DEVELOPMENT OF A SOFT SYSTEM MODEL TO IDENTIFY INFORMATION AND COMMUNICATIONS TECHNOLOGY ISSUES AND OBSTACLES IN GOVERNMENT ORGANIZATIONS IN SAUDI ARABIA

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ABSTRACT

Soft system methodology (SSM) has attracted great attention in industry and in the academic world. The central theme of this research is to demonstrate the application of SSM to issues and obstacles facing Saudi Arabian government organizations using information and computer technology (ICT). A number of techniques and approaches were used in achieving these objectives including quantitative and qualitative techniques of data analysis. An empirical study indicates that most subject organizations suffer from people issues rather than technical issues. By applying SSM, the study identified the problems and obstacles facing Saudi government organizations. A conceptual model has been proposed. This is the first attempt using SSM to tackle IT problems in Saudi Arabia.

Keywords: *Checkland's Soft Systems Methodology (SSM). Saudi Arabia. Government organizations. Information and communication technology (ICT).*

1- INTRODUCTION

Information and communications technology (ICT) has significantly expanded the power and potential of most information systems. Technology has created a data and information explosion in virtually all businesses where the ability to harness and manage this data and information has become a critical success factor. Information systems in an organization are dedicated to improve the performance of the organization's knowledge workers through the application of information technology (IT).

ICT is gradually becoming a familiar tool in all types of government organizations and has great potential for initiating revolutionary change in working procedures in Saudi government organizations which have the same chance for successes and failure [Al-Zahrani 2006] [Al-Zahrani and Pichappan, 2007]. They most important problems of a large portion of these organizations are people issues rather than technical issues. Typically, an organization's staff doesn't share and exchange knowledge and experience internally. Effective use of ICT would enable people within and across organizations to communicate effectively and efficiently.

2- GOALS AND OBJECTIVES

The main goal of this paper is to demonstrate the application of SSM to issues and obstacles facing Saudi government organizations attempting to manage ICT to their advantage. This was the central theme of this research which was undertaken in the Department of Information Systems at Imam Mohammad Ibn Saud Islamic University.

3- STATEMENT OF THE PROBLEM

Saudi government organizations depend heavily on ICT as a result of prolonged and recently accelerated growth in the latter and several organizations have achieved reasonable level of using this technology. Saudi government organizations suffer from problems familiar to all technology dependent organizations such as: lack of qualified staff, lack of continuous training, lack of updated hardware, and lack of software standards. Typically and unfortunately, the organization works independently to overcome its obstacles without taking advantage of the synergies that co-operation would bring. The study identified problematic situations

regarding IT issues among 12 government organizations.

4- SSM PRINCIPLES

Checkland's Soft Systems Methodology (SSM) is a systematic approach for tackling real-world problem situations [Checkland and Poulter 2006]. It was developed in the 1970's by a team of academics from the University of Lancaster led by Prof Peter Checkland. The team found that Systems Engineering, which was a methodology so far only used for dealing with technical problems, proved very difficult to apply to real world management problem situations. This was especially so because the approach assumed the existence of a formal problem definition. It was found that such a unitary definition of what constitutes "the problem" was often missing in organizational problem situations, where different stakeholders often have very divergent views on what constitutes "the problem." A brief explanation of the seven stages of the methodology can be found in [Checkland and Poulter 2006]. It is worth noting that the research process can start at different stages.

1. At Stage One there is no a clear definition of the problem situation, but a greater understanding of it is obtained through involving stakeholders in the resolution process [Atkinson 2002]. In the author's research this was achieved by conducting semi-structured interviews with organizations identified through a literature review as being involved in the field of IT management. These interviews provided information about the stakeholders' activities and relationships which, as a whole, constitute "the problem situation." The 12 information-dependent organizations studied within the scope of this research came from a diverse range.
2. All of this information is then brought together to form Stage Two to yield a "rich picture" which is defined as the expression of a problem situation compiled by an investigator, often by examining elements of the structure as well as elements of process. Elements of structure change slowly within time, for example the physical layout of a building, whilst elements of process include rapidly changing organizational activities, for example office procedures.
3. Stage Three involves the development of root definitions from the rich picture. A root definition is defined as a concise, tightly constructed description of a human activity system which states what the system is [Checkland 1999 and 2006].
4. Stage Four is the construction of conceptual models of the problem situation by either determining the minimum set of activates satisfying the root definition or by listing the activities, arranging them in a logical order and drawing a diagram to represent this order.
5. Stage Five is concerned with the comparison of models against the expression of the problem situation.
6. Stage six tests each model against the problem situation, and the possibility of implementing the changes suggested in the model.
7. Finally, Stage Seven involves the implementation of the changes to improve the problem situation.

5- WHY DO WE ADOPT SSM?

Checkland's SSM methodology was used to analyze organizational IT problems because it was seen to have the potential to allow an in depth investigation of the human dimension of the problem. Several reasons lead us to use SSM:

1. SSM allowed us to appropriately establish the current position on IT problems and issues from the stakeholders' perspectives.
2. The SSM emphasis on the process of inquiry as a system is an intuitive alternative to the hard systems tradition of taking a systematic view of the world [Jenkins 1969, Checkland 1999].
3. SSM provides a technique for analyzing the qualitative aspects of IT and management problems.
4. SSM has been developed for use in ill-structured or messy problem contexts such as those discovered during this study.
5. SSM in action prevents decision makers from rushing into

poorly thought-out solutions based on preconceived ideas about an assumed problem.

6- SSM is useful in exploring problems by providing a structured approach for examining the views and concerns of stakeholders.

7- SSM is flexible and has been adopted in different fields [Checkland and Winter 2006, Al-Zahrani 2001, Ledington 1999, Janson, Jon and Warwick 2008, Cecez-Kecmanovic 2005, Jagodzinski 2002, Atkinson 2000].

6- AN APPLICATION OF SSM

The following pages show the application of SSM stages to ICT problems and issues associated with the use of ICT in Saudi government organizations. This study is placed in a wider context to define the elements of the system and the system environment.

Stage One:

In the initial stage, the problem needs to be examined. Many different views will be investigated. In the author's research, this was achieved by conducting semi-structured interviews with 12 IT mangers. Through the interview we were able to identify organizational activities and relationships which, as a whole, constitute the problem situation. The range of information dependent organization is diverse and within the scope of this research. The background of the problem was further examined by taking note of the literature reviews and data and information from the empirical study.

Stage Two:

In this stage, the problem situation is expressed in order to get rich picture. A rich picture is defined as the expression of a problem situation compiled by an investigation often by examining elements of the structure, elements of process and climate [Checkland and Winter 2006]. Data about the expectations of end users in the concerned organization as well as their mangers' opinions were collected. Additional data such as organizational structure, operations, policies, and procedures etc., were also collected. In this stage we don't completely define the problem; rather we clarify the problem solving and problem content system and link them together.

In this study, the author has in-depth experience with Saudi organizations and has professional knowledge of information systems. He occupied the role of problem solver. The author can call on other resources such as the combined experience of the participants, evidence from the surveys and time. The role of the problem solver here is to explain the problem content system and then apply SSM to take action to solve the problem or to explain it again on behalf the problem owner. The relationship contents' system is depicted in Fig. 1.

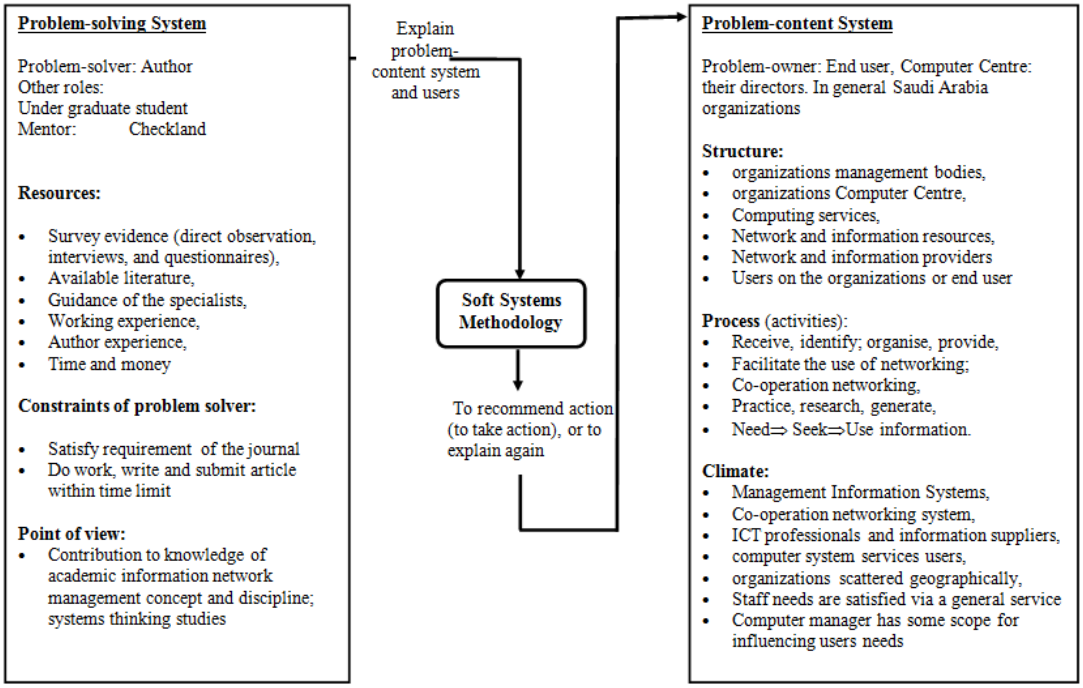

Figure: 1. The relationship between the problem-solving system and the problem-content system

Government organizations, information services providers, end-users, and IT professionals occupied the role of problem owners.

According to [Checkland 1999 and 2006] the client is someone who wants to do something and commission the study. In this study clients do not exist in this sense but exist, rather, as "partial" clients. In other words, the client exists but in a diffuse form, not as a single person or organization. These partial clients are: the author, IT professionals, IT mangers and the Saudi government.

Stage Two: Creating the rich picture:

A rich picture diagram aims to highlight the primary purpose of the organization at high levels and to identify the issues which matter or are of concern in the development of effective information systems. The drawing of a rich picture establishes the interconnections and relationships that exist between various components and stakeholders in the research context [Bausch 2002 and Checkland and Holwell 2006]. Data for the rich picture were obtained via different methods: interview with stakeholders at each site, literature review, questionnaires, document analysis and direct observations.

There is no universal set of symbols to draw a rich picture. In this study, we have 4 actors. Those actors are: organization management bodies, IT managers, staff and customers. All these actors are considered problem owners. External parties were also represented. See fig. 2.

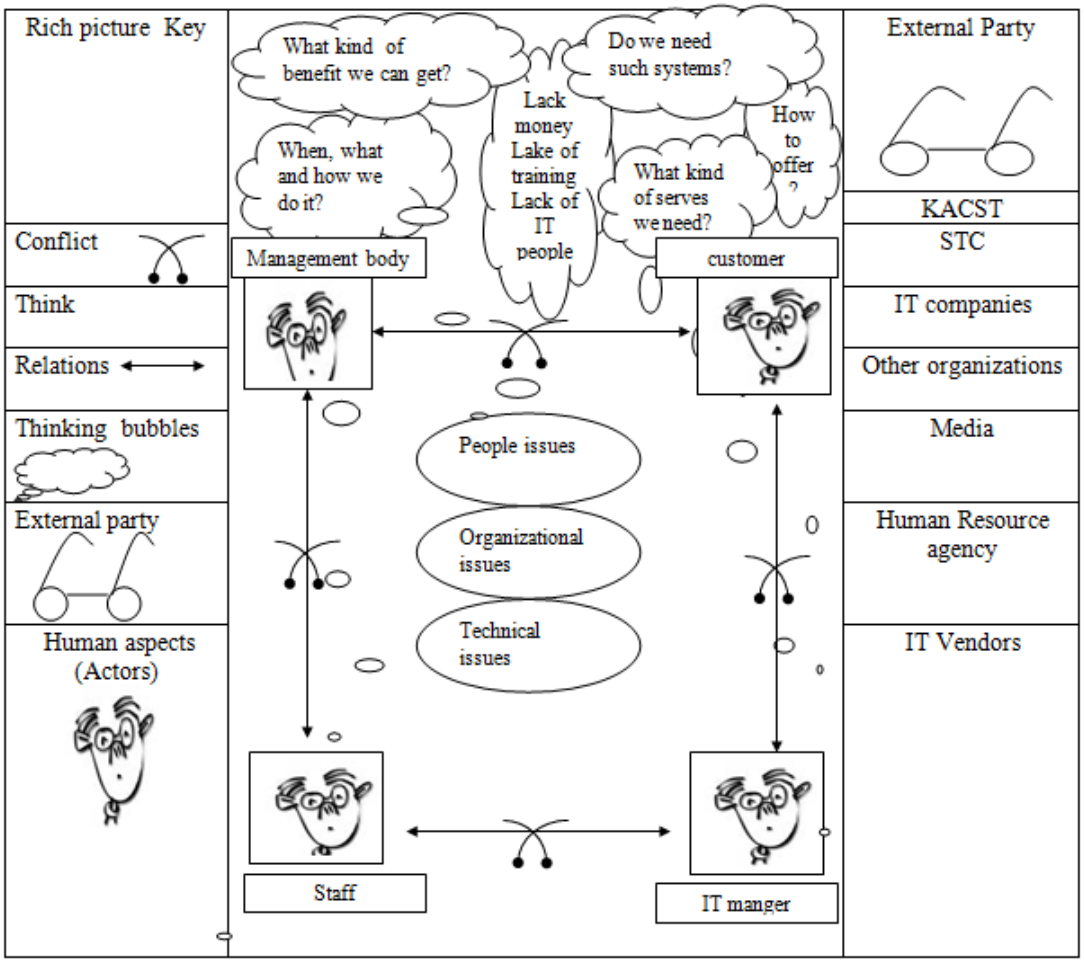

Figure 2: Rich picture : holistic view

The diagram highlights the various parties affected in this study such as the management body, IT managers, staff and customers. Human figure represent the key actors in the system. Obstacles, issues of concern and expectation of actors are represented as think bubbles. Conflicts between actors are depicted by crossed swords. Additionally, external parties are represented by glasses.

Stage Three:

This stage involves the development of a root definition from the rich picture. A root definition being is defined as a concise, tightly constructed description of a human activity system which states what the system is [Checkland 1999]. A root definition is a short verbal statement of the relevant system [Kurbanoglu 1992].

The aim of the root definition is to capture the basic elements involved in the system. There are two different types of systems that can be described: primary task and issue based.

The primary tasks in this work are to create a computer information system to transfer information, knowledge and experience among Saudi organizations. Issues and concerns are captured by the SSM in this work. Examples considered in this work include: social and cultural issues, end users' acceptance, system success and failure, technology change, regulations and security.

In this work, root definitions of the system relevant to the above expressed problem situation were selected. These were as follows.

1- Network steering committee relevant system.
2- Monitoring and maintenance relevant system.
3- Communications relevant system.
4- Education and training relevant system.

This leads to the following overall root definition of computer information system issues and obstacles:
A government owned computer information system to fulfill its required function of managing an information network system providing access nationality and internationally to co-ordinate an electronic information system for providing an electronic communication channel for staff in order to facilitate their information use for improving the Saudi organization's product in accordance with standards set by the government.
According to [Checkland 1999], root definition should be tested against a group of elements known by the mnemonic "CATWOE" derived from **C**ustomers, **A**ctors, **T**ransformation process, **W**eltanschauung worldview, **O**wners, **E**nvironment.
The general format for root definition of computer information systems for Saudi organizations which takes account of the CATWOE elements can be developed as follows:

C*: Saudi organization staff, IT managers, chief information officer (CIO), information network users and public users.*

A*: CIO, IT professionals.*

T *: The need to change the traditional way and transform scattered information to coordinated information units with interconnected services.*

W*: The need for an adequate electronic computer system that offers and exchanges information and experience in order to meet users' needs to improve the public organization.*

O*: Public organizations and funders in Saudi Arabia.*

E*: Government regulation, Saudi culture, organization policy, human resources, funds, technical and political issues, network infrastructure, hackers, viruses and technology change.*

Stage Four: conceptual model:

The fourth stage is to build conceptual models, based on the root definitions. The model building stage starts from the root definition and asks what activities would have to take place in system in order to meet the requirement of the root definitions?
[Checkland 1999] claimed that this stage is a logical model of the activities and processes that must be carried out in order to satisfy the root definition produced in stage two. It is a permutation of what must be done rather than what is currently being done. However, the model should contain some minimum set of activities. In this work, these activities can be defined using verbs as follows: organize, communicate, identify, deliver, and provide.
After the conceptual models are completed they should be checked by using appropriate guidelines and by using formal system models. Examining the problems suggested by the rich picture leads to the following conceptual models which define how activities should proceed for the system to function properly.

A. **Network Steering committee theme**

Saudi public organizations aim to provide excellent services to all customers. This can be done if there are immediately available electronic channels to help staff and customers communicate more effectively. Therefore, the network steering committee should be organized to represent participant organizations to set up a mission and establish co-ordination mechanisms for collaboration among different public organizations in order to address the highest strategic priorities of their organizations.
The root definition of the network steering committee relevant system is as follows:

A Saudi government owned national computer network system to provide an implementable technology plan by means of consensus decision-making methodologies for the purpose of enhancing the ICT and network services between different Saudi public organizations.

A CATWOE analysis reveals:

C: Public organization's management and IT professionals.

A: Computer network and IT professionals.

T: The need to create a steering team to look after the new system.

W: It is necessary for the organizations to create a steering team.

O: The organizations internal bodies as well as the government.

E: Environmental constraints: Saudi culture, regulations, social and political pressures, speed of growth of technology, Saudi organizations regulations and policy, network infrastructure, hardware and software, hackers, software viruses and budget constraints.

The main requirements of the steering committee can be defined as follows:

- Establish an effective decision-making team that has actors from concerned organizations.

- To provide and use effective decision making techniques.

- To make actors aware of and familiar with the latest technologies.

B. Communication relevant theme

Staff and customers need to communicate to provide and receive services respectively. Our initial survey indicates that lack of communications was rated as one of the main obstacles to better interaction between different organizations.

The root definition of a communication relevant system is as follows:

Public organization-owned network subsystem to deliver information, knowledge and expertise by organization's staff to achieve effective communication across organizational boundaries within and between the organizations environments.

A CATWOE analysis reveals:
C: Organization's management committees and IT professionals.
A: Computer network, IT professionals and organization's staff.
T: The need to create communication channels and the need to identify end-users and their applications.
W: It is necessary that the Saudi organizations communicate and co-ordinate their efforts. Communication and co-operation are required and feasible.
O: Public organization's management bodies.
E: Environmental constraints: Saudi culture, regulations, social and political pressures, speed of growth of technology, Saudi organization's regulations and policy, network infrastructure, hardware and software, hackers, software viruses and budget constraints.

The main requirements of the communication theme can be defined as follows**:**
- Define information and knowledge needs to be shared.
- Identify end-user applications that are needed.
- Organize network services and provide access to network services.
- Deliver an effective communication mechanism.

C. Maintaining and monitoring relevant theme.

System should be maintained as soon as it has been implemented. It is estimated that maintenance consumes more than half of the resources available in an IS department. The new system should be monitored and maintained without interruption. Therefore maintenance should be organized with computer centers and IT suppliers.

The root definition of maintaining and monitoring theme relevant system is as follows:

Saudi organization-owned subsystem to maintain and monitor their computer network system in order to avoid interruptions and to monitor network activates in order to improve effectiveness by means of network professionals.

A **CATWOE** analysis reveals:

C: Public organization's management committees and IT professionals.
A: Computer network and IT professionals.
T: The need to create a monitoring and maintenance team.
W: It is necessary for the Saudi organizations to construct monitoring and maintenance team. Establishing such a team is feasible and desirable.
O: Public organization's management bodies and the government.
E: Environmental constraints: Saudi culture, regulations, social and political pressures, speed of growth of technology, Saudi organization's regulations and policy, network infrastructure

hardware and software, hackers, software viruses and budget constraints.

The main requirements of the maintaining and monitoring theme can be defined as follows:
- Monitoring network performance.
- Establish quality assurance criteria.
- Determine obstacles such as lack of funds, people, technology, etc.
- Provide security privileges to protect data as well confidentiality and privacy.
- Assess and adjust network services.
- Prepare IT specialists for network activities.

D. Education and end-user training relevant theme

Maximum benefits cannot be gained from any organization unless staff receives an excellent training. Therefore, an adequate training program must be provided.

The root definition of education and end-user training theme relevant system is as follows:

Public organization-owned subsystem to provide ICT related education and training in order to gave organization's staff the required knowledge, skills and competencies by means of defined education and training programs in the use of network services and facilities, effectively and efficiently, according to the organization's information policy and regulations.

A **CATWOE** analysis reveals:
C: Public organization's staff and IT professionals.
A: Computer network and IT professionals.
T: The needs for trained experienced people to run and use the new system.
W: Adequate computer training that offers knowledge and experience to all of the organization's computer staff is important.
O: Public organization's management bodies.
E: Environmental constraints: Saudi culture, regulations, social and political pressures, speed of growth of technology, Saudi organizations regulations and policy, network infrastructure hardware and software, hackers, software viruses and budget constraints.
The main requirements of the education and training theme can be defined as follows**:**

- Provide sufficient tools and facilities for IT professionals.
- Supply instruction guidance and manuals that can be easily understood.
- Offer suitable courses to cover specific topics.
- Provide well-trained lecturers.

Stage 5: Comparison of the conceptual model with real world:

This is the stage at which the real word, based on data collected at Stage Two is compared with the conceptual world, as developed in Stage Four.
Comparison of the conceptual model with real world or what should happen with what actually happens. A comparison is to test where the differences and similarities lie. In fact, there are different ways of comparison. The aim of this stage is to generate debate, which could lead to a set of recommendations regarding change in order to help the problem situation. So we need an agenda. The final output of this stage is the production of an agenda. The activities of the model should be taken as a set of questions such as: Does it happen in the real world? If yes, how are we involved in it? What is our experience? Why we are doing it that way?

To simplify this process an agenda for change is listed in Table (1) that been constructed for each relevant system.

Table 1: Agenda for Change

Activities in conceptual model (Stage Four)	**Present in real world situation (Stage Two)**	**Comments**
1. Establish an effective network steering committee.	There are no steering committees working properly and there was no cooperation or any kind of communication or coordination between public organizations.	Network steering committee should be organized at each site. A project management team should be established. This team should be created to coordinate planning for the new system.
2. To provide and use effective decision making techniques.	No.	Need to establish.
3. To have each actor conversant with the latest technologies.	Partially.	Some executive staff were familiar with latest technology and able to cope with it.
Activities in conceptual model (Stage Four)	**Present in real world situation (Stage Two)**	**Comments**
1. Identify information and knowledge needs of a cross section of end-users.	End-users were identified as internal and external users.	End-users should be identified clearly.
2. Identify end-user applications.	To some degree.	Each organization should obtain or make in-house software to meet their staff needs. All found they develop some software but not fully.
3. Organize network services and provide access to network service.	Some of the organizations that were visited for this study offer reasonable information services for their staff. Several organizations were fully networked. Just a few need time to be full networked.	Most information services were carried out independently rather than incorporated. Some organizations need to speed up their efforts and make network services accessible. Public should have excess to public information.
4. Deliver effective communication mechanisms.	Some resources were moderately available.	Some information resources were partially available. However, more services were needed eg. remote access.
Activities in conceptual model (Stage Four)	**Present in real world situation (Stage Two)**	**Comments**
1.Monitoring performance.	Partially.	Committee to monitor IT performance did not exist in some organizations and was not working properly in others. Without monitoring performance there will be no commitment to improve the services and keep up to date.
2. Establish quality ensurance criteria.	Partially.	Part of these activities were already done but not complete. For example, nine organizations had quality assurance teams. Other organizations don't have but they plan to acquire.
3. Determine obstacles encountered such as lack of funds, people, technology, etc.	Incompletely.	Organizations already defined some problems regarding their future plans. Problems such as lack of IT strategy and IT staff, lack of funding, lack of cooperation and coordination between organizations and fast change of technology.
4. Provide security privileges to protect data and people confidentiality and privacy.	Partially.	Security is extremely crucial because this network will pass on information, which means this information is very sensitive. Confidentiality and privacy should be and

		protected.
5. Assess and adjust network services.	Incompletely.	In some organizations their services were not up to date. Also, some basic activities were not implemented yet.
6. Prepare and organize IT specialist for network activities.	Incompletely.	However, there is shortage of IT staff. At least 5 people are needed at each site.
Education and end-user training theme	**Present in real world situation (Stage Two)**	**Comments**
1-Provide sufficient training tools and facilities for IT professionals.	Partially done.	Each organization offers training courses for all staff but the activities were not adequate to update staff in new IT knowledge.
2- Supply instruction guidance and manuals.	Partially.	Some organizations provide guidelines to their staff.
3- Offer suitable courses to cover specific topics.	Partially.	Some organizations offer reasonable training for their staff in general.
4. Provide well-trained lecturers.	Partially.	A few organizations have qualified lecturers. Some organization bring outside paid trainers.

Stage Six: Debate with people involved in this situation (feasible and desirable change):

The result of Stage Five leads naturally into a discussion of things as they are now currently versus things as they might be in the future after change. There are different ways to proceed at this stage. One way, for instance, is to conduct structured discussions with the actors involved such as problem-owner and problem-solver. Discussion will generate possible changes which are systematically desirable and culturally feasible. In this study, we will use discussion with key people in this situation.

Discussion and debate with actors as change agents in this situation

We have obtained a clear picture through group discussion, direct observations and data collected at each of the sites visited. Challenges which stakeholders identified with the long-term use of IT includ: lack of financial and human resources, large volume of material and overload of paper work, lack of information, the speed of technological change, and the training/re-training of staff. In fact, there was an agreement between stakeholders that these are challenges which require resolution.

Discussion results led us to some ideas about possible change. This change were agreed by actors to be systematically desirable, technically possible and culturally feasible. As was indicated at the beginning of this study, there are problems of which no single person or organization can gain ownership. In the present study, the present problem is neither client-owned nor impossible to own but seems to be somewhere in between. According to [Checkland 1999] the "client" is someone who wants to know or do something and commissions the study. The client does not exist in this sense in the present study. Instead, there are several partial "clients" each displaying some of the above characteristics to some degree which when taken together constitute the "client". In other words, the client exists but in diffuse form, not as a single person or organization. These partial clients include the author, IT professionals, the real world information suppliers, and the Saudi government.

The author commissioned the study by selecting the problem initially, but is not in a position to take action as a result of it. The government body may take action when it becomes aware of the study but is not required to do so. The general manager of each organization did not commission the study but he may take action as a result of it if he wishes and he is most likely to derive benefit from it. The effect of this has been to make feasible, within the scope of the present study, the execution of Stages Six and Seven. Consequently, these two stages of the methodology have been omitted because the author commissioned the study by selecting the

problem initially, but is not in a position to take action as a result of it.

Conceptual model of the total system:

Interlinking between the four sub-systems of network steering committee, communications, maintenance and monitoring, and training and education yields the final model as shown in fig. 3.

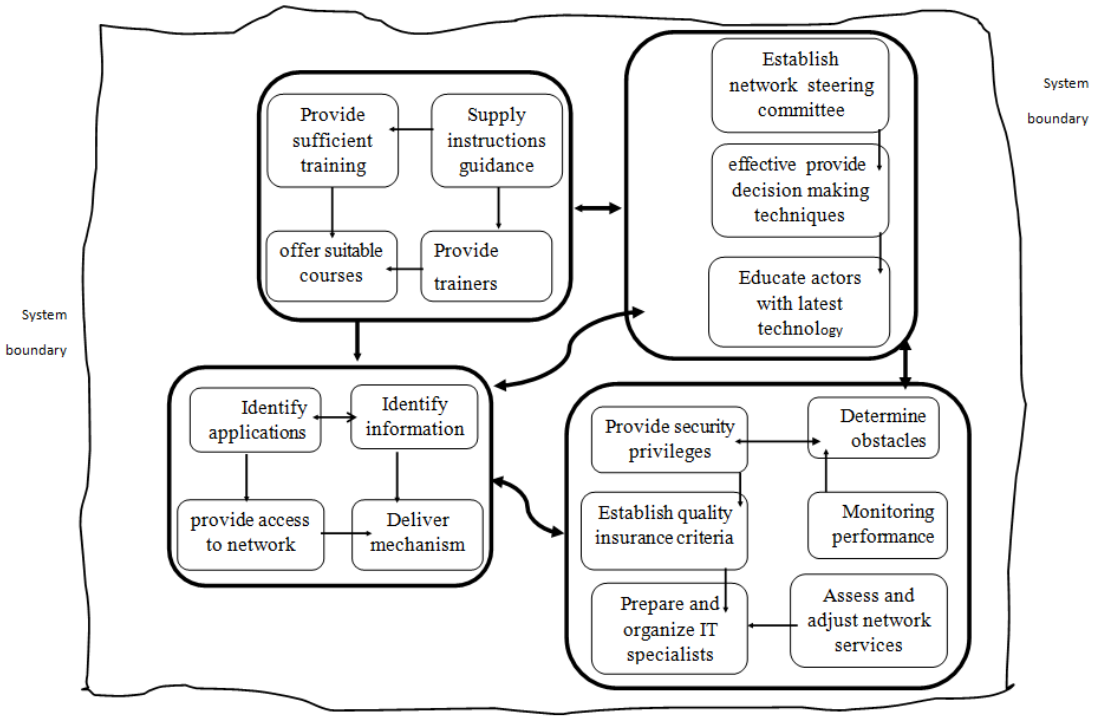

Figure 3: Conceptual model of the total system

The model is not a representation of activities actually carried out in the real world, but rather an ideal version of an organized set of activities**.**

7. VALUE OF THIS STUDY

It was clear from the literature review that this is the first application of SSM to investigate IT problems in developing countries in general and in Saudi Arabia in particular. The result of this study suggests that managers and IT professionals could apply this methodology to tackle ill- structured and unclear problems in their organizations. Using questionnaires and interviews was both sufficient and relevant to identify IT problems in Saudi Arabia to improve the problem situation. The result of this study indicates that this methodology is useful for different organizations. The model developed for this study is basic and adaptable to other organizations with a only minor modifications based on their particular situations.

8. CONCLUSION

The main focus of this study has been on the development of a conceptual framework to identify ICT problems in Saudi public organizations with the goal of improving the current status. The framework is aimed to use ICT to improve the information exchange between several organizations. This paper has examined how Checkland's Soft Systems Methodology might be applied to the problem of acquiring an effective information system capability for government agencies. Study results are reformulated, following Checkland's precepts, to achieve greater insight into the problem situation, and with the aim of identifying actions which could improve it. This study used a survey in the form of questionnaires and face-to-face interviews supplemented by a document analysis of activities relating to 12 different organizations. Problems and obstacles facing Saudi government organization were

identified as a result of this study and a conceptual model has been proposed. Finally, to the best of our knowledge this study represents the first attempt to apply SSM to model systems to tackle ICT problems in Saudi Arabian government agencies.

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