are based in.
- Discussion and disagreement to the ideas expressed are welcome.

2. Root definition

The next session aims to develop a root definition. This can be assembled by referring to the CATWOE elements already identified, in the form of do X by using Y to achieve Z. The root definition provides a representation of the activity undertaken in the care system which can be loosely compared to a company's mission statement.

In the second part of the tool, a guiding sentence is provided, which the users or facilitator can use to start of with the definition. This can be further enriched with further information based on the group discussions.

To see an example of a CATWOE and how this is converted into a root definition, refer to Example 1 in the Define the System toolset.

Conceptual Modelling Tool 1

This tool has two parts. In the first part, the CATWOE elements are identified and in the second part the root definition is assembled based on the first part. These are assembled in consensus with the stakeholders as part of a facilitated workshop.

1. CATWOE

i. In the table opposite please list possible examples that represent the corresponding element in the first column of the table.

ii. Then using the names listed for each element, provide a corresponding definition in the third column.

Figure 1: Screenshot of contact details – section 1 in tool.

CATWOE elements	Example list	Definitions
Customers	*List examples of care system customers* – Click here to enter text. – Click here to enter text. – Click here to enter text.	*Define the element Customers here*
Actors	*List examples of Actors in the care system* – – –	*Define the element Actors here*
Transformation process	*List the key inputs which are transformed to a specific output from care system activity* Inputs: – – – / Outputs: – – –	*Out of the key inputs and outputs identify one pair (transformation) that would represent the key activity that is deemed to need improvement. Note: whatever goes through a transformation must come out in a transformed from.*
Weltanschauung (World view)	*Please list the key values that express the care system concerned* – – –	*Identify one value that makes the transformation process defined above meaningful and give a definition of the world view taken.* Click here to enter text.
Owners	*List the people or groups who could stop the transformation process defined above* – Click here to enter text. – Click here to enter text. – Click here to enter text.	*Define the element Owners here*
Environmental constraints	*List some of the care system constraints:* – Click here to enter text. – Click here to enter text. – Click here to enter text.	*Define the element Envirnomental Constraints here*

2. Root definition

Referring to the definitions of the CATOWE elements in the previous section of this tool and using as a guide the sentence below, define the root definition of the care system studied.

A system owned by ... the Owners ... operated by ... Actors ... undertaking ... Transformation Process ... that support the care system concerned by a set of clinical, managerial and research activities in order to achieve the Worldview held whilst recognising Environmental Constraints of ....

Example 1: CATWOE and root definition for a bariatric care system

CATWOE

Customers: People with morbid obesity in the specified geographic area in the UK.

Actors: Various healthcare professionals specialising in the treatment of morbid obesity at the hospitals concerned.

Transformation: The provision of treatment to obese people is met, by designing and operating a care system that consists of clinical, managerial, and research activities.

Weltanschauung (World view): A belief that designing and operating a system of clinical, managerial, and research activities for providing care to morbidly obese people and for creating a framework for research is important in providing effective care for people with obesity.

Owners: The trust board at the London-based hospital and the Specialised Commissioning Group.

Environment: Funding for resources, changes in government targets, current public healthy living initiatives (e.g. eating five portions of fruits and vegetable a day, cycling to work), research-based therapy and technological changes.

Root Definition

A system owned by the trust board of a London-based hospital and the Specialised Commissioning Group operated by various healthcare professionals at a London-based hospital specialising in the treatment of obesity that support the bariatric care pathway in their jurisdiction by designing a system of clinical, managerial, and research activities in order to provide effective care for people with obesity whilst recognizing the constraints of funding for resources, changes in government targets, current public healthy living initiatives, research-based therapy and technological changes.

Manual for Conceptual Modelling Tool 2

This manual accompanies the Conceptual Modelling Tool 2, which captures information for the development of a care system model (CSM). The tool is divided into four parts, corresponding to each category of activities, plus one other category, if none of the previous categories is suitable for the activities identified. The three generic categories of activities are: the clinical, managerial and research activities. The CSM should at least include two of the three categories of activities. Obviously users can include other categories, depending on the system of interest. However, it is recommended that a sensible check is first made to ensure that these additional activities cannot be included in any of the three generic categories already provided. A brief explanation of the three categories of activities is provided in each tool. However, the facilitator should describe these in terms of the system concerned.

In this manual, some recommended steps to be followed during the process of developing a CSM diagram in a facilitated workshop environment are provided:

a. First, the facilitator invites participants to consider what three types of activities are undertaken in the care system concerned. (It is recommended that these are written and displayed in front of the participants/ stakeholders, while being discussed.)

Checkpoint: Are clinical, managerial or research activities mentioned among others? If the answer is NO go to step b, if it is YES go to step c.

b. In this case the brainstorming session should continue further with the aim to identifying the specific activities involved in the care system concerned.

✓ The activities discussed can then be grouped into categories. This can be done interactively with the participants' input, or in groups (participants are divided into 2-3 groups and asked to categorise the activities mentioned into 3 sensible groupings and to name them).

✓ The final categories of activities are displayed and a debate may follow.

✓ Proceed with step c.

c. In the next session the team continues with identifying the respective activities in each group of activities using the corresponding forms in Conceptual Modelling Tool 2:

✓ Clinical activities (form A)

✓ Managerial activities (form B)

✓ Research activities (form C)

✓ Other activities (form D), please name according to the category decided.

Tips for completing the activity forms:

* One can follow different ways to complete the forms with the activities involved. We recommend here one possible way:

- Brainstorming session to identify the activities corresponding to the category of activities. The facilitator or recorder may write the activities suggested on the board or on flipcharts.

- These are then set in a logical order (numbering or redrawing).

- Then the forms are populated to form a diagram. (Please note that when populating the forms in this tool, the activities already listed may need to change to match the format required.)

* Be creative when completing the diagrams.

* Do not get discouraged if changes are suggested. Go with the flow.

d. The three separate diagrams developed are next compiled into one diagram and inter-connections between activities are made. (For an example of a CSM diagram refer to Example – A complete CSM diagram).

e. The overall CSM diagram developed is then considered looking for participant consensus.

Conceptual Modelling Tool 2: The Care System Model

This tool can be used to support the process of developing diagrams for each part of the care system model (CSM). The user is advised to develop each part separately using the guides provided and then to assemble them all in a final CSM.

The activities identified represent the activities necessary to carry out the transformation process, including obtaining the input, transforming it and disposing it. A usual practice is to use verbs in the imperative. Some useful verbs that can be used in a CSM are:

- Identify
- Organise
- Appreciate
- Compare
- Provide
- Update
- Know
- Reach agreement
- Procure
- Select
- Obtain
- Determine
- Build
- etc

The forms that follow can be used in any order.

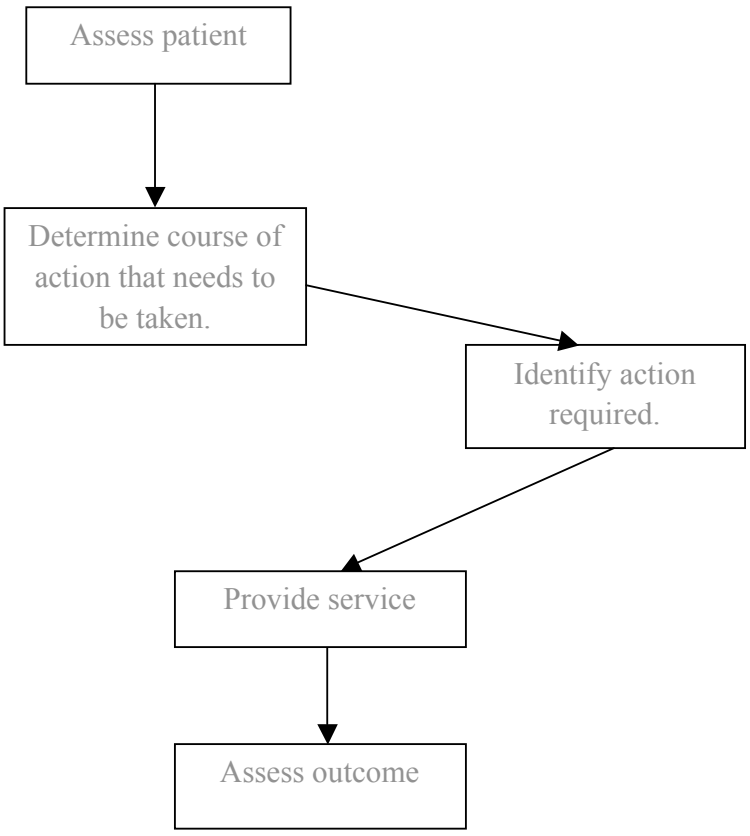
A. Clinical activities diagram

The clinical activities are concerned with the activities involved in the care system at operational level. These are a more concrete representation of the processes occurring in the care system of interest, considering the flow of services or patients in the system.

- ✓ Consider in a logical order the clinical activities involved in the provision of care in the system of interest. Think in terms of the flow or services or patients in the system.
- ✓ In the form below enter in each box the activity that best describes the description provided.
- ✓ If needed add further boxes, by copy and pasting the specific activity box.
- ✓ Make sure to consider the logical dependencies involved. If it helps number the boxes, starting from the activities that occur first to the last activity.

For illustration purposes refer to Example 2 (in the Define the System toolset), where a complete diagram of the Care System Model is provided.

Form A: Clinical Activities diagram

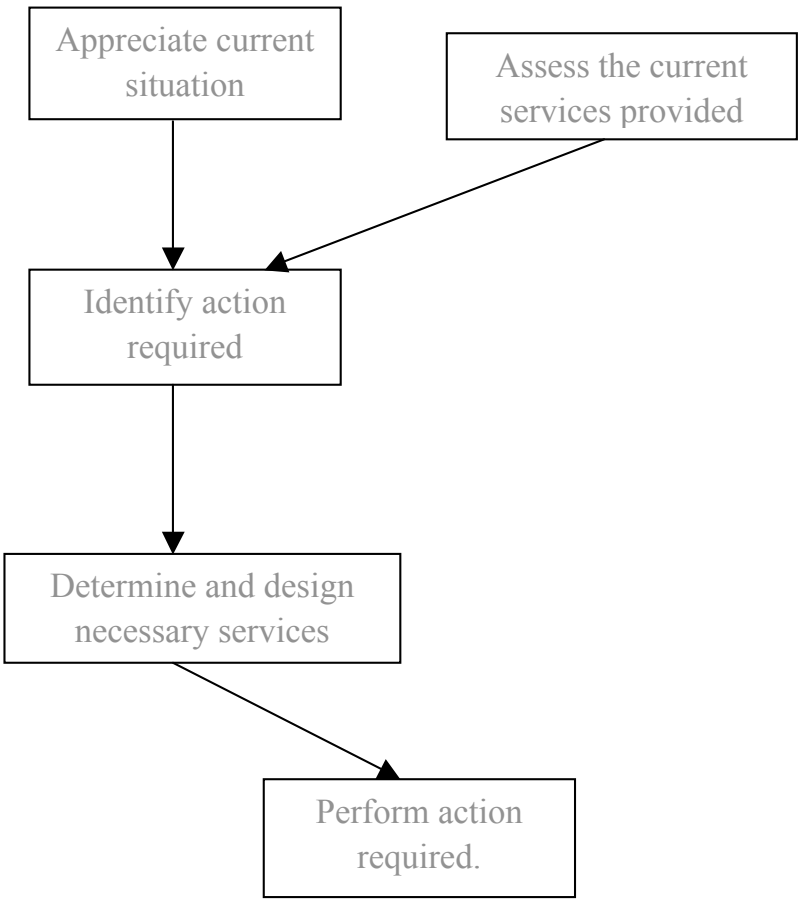


B. Managerial activities diagram

The managerial activities consist of the strategic activities required to design the care system.

- ✓ In a logical order consider the activities required to maintain and design the clinical activities listed in part A of the current tool.
- ✓ In the form below enter in each box the activity that best describes the description provided.
- ✓ If needed add further boxes, by copy and pasting one of the activity boxes.
- ✓ Make sure to consider the logical dependencies involved. If it helps number the boxes, starting from the activities that occur first to the last activity.

Form B: Managerial Activities diagram



C. Research activities diagram

The research activities include the activities that support the development of clinical research activities in the system studied.

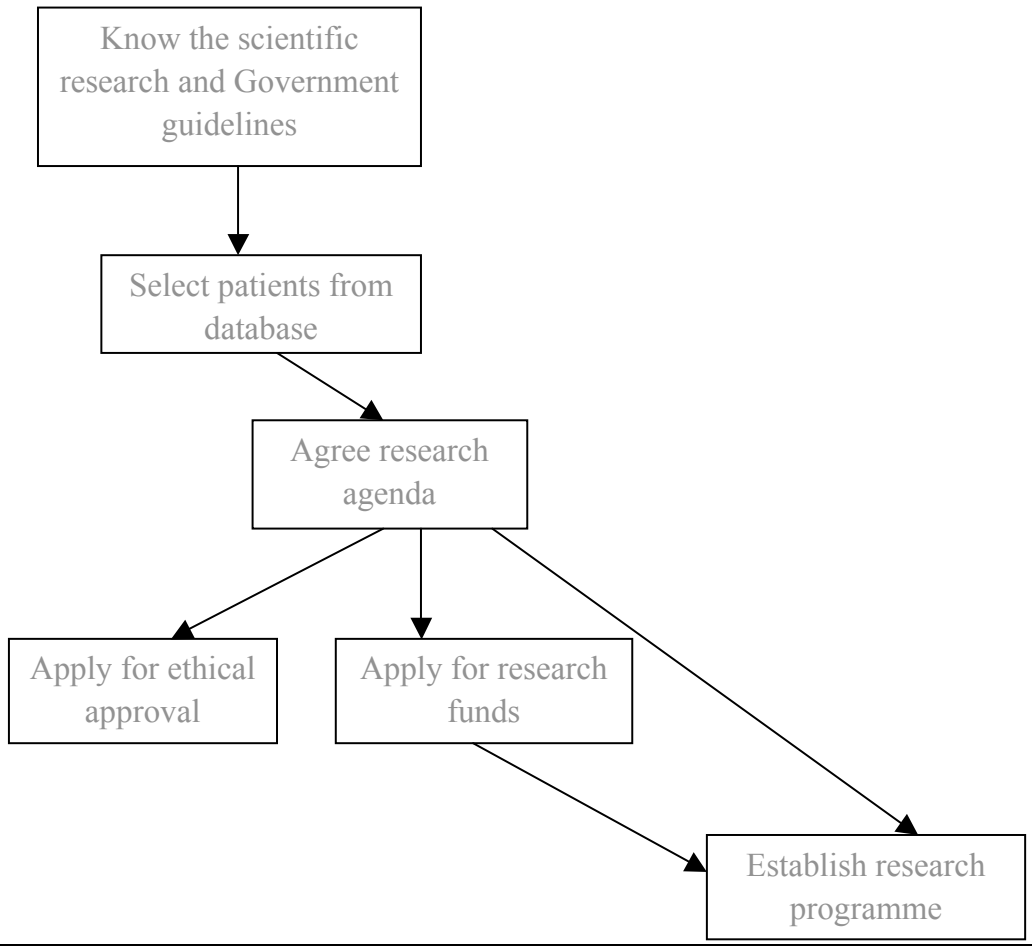
✓ Consider the research activities that enable a high level of expertise in the care provided through the clinical activities.

✓ In the form below enter in each box the activity that best describes the description provided.

✓ If needed add further boxes, by copy and then pasting the specific box in the table.

✓ Make sure to consider the logical dependencies involved. If it helps number the boxes, starting from the activities that occur first to the last activity.

Form C: Research Activities diagram

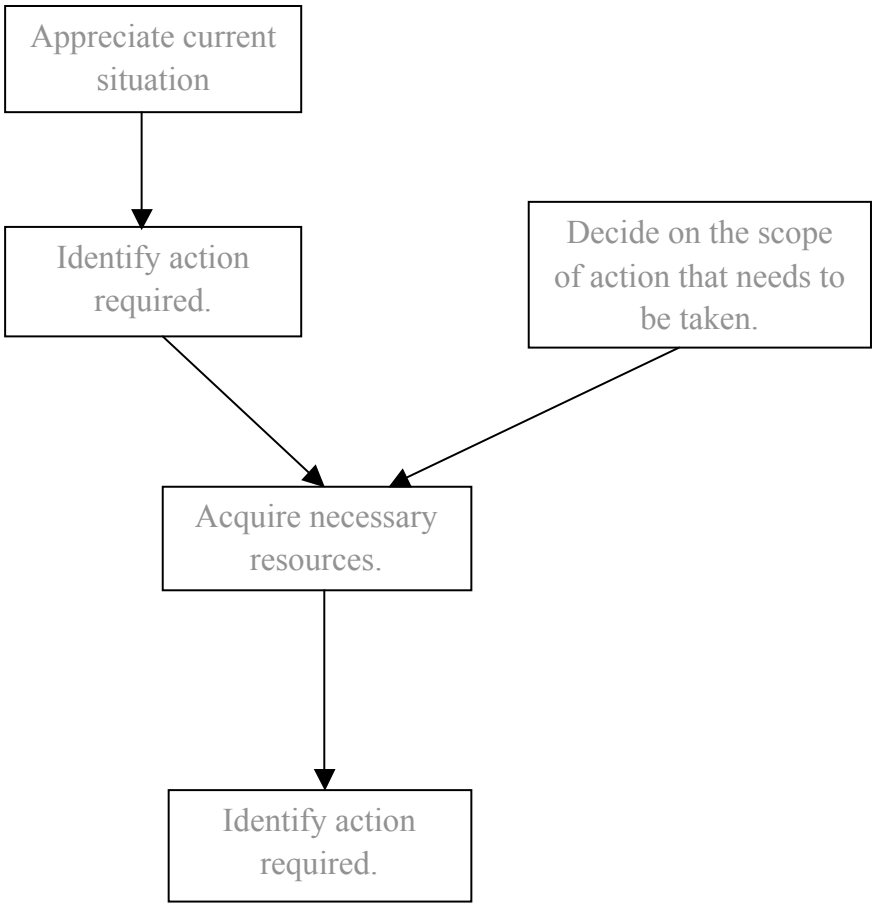


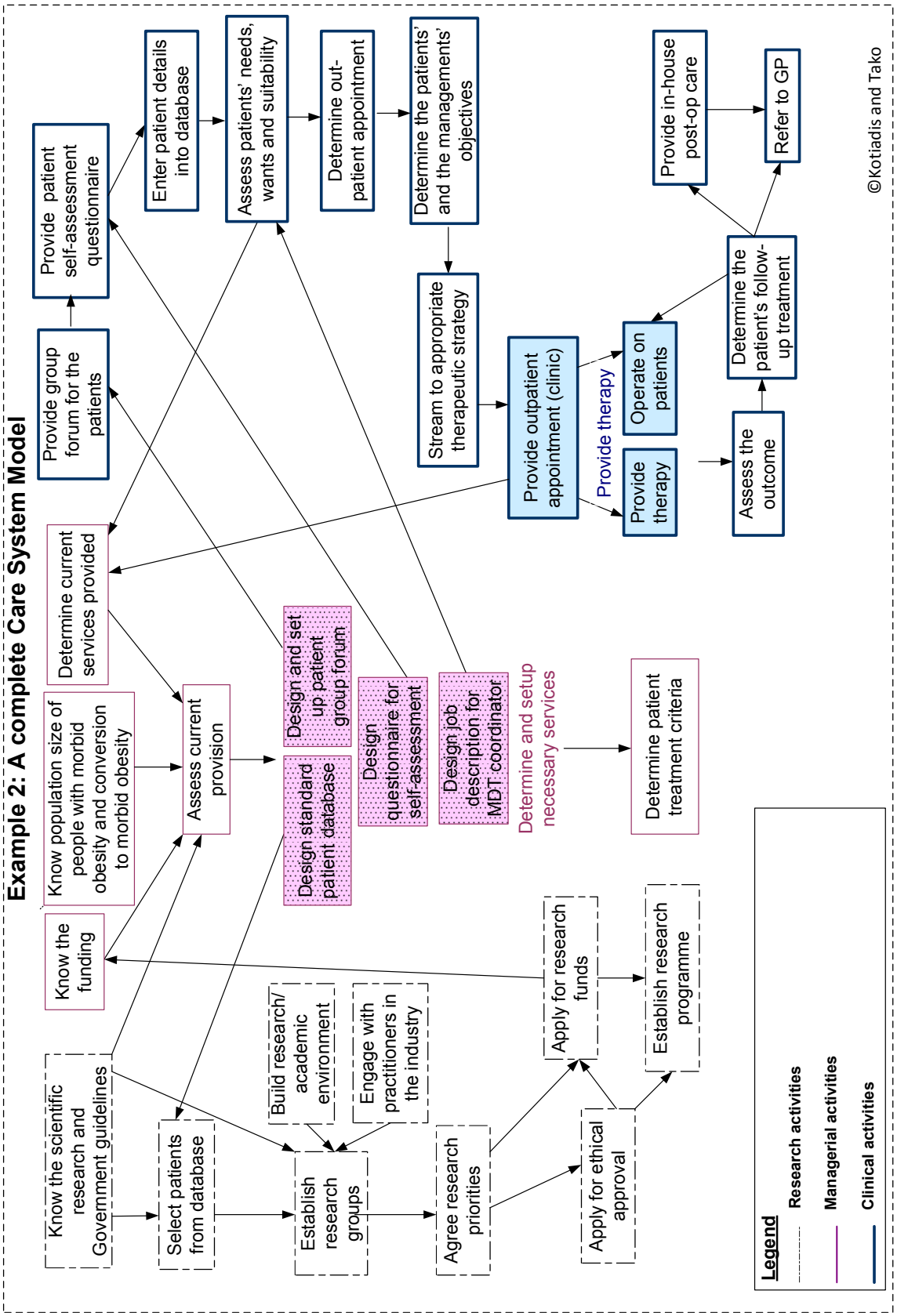
D. Other category of activities (optional)

In this category, the user can identify a group of activities which might have not been covered in the previous 3 sections (A, B and C).

- ✓ It is recommended that before populating this diagram a name/title should be given to this group of activities.
- ✓ Consider in a logical order the activities involved in the category chosen.
- ✓ In the form below enter in each box the activity that best describes the description provided.
- ✓ If needed add further boxes, by copy and then pasting the specific box in the table.
- ✓ Make sure to consider the logical dependencies involved. If it helps number the boxes, starting from the activities that occur first to the last activity.

Form D: Please add a name here




Example 2: A complete Care System Model
Provide patient self-assessment questionnaire
Enter patient details into database
Assess patients' needs, wants and suitability
Determine out-patient appointment
Determine the patients' and the managements' objectives
Provide group forum for the patients
Stream to appropriate therapeutic strategy
Provide outpatient appointment (clinic)
Provide therapy
Operate on patients
Provide therapy
Determine the patient's follow-up treatment
Provide in-house post-op care
Refer to GP
Assess the outcome
Determine current services provided
Know population size of people with morbid obesity and conversion to morbid obesity
Assess current provision
Design and set up patient group forum
Design standard patient database
Design questionnaire for self-assessment
Design job description for MDT coordinator
Determine and setup necessary services
Determine patient treatment criteria
Know the funding
Know the scientific research and Government guidelines
Select patients from database
Establish research groups
Build research/ academic environment
Engage with practitioners in the industry
Agree research priorities
Apply for research funds
Apply for ethical approval
Establish research programme
Legend
Research activities
Managerial activities
Clinical activities
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PartiSim Facilitator Toolset for Stage 3

Specify Conceptual Model

Sessions	Associated Tools, Scripts and Manuals
1 Brainstorming Objectives	• Example 1: Write study objectives
2 The Perfomance Measurement Model	• Manual for Conceptual Modelling Tool 3 • Handout Form for Conceptual Modelling Tool 3 • Conceptual Modelling Tool 3
3 Extracting Simulation Study Objectives	• Manual for Conceptual Modelling Tool 4 • Example 2: Final PMM diagram • Conceptual Modelling Tool 4
4 Develop a Communicative Model	• Manual for Conceptual Modelling Tool 5 • Example 3: From CSM to PFD • Conceptual Modelling Tool 5

Example 1: Write study objectives

Please complete the form and return to facilitator

Name: _____

By the end of this study what do you hope to achieve?

Please attempt to write the study objectives that you think the study should explore. Try to follow the format provided, but you can deviate from this format if you feel you need to.

Example:

Purpose: We want to increase the number of patients seen in the Surgical clinic

Target performance: by 20%

Change: by increasing the number of clinics run

Constraints: ranging between 8 and 20 clinics per week

Objective 1:

Objective 2:

Objective 3:

Manual for Conceptual Modelling Tool 3

This manual should be used by the facilitator to familiarise him/herself with the process of developing a Performance Measurement Model (PMM), as part of a facilitated session. The generic structure of a PMM is represented in the Conceptual Modelling Tool 3.

In this manual you will read about the following:

- An introduction to the Performance Measurement Model (PMM)
- An explanation of the performance criteria also known as the three Es
- Advice on using the tool Conceptual Modelling Tool 3.

1. Introduction to the Performance Measurement Model

The PMM consists of a series of monitoring activities and the resulting actions used for the evaluation of the performance of the care system. The following underpin the development of the PMM:

- Performance criteria (3 Es),
- Monitoring activities,
- "Determine if" activities – these identify if action is needed
- Take action activities.

These are represented by squares connected with one-directional arrows in a logical order.

2. The performance criteria (3Es) explained

The key concepts driving the PMM are the three performance criteria, each starting by E and hence called the 3Es. Further performance criteria can be considered and defined if necessary. These performance criteria are useful especially in the process of identifying the activities required for the evaluation of the care system's performance. A brief explanation of each one follows:

Efficacy	Ensure that the system provides the intended care.
Efficiency	Ensure that the system works efficiently, provides the best possible care, using the minimum resources.
Effectiveness	Ensure that the overall system provides a seamless patient journey.

3. Advice on using Conceptual Modelling Tool 3

Step 1: Defining the performance criteria

In this activity, stakeholders are initially asked to define the performance criteria in relation to the system of interest. The facilitator should provide generic definitions of the performance criteria. The CSM model is also concurrently considered as it represents the system of interest. In the meanwhile, a second facilitator lists the definitions of the performance criteria on the left hand-side of a flipchart, visible to everyone (Column 1, Table 1).

Step 2: Identifying monitoring and control activities

This activity builds upon the discussion that has taken place during the previous task (step 1). The discussion focuses on identifying the monitoring and control activities. The care system model (CSM) (developed in stage 2 of the PartiSim study) is initially discussed, with the view to identifying what monitoring activities could support the performance criteria defined. For example the participants could be asked: what would you need to monitor to determine if your system is efficient. In this task you are identifying CSM activities that require improvement and how to evaluate these activities. During this session, the facilitator explains how the PMM model works and should give some examples of monitoring activities relevant to each performance criterion. The performance criteria are further broken down into monitoring activities and control activities and then action to be taken is identified. The Performance Criteria Form, which is part of tool 3, can be handed out to the stakeholders to assist their thinking process. Stakeholders are encouraged to independently brainstorm and then invited to suggest answers in the following manner:

First, stakeholders are asked to suggest monitoring activities that they consider important for evaluating the performance of the system (Column 2, Table 1). In this case verbs that represent activities should be identified. The facilitator may ask the following or similar questions:

- What do you need to monitor in order to know to ensure that there is efficacy in the system?
- What do you need to monitor in order to ensure efficiency in the system?
- What do you need to monitor in order to ensure effectiveness in the system?

In the meanwhile, a second facilitator notes down participants' suggestions, in a format visible to all. The monitoring activities involve observing and collecting information, these should normally follow the format "monitor …"

After having identified monitoring activities, the same order follows in order to identify the control activities. The activities identified need to start with: "Determine if…". The question asked is:

- What level (or failure) of performance makes it necessary for action to be taken? (Column 3, Table 1)

Stakeholders suggest their individual answers from their individually completed form (Tool 3).

Next the potential action that can be taken based on the "determine if…" activities is identified. (Column 4, Table 1). These actions need to be in the form of policies or scenarios to be implemented in the care system in order to achieve an improvement. The facilitator may ask the following question:

- What action should/could be taken?

Please note that the actions suggested here will feed the suggested changes/improvement that can be performed in the real system. These will be screened later on in the next stage to identify the objectives of the simulation study.

- Facilitator 2 records the information in a flip chart, visible to all participants.

The different performance measures, activities and actions can be connected with unidirectional arrows.

Table 1 can be used to generate and record the ideas expressed during the session.

Table 1: Breaking down the performance criteria into monitoring and control activities

Performance criteria	Monitoring activities	Control activities	Action to be taken to achieve the performance measures
– Performance criterion 1 – Performance criterion 2 – Performance criterion 3	– Monitor … [attendance] – Monitor … – Monitor … – Monitor … – Monitor … – … – … – …	– Determine if … [sufficient number of patients are treated] – Determine if … – Determine if … – Determine if … – Determine if … – … – …	– Action 1 – Action 2 – Action 3 – … – …

Step 3: Completing the PMM

Based on the information discussed in steps 1 and 2 the performance measurement model (PMM) is next constructed with the active participation of the stakeholders. The structure of the PMM is provided in Conceptual Modelling Tool 3, which could be used in the workshop to give participants a visual representation of the PMM.

Please note that in order to use the electronic version of the tool, the user should double click on the image in order to make necessary changes. (The PMM is developed in Microsoft Visio, which needs to be first installed. To download a free 60-day trial version of Microsoft Visio please go to: http://trial.trymicrosoftoffice.com/trialukireland/product.aspx?re_ms=oo&family=visioprofessional&culture=en-GB)

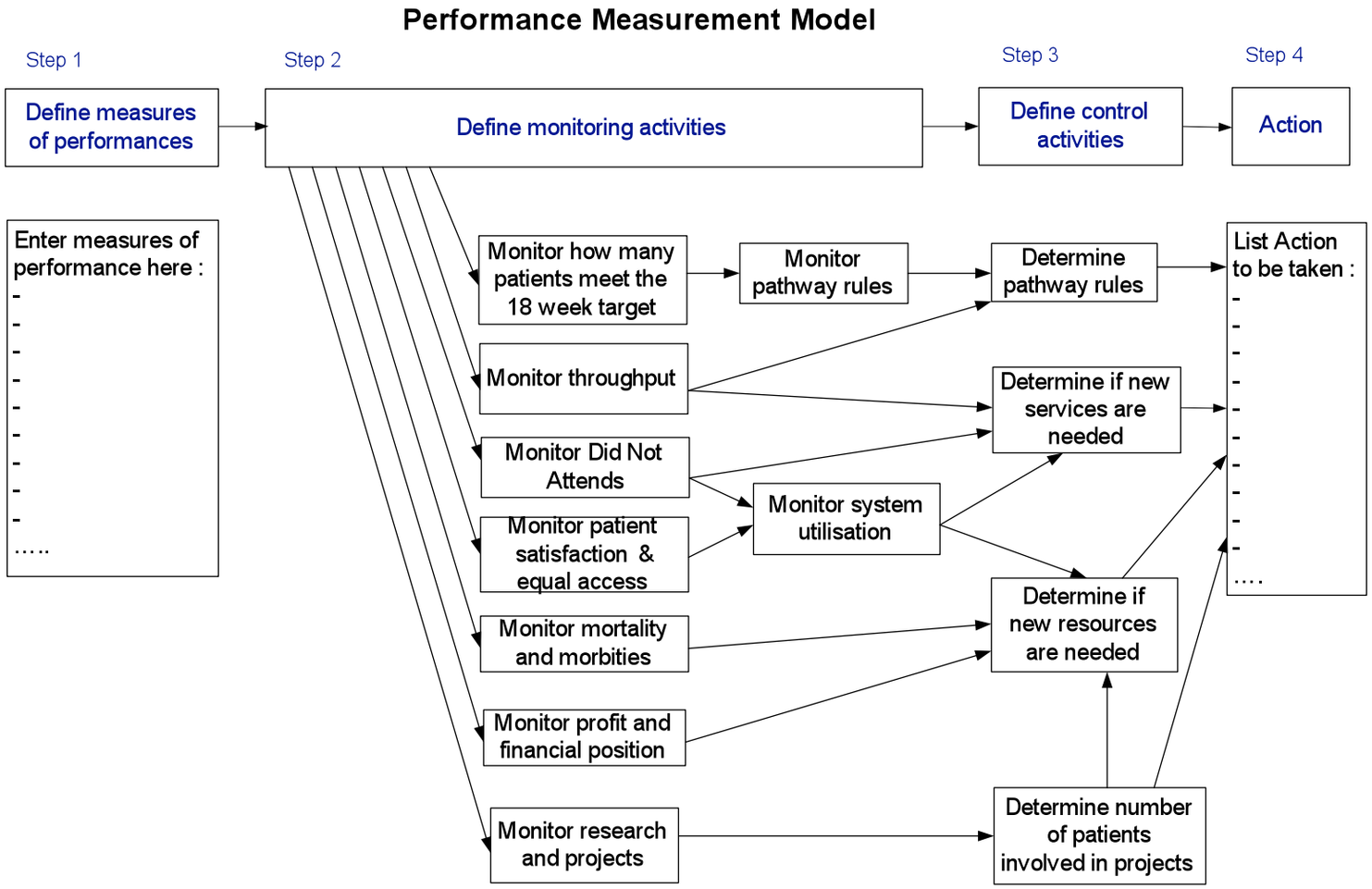
Recommendations as to how to use the sample PMM:

- Users can add further boxes for each group of activities.
- The names given are optional, and should be changed to fit to the situation of interest.
- This diagram can be filled in a facilitated session involving stakeholder participation.
- The handout form for Conceptual Modelling Tool 3 (in the Specify Conceptual Model toolset) can be used as a brainstorming tool to support the development of the PMM.

Handout Form for Conceptual Modelling Tool 3 Please complete the form and return to facilitator			
	Monitoring activities	**Determine if activities**	**Suggested changes**
Efficacy (E1) – What? Ensure that the system provides the intended care.	What do you need to monitor (measure) to know that the system is providing the intended care?	By undertaking each monitoring activity, what would you be able to determine?	Based on each "Determine if" activity, what changes do you think are needed to ensure that the system provides the intended care to obesity patients?
	I would like to monitor:	I would be able to determine if:	I would suggest: ....
Efficiency (E2) – How? Ensure that the system works efficiently, provides the best possible care, using the minimum resources.	What do you need to monitor (measure) to know that the system works efficiently?	By undertaking each monitoring activity, what would you be able to determine?	Based on each "Determine if" activity, what changes do you think are needed to ensure that the system works efficiently?
	I would like to monitor:	I would be able to determine if:	I would suggest: ....
Effectiveness (E3) Why? Ensure that the overall system provides a seamless patient journey.	What do you need to monitor (measure) to know that the system provides a seamless patient journey (the right thing is being done)?	By undertaking each monitoring activity, what would you be able to determine?	Based on each "Determine if" activity, what changes do you think are needed to be made to ensure that the system provides a seamless journey to obesity patients?
	I would like to monitor:	I would be able to determine if:	I would suggest: ....

Conceptual Modelling Tool 3: Performance Measurement Model

This tool represents the structure of a Performance Measurement Model (PMM), which can be used in a facilitated session in Workshop 2.



Manual for Conceptual Modelling Tool 4

This manual provides help with using the Conceptual Modelling Tool 4: Study Objectives, which can be used to guide the process of extracting simulation study objectives and model inputs and outputs. This manual has two parts based on the two key activities undertaken:

- Identify model inputs and outputs
- Determine study objectives

These activities can be undertaken in an interactive session with the stakeholders or it can be optionally undertaken by the modelling team after the completion of the workshop. Before starting this session, it is important that the modelling team convenes to group and reformat the PMM diagram and to also discuss which activities can be modelled using simulation. The quantitative performance measures should be distinguished from qualitative measures, the ones that can be explored in a simulation model and the ones that cannot be directly explored in a simulation model. The opinion of the modeller is important.

Next guidance as to how to accomplish each activity follows:

1. Identify model inputs and outputs

1. First, the monitoring and determine if activities in the PMM diagram are distinguished into:
- Inputs (I) data entered into the model in the form of experimental factors
- Outputs (O) the results collected from the model as system performance and
- Some of the activities (Is and Os) that cannot be modelled using simulation, can be converted into model content.

If this activity is undertaken in a facilitated session, the next activities can be undertaken in the form of the facilitated session. If not, the modelling team can undertake them in a non-facilitated environment. The tables in Conceptual Modelling Tool 4 can be used to assist the process.

To view an example of a final PMM diagram developed for the obesity case study please refer to Example 2: Final Diagram in this toolset.

2. Next, for the list of changes identified in the PMM that can be explored in a simulation study, further information is extracted. The answers given by the stakeholders can be recorded in table 1 of the Conceptual Modelling Tool 4. The information asked should include the following:
- How each change will be achieved? (column 2)
- What is the range (minimum and maximum) of each input (I)? (column 3)
- What is a good or bad performance for each output (O)? (column 4)

2. Determine study objectives

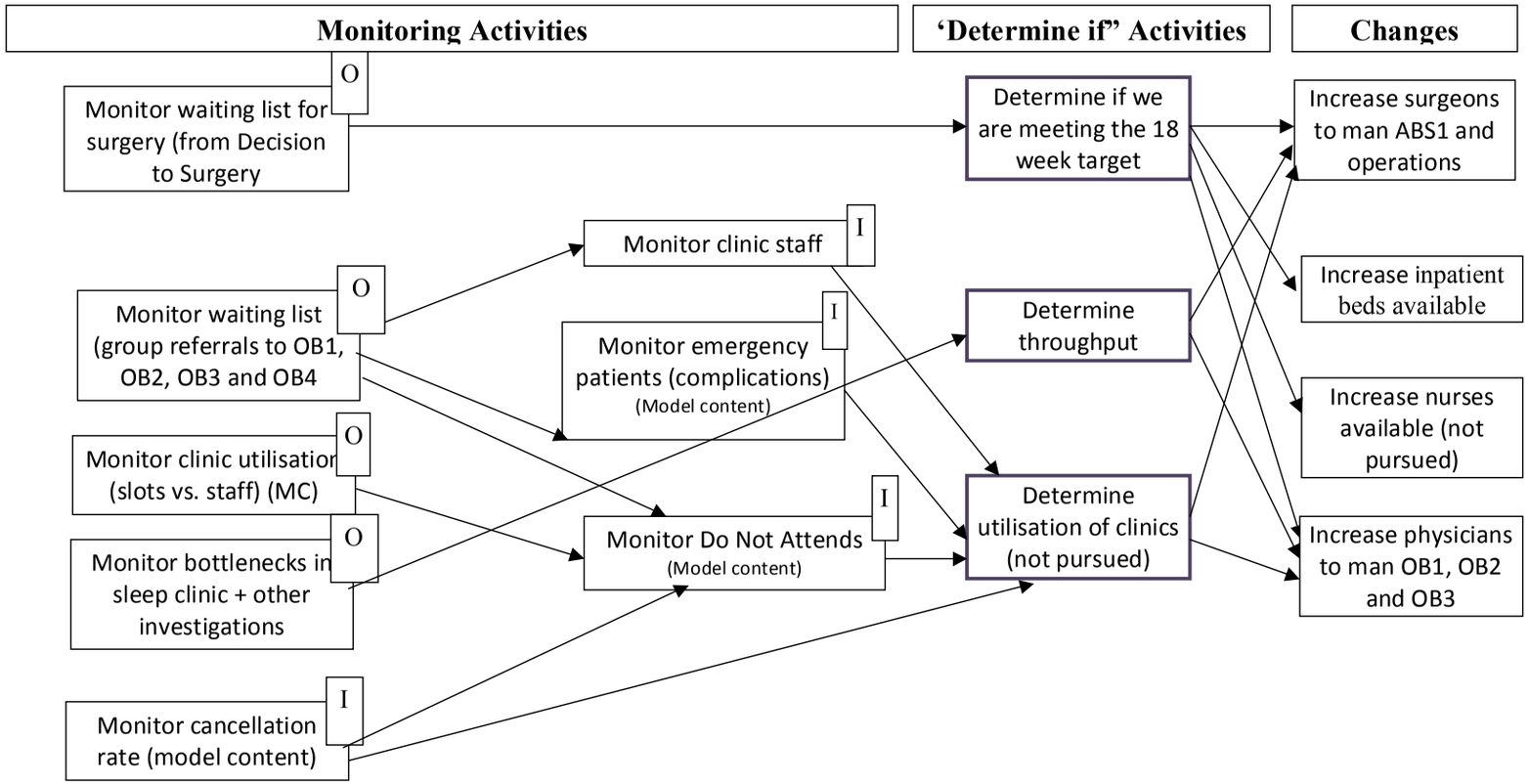
Next, model objectives are formulated following the format: Purpose, Target performance, Constraints, linking them with the relevant change to be introduced. Table 2 in the Conceptual Modelling Tool 4 can be used to record the objectives.

An example showing how the objectives are compiled is provided below:

Objective 1: Identify the number of clinics needed in order to [Change] to increase the number of patients seen in the Surgical clinic [Purpose] by 20% for 95% of cases [Target performance], knowing that the number of clinics can range between 8 to 20 per week [Constraints].

Objective 2: Identify the number of doctors and nurse practitioners needed [Change] in order to reduce the waiting list for the Medical clinic [Purpose] to two weeks for 90% of cases [Target performance], knowing that up to 2 doctors and 3 nurse practitioners are available [Constraints].

Example 2: Final PMM diagram (Obesity study)



Conceptual Modelling Tool 4: Study Objectives

This tool is aimed at guiding the process of extracting simulation study objectives and model inputs and outputs based on the Performance Measurement Model. This involves two main activities:

- Identify model inputs and outputs and
- Determine study objectives

1. Identify model inputs and outputs

In this task the PMM, is further discussed with the view to extracting the simulation study objectives using the tables 1 and 2 below. For further help with this tool the user is referred to the manual for Conceptual Modelling Tool 4.

Table 1: Extract information about model inputs and outputs.

Suggested change in PMM	How can it be achieved	I: Identify range of variation	O: Identify good/bad performance
Change 1:			
Change 2:			
Change 3:			

2. Determine study objectives

The simulation study objectives are next determined using the format: change, purpose, target performance and constraints, combined with the relevant changes to be introduced. The form in table 2 can be used to collect the information before collating the separate elements in the form of objectives. Further guidance is provided in the manual for Conceptual Modelling Tool 4.

Table 2: Determining simulation study objectives

	Purpose (What do we want to achieve?)	Target performance	Constraints
Objective 1			
Objective 2			
Objective 3			

Manual for Conceptual Modelling Tool 5: The communicative model

This manual assists the development of a communicative model. The diagram developed is called Patient Flow Diagram (PFD) of the system of interest, consisting of a series of queues and activities. For non-health care settings it can be simply called Process Flow Diagram. The PFD is a more elaborate representation of the clinical activities taking place in the care system compared to the CSM developed in the PartiSim stage 2.

The diagramming notations used are:

- Clinical activities or tasks are represented by squares.
- Circles represent patients waiting for an activity to happen, i.e. patients queued in a waiting list for surgery.
- The squares and circles are connected with one-directional arrows, in a discipline of queues (circles) followed by activities (squares).

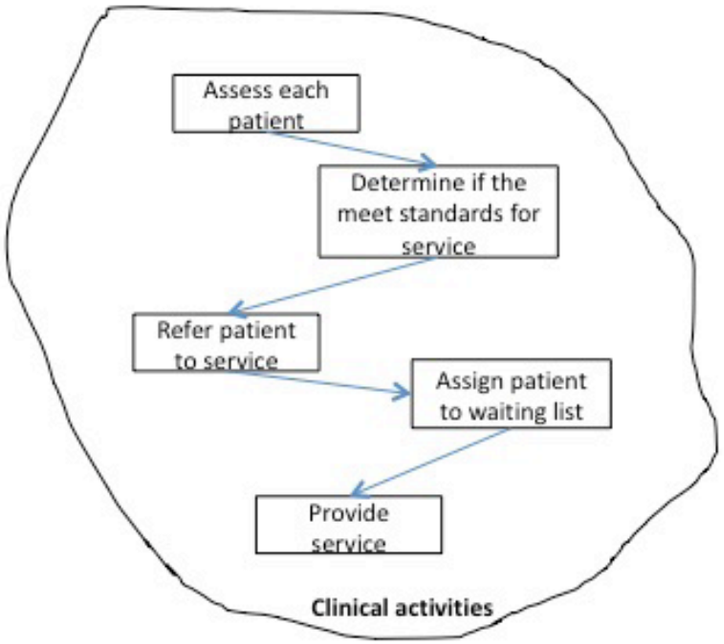
For a visual representation of how a care system model is transformed into a patient flow diagram, refer to example 3 provided in the toolset: “Moving from a CSM to a PFD”.

Recommendations:

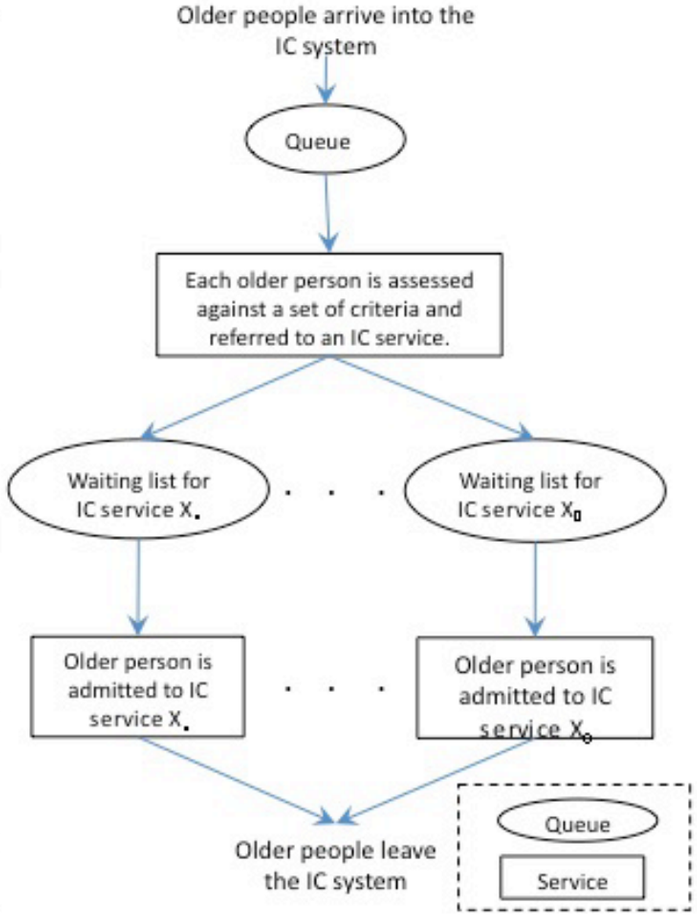
- In Conceptual Modelling Tool 5 a generic PFD is provided (Conceptual Modelling Tool 5). The user needs to double click on the image in order to make necessary changes. (Please note users need to have Microsoft Visio installed on the computer. To download a free 60-day trial version of Microsoft Visio please go to: http://trial.trymicrosoftoffice.com/trialukireland/product.aspx?re_ms=oo&family=visioprofessional&culture=en-GB)
- Further boxes or circles can be added to represent the care system of interest.
- The names given are optional, and one can change them so that they fit to the situation of interest.
- Please remember to complete this diagram as part of a facilitated session involving stakeholder participation.

Example 3: Moving from a CSM to a PFD

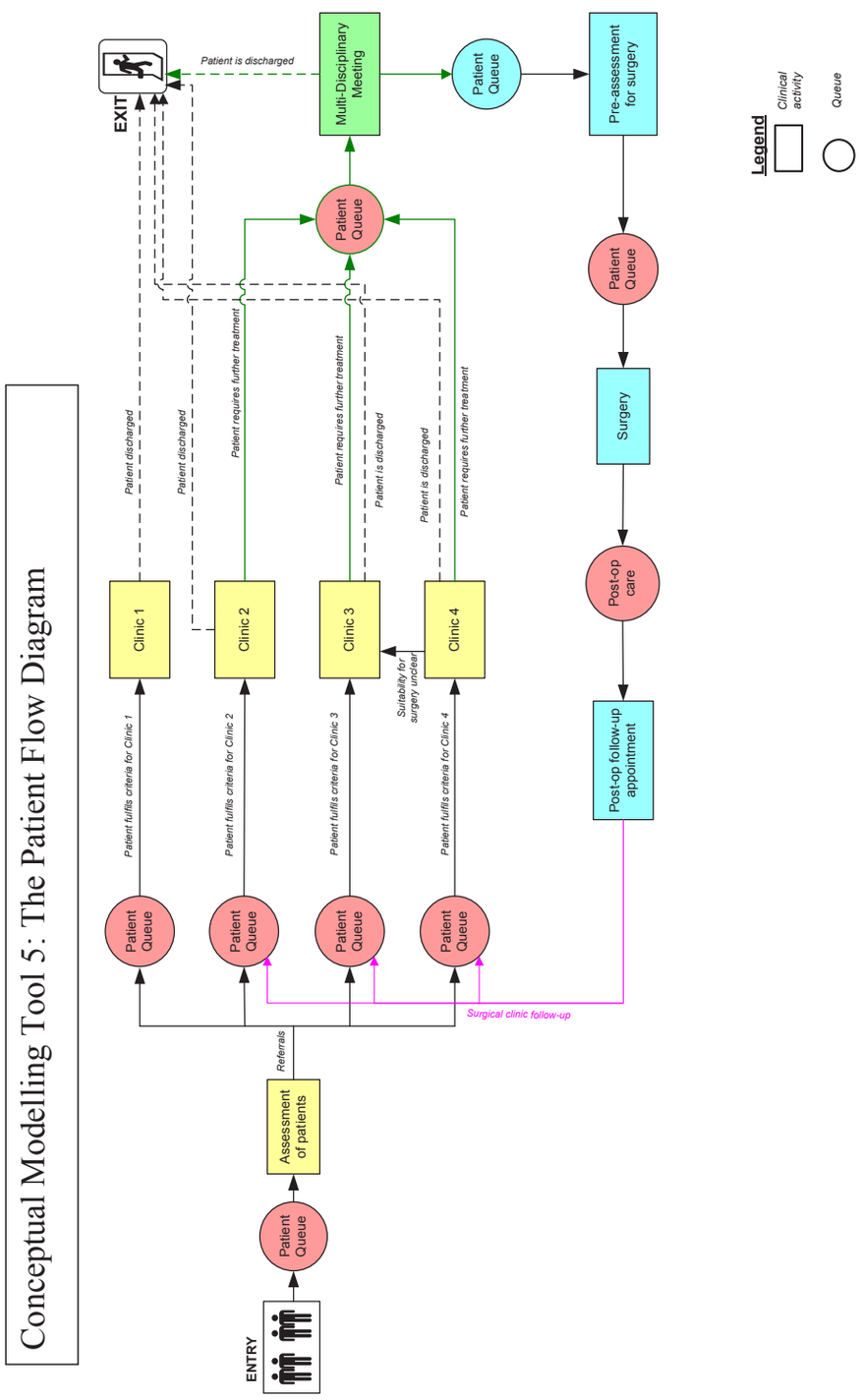
Care System Model (CSM)



Patient Flow Diagram (PFD)



PartiSim Participative Simulation



PartiSim Facilitator Toolset for Stage 5

Experimentation

Sessions	Associated Tools, Scripts and Manuals
1 Simulation Model Validation	Experimentation Tool 1
2 Rating the Performance Measures	Manual for Experiementation Tool 2 ExperimentationTool 2
3 Debating the Desirable and Feasible Solution Space	Manual for Experiementation Tool 3 ExperimentationTool 3

Experimentation Tool 1: Model Validation (Facilitator Form)

This tool can be used by one of the facilitators as a note keeping aid to record the changes or comments suggested by stakeholders while model validation takes place as part of the Experimentation stage in Workshop 3.

Name particular aspect/part of the model identified	Agree/Disagree	List suggested changes to the model

Experimentation Tool 1: Model Validation (Stakeholder Form)

While the simulation model is being presented, you may use the form below to make any notes about aspects or parts of the model that require improvement. Your comments may be in the form of suggestions of changes to the model or parts of it, additional components not included in the model, data used etc. Please share your suggestions during the discussion.

Name particular aspect/part of the model you would like to comment on	Agree/Disagree	Suggested changes (change to model, improved data collection etc.)

Manual for Experimentation Tool 2

This manual is aimed at supporting the use of Experimentation Tool 2: Rating the Performance measures.

In the facilitated session, stakeholders should be asked to identify the performance measures that are important for the evaluation of the system. It is likely that a number of performance measures have already been identified. These performance measures can be rated in their importance by using Experimentation Tool 2 (paper-based) in this toolset or by using a software package such as VISA (http://www.visadecisions.com). Further advice on how to use VISA in general is available by the developer.

If the paper-based tool is used, the stakeholders could be asked to either tick the important performance measures or rate them in an order of importance e.g. from 1-5, where 1 is most important and 5 least important. The example of the paper based tool (table 2) demonstrates the rating by ticking the most important performance measures in a facilitated session. X's are used for performance criteria that are irrelevant and a measure that is not considered important is not ticked. Note that stakeholders will need to debate each measure before rating it.

Table 1: Example of a completed paper-based Experimentation Tool 2.

Performance measure	**Importance (please tick)**
Number discharged after operation	✓
Number of GP referrals	
WL for outpatient clinic	✓
WL for colonoscopy	✓
WL for colonoscopy	✓
WL for follow-up clinic (cancer patients)	✓
WL for follow-up clinic (non-cancer patients)	
Average waiting time to surgery	X
2-week target	✓
31-day target from GP referral	✓
62-day target	X
18-week target	✓

Experimentation Tool 2: Rating the Performance measures

From the list below please identify the performance measures that you think are important for the evaluation of your system.

Performance measure	Importance (please tick)
Number discharged	
Number of referrals	
WL for	
WL for	
WL for	
WL for	
WL for	
Average waiting time to X	
2-week target	
31-day target from GP referral	
62-day target	
18-week target	

Manual for Experimentation Tool 3

This manual is used to help the facilitator lead the discussion on the experimental scenarios using Experimentation Tool 3: Debating the Solution Space.

The aim of the Experimentation Tool 3 is to check if stakeholders understand the behavior of the system and to generate learning by discussing the difference between their initial expectations on the best scenario. The facilitator gradually presents the scenarios and their ranking of the performance measurement results. The objective is for the stakeholders to understand the model performance for each scenario and ultimately understand the model behaviour. Stakeholders should also be reminded of the model objectives agreed in the previous stage. Finally stakeholders should decide on which scenario is the best based on looking at the model results.

The following steps can be followed:

1. The facilitator displays the table using the Form for Facilitator of the tool, but hides the numerical results (function in PowerPoint). The first column of the table lists the details of the current scenario and future scenarios decided upon in stage 3 explaining key changes in the experimental factors (column 2 of the table).
2. The facilitator asks stakeholders the following questions:

- Are there any other questions about the scenarios?
- Which scenarios do you think will have the most improved results from the current scenario?

3. The Facilitator then gradually reveals and describes the model results from the table showing the model's numerical average results on each performance factor for each scenario, starting with the current situation.
4. Then the rankings of each performance measure are revealed.
5. The facilitator creates discussion by asking the group as a whole:

- Are the results different from what you thought they would be?
- Did the results improve when you thought they would? If not, why do you think it was different? (The facilitator explains if needed)

6. The facilitator next asks the group to identify the best performing scenario. This can take the form of an open discussion or voting or a combination of both. The following questions can be posed to the group:

- Which scenario is the preferred future scenario by just looking at the model results?

7. Finally the facilitator encourages the stakeholders to put forward any further scenarios that should be explored. The following question can be used for this purpose:

- Are there any other combinations of changes you would make and why?

Experimentation Tool 3: Debating the Solution Space (Form for Facilitator)

This table shows a possible format for facilitators to present the Current and Future Scenario results. The table shows the model results for each 'Performance Indicator' per scenario. Performance Indicators can be ranked (statistically) in order of importance in the column "Ranking". Scenarios are listed in order of minimal to increased changes of inputs for easier viewing.

Scenario	Definition of Scenario	Performance Indicator 1		Performance Indicator 2		Performance Indicator 3		Performance Indicator 4		Performance Indicator 5		Performance Indicator 6	
		Average value	Ranking	Average value	Ranking	Average value	Ranking	Average value	Ranking	Average value	Ranking	Average value	Ranking
Current Scenario	1 Surgeon 1 Physician 100/month Referrals												
Scenario 1	+1 Surgeon - 45 referrals/month												
Scenario 2													
Scenario 3													

Experimentation Tool 3: Debating the Solution Space (Form for Stakeholders)

In the form below, please add any suggestion for additional future scenarios that the modelling team could consider.

Scenario	Definition of scenario e.g. add 5 outpatient slots/ week

PartiSim Facilitator Toolset for Stage 6

Implementation

Sessions	Associated Tools, Scripts and Manuals
1 Review Learning	Refer to User Guide
2 Identify Changes Already Implemented	Implementation Script
3 Risks and Feasibility of Change	Manual for Implementation Tool 1 Implementation Tool 1
4 Determine Action Trail	Manual for Implementation Tool 2 Implementation Tool 2 Manual for Implementation Tool 3 Implementation Tool 3

Implementation Script: Identify changes in the system

This script contains potential questions that could be used in the second session in the PartiSim Workshop 6.

In order to identify changes that might have already occurred in the system, the facilitator may decide to ask stakeholders the following (or similar) questions:

- Have any changes been (already) introduced to your system?
- What led you to do this? Or Why?
- What affected your decision to implement this change?
- Were these changes implemented due to the workshops or due to other developments?
- Did your implementation of X provide the expected results?
- What is the situation like at present?

Manual for ImplementationTool 1

This manual aims to asssist the facilitator in using the Implementation Tool 1: Feasibility and Risks scale, in Workshop 4 of the PartiSim framework.

This tool's aim is to identify factors that might have not been aired so far that may affect the feasibility of implementing the most preferred scenario. With the help of this tool, further analysis is undertaken in order to bring into the open any positive or negative viewpoints. Once this is completed the Stakeholders are asked to make a decision on a preferred future scenario. Consensus needs to be reached on a decision before future action plans can be discussed.

Definition of Not Feasible factor: A physical factor that makes a scenario seem unpractical and 'impossible'. For example: lack of resources such as budget, number of staff, or lack of skills, knowledge, etc.

Definition of Feasible Factor: A physical factor that makes a scenario seem practical because they are already available in the system or can be attained. For example, within budget, can attain skills and knowledge, can attain new staff (if within budget) or change roles of staff.

A Facilitator and Recorder are required for this session. The Facilitator leads the session by following the following steps:

1. Individual stakeholders are asked to write factors which can affect the feasibility (Not feasible or Feasible) of the preferred scenario on an index card (a factor per index card in large legible handwriting. It is advisable that the preferred scenario is written on the flipchart based on the discussions in the previous session The facilitator poses some of the following questions to stimulate ideas:

- What issues (i.e. feasibility, resources availability, management) may impede the implementation of this scenario?
- What might be the possible risks not shown in the model when carrying out the changes?
- The opinion of which individual or group is most important in implementing this change(s)?
- Are there any factors/risks that affect the feasibility of the scenario, but that can be attained/resolved in the near future?
- Which key resources such as equipment, skills, would not be possible to attain?

The recorder writes on the flipchart on the left side of the scale Not feasible and on the right side Feasible. It is advisable not to draw the complete scale yet, but just the triangle or the base. The line should be drawn later on (to view a visual idea of the layout see Implementation Tool 1).

2. The recorder collects first the index cards that make the scenario not feasible and then the index cards that make it feasible. Blue tack or tape is used to stick them on the flipchart in the appropriate location.

3. Discussion takes place, where the facilitator asks stakeholders the following questions (or similar), while the Recorder writes responses on the flipchart:

- Are there any other factors that may seem infeasible or feasible?
- Are there any that are attainable?
- Which side do you think the scale is tipping – infeasible or feasible?

4. When the facilitator considers it appropriate, the discussion above is wrapped up by drawing a line that shows whether the Not feasible or Feasible side is heavier. The side with the most factors will be the one that will be considered heavier and the one that will tip the scale. If the scenario is considered Feasible, the group can either continue with considering additional possible scenarios to be implemented (and repeat steps 1-4) or stop here. If the scenario is considered Not feasible and hence not attainable then another scenario should be chosen and steps 1-4 are repeated.

If many scenarios are put forward as appealing and all tipping the scale as feasible, the facilitator can ask the group the following questions to select the most preferred one to explore further:

- Which scenario do you think should be taken forward taking into account model results?
- Why do you suggest that?
- What specific improvement do you expect to see as a result of this change (s)?

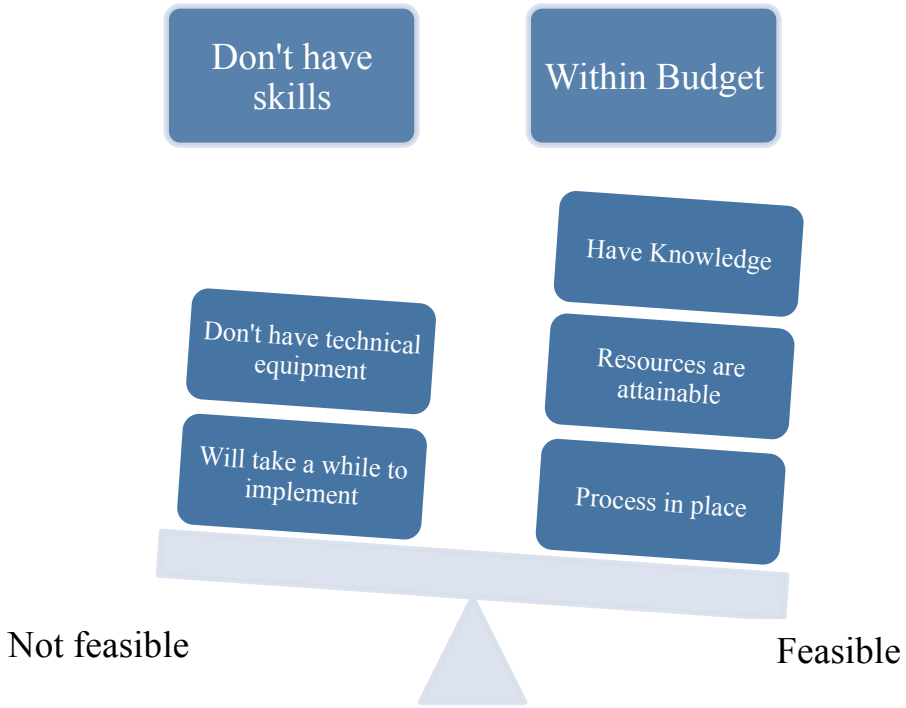
If a decision is not reached in discussion there can be a vote on the best preferred scenario (raise of hands or even secret ballot voting).

5. The Facilitator should record the chosen future scenario deemed as most desirable and feasible.

Implementation Tool 1: Feasibility and Risks Scale

This tool is an outline for a structure to show the feasibility and risks for each scenario. A flipchart can be utilized to write stakeholders' suggestions on, so that they can be seen by the stakeholders. First, the preferred scenario is written at the top then "Not feasible" on the left hand-side and "Feasible" on the right-hand side of the base of the scale. Stakeholders can write feasibility and risk factors on the index cards and the facilitator can put them on the board in the appropriate area. Then a discussion takes place and at the end a line is drawn to show where the scale is dipping and whether the scenario is "Feasible" or "Not Feasible". For further advice on the suggested steps to follow, the user is referred to the manual.

Preferred Scenario Description: Add 1 Surgeon



Manual for Implementation Tool 2

This manual is aimed at asssisting the facilitator in using the Implementation Tool 2: Overcoming Barriers to Change in the PartiSim Workshop 4.

This form consists of three parts:

- Listing of changes in resources, processes, or other changes
- Listing of barriers to change and the associated actions to overcome barriers.
- Listing of the benefits expected to be achieved from implementing the change discussed.

This aim of Implementation Tool 2 is to generate discussion on the necessary changes required for the implementation of the chosen scenario and to challenge psychological and physical barriers which may act as a barrier to change but can be overcome by certain action steps. Listing the changes and the potential benefits of the chosen scenario, make it possible for implementation to take place. Enabling stakeholders to discuss ways to overcome barriers can make the implementation of changes to the real life system seem more feasible and desirable.

Definitions

Changes in Resources: The changes in resources necessary to attain the chosen scenario. This type of changes can include changes in the experimental factors as well as other resource changes. Examples include: the addition of equipment, staff, skills, money, etc.

Changes in the Processes: The changes in the process necessary to attain the chosen scenario. This type of change can include changes in the experimental factors or other changes that may enhance the communication, patient flow, or document flow. Examples include: the addition of criteria/guidelines, re-direction of patient flow, new treatments etc.

Barriers to Change: Barriers to change can include psychological or physical barriers which may hinder or make the implementation of the listed changes difficult. Examples include doubts, fears of change, negative feelings, timelines, training etc.

Expected Benefits: The expected benefits can be quantitative or qualitative in nature. They could refer to potential expectations from the stakeholders' point of view if the changes were to be implemented. These should be normally based on model results and knowledge of the system.

The following steps can be pursued in order to complete the form, but to also generate discussion:

1. The Implementation Tool 2 is handed out to the stakeholders. The facilitator may ask stakeholders to complete the form in the following sequence:

a. First fill in the chosen scenario changes in resources, the process and other changes decided upon (3 boxes on the left in the tool).

b. Then list two possible barriers to changes and the appropriate action to overcome that barrier (middle box in the tool).

c. Then appoint an action number, to each action with 1 being high priority.

d. At the end stakeholders are asked to write down the benefits they expect to be achieved as a result.

The Facilitator can give stakeholders 5-10 minutes to fill in the form. Stakeholders may discuss in a small group to generate ideas if needed.

2. Next, the ideas generated should be openly discussed. The facilitator should encourage all participants to contribute to the discussion. The facilitator may assist the discussions by asking the following questions (or similar) whereas the recorder can write responses on the flipchart:

- What are the changes in resources, the process and other changes for the chosen scenario to be taken forward?
- What are the particular barriers to these changes? For example what are some of the physical and psychological barriers that may need to be overcome? What barriers have you seen from past change projects?

Note: The facilitator may suggest examples if there is trouble generating ideas such as politics, or a lack of skills, management support, other stakeholder support fear of change, rules, process, lack of knowledge, money, time, people, and other resources.

- What else needs to be in place to overcome each barrier? What actions can help overcome these barriers?

Note: Some examples can also be provided by the facilitator if there seems to be a mental block such as creating a report, hiring staff, communication of the project benefits, develop understanding of the project,

training, meetings, fundraising, change of roles, addition or elimination of a work station.

- What would be the ranking of these actions to overcome barriers in priority order?
- What do you believe the benefits of these changes and supporting actions will be?

3. At the end of the discussion, the facilitator should reiterate the key parts of the discussion and encourage stakeholders to declare their belief about the feasibility of the particular scenario explored, as the next step involves constructing the action trail.

Implementation Tool 2: Barriers to Change

Please start by filling in the changes in resources, processes and other suggested changes for the scenario to be explored. Then please list possible barriers to these changes and the actions needed to overcome these barriers. Then rank each action, with 1 being high priority. Then write down the benefits you expect to achieve from the changes.

Changes in Resources:

_____

_____

_____

Changes in Process:

_____

_____

_____

Other Changes:

_____

_____

_____

Please write possible barriers to the changes and the actions to overcome those barriers. Then please number the actions in priority.

1. Barrier to Change:_____

Action #	Actions to overcome barriers to change

2. Barrier to Change:_____

Action #	Actions to overcome barriers to change

Expected benefits from changes:

_____

_____

_____

_____

_____

_____

Manual for Implementation Tool 3

This manual is to help asssist the facilitator in using the Implementation Tool 3: Action and Communication Plan Form for the PartiSim Workshop 4.

The aim of this form is to organize changes and necessary communication to support stakeholders in planning future actions, listing who is responsible for the carrying out the actions and developing a timeline for when actions should be carried through. These actions will enable the chosen scenario and the relevant changes to be implemented. If support is generated in the planning stage then the changes are more likely to be carried out since it develops understanding of what needs to happen next.

1. The Implementation Tool 3 is handed out to the stakeholders.
2. Using the list of changes and actions produced using Implementation Tool 2, column 1, actions for change is completed interactively, starting with priority actions for overcoming barriers. The Recorder writes the responses in a flipchart.
3. The facilitator can ask the following questions to infuse discussion:

- What sub-actions and communication tasks are needed to achieve the action for change?
- Who will lead and be responsible for each action and communication task? Preferably this person should be someone who supports the project, has good connections and is listened to by other colleagues. It could be a stakeholder attending the workshop or it could someone else in the organization that is involved in the process considered, such as admin, technical staff, etc.
- Who else do you need to communicate the actions/ changes that need to take place? Whose support do you need who will be impacted by the change decision?
- What is the expected deadline for these activities to be completed?

The Stakeholders can use the forms to help their thinking and generation of ideas and should be encouraged to complete them if possible. The form with the agreed action trail should be agreed in the workshop but also sent to the workshop participants' in a tidier format after the workshop. This form will serve as a reminder to workshop participants of the specific actions, responsibilities and dates agreed.

Implementation Tool 3: Action and Communication Plan

Please fill in the first five columns of the form first. The last two columns should be filled in as changes are implemented.

Action for change	Action and communication tasks	Action Leader	Stakeholders to communicate with	Date expected to complete Action	Date Achieved Action	Comments
1. e.g Hire Surgeon	Create report for HR	Mike Gray	Sara Halifax Vanessa Brown	12 May 2011	10 May 2011	HR approved report
2.						

Action for change	Action and communication tasks	Action Leader	Stakeholders communicate to	Date expected to complete Action	Date Achieved Action	Comments
3.						
4						