A Systemic Approach for Evaluating Stakeholder Collaboration within Requirement Collection

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Abstract

The involvement of Stakeholders in requirement collection of software projects is essential, and that is evident in the diverse methodologies available that emphasise stakeholder collaboration. However these processes scarcely provide further understanding of the social interaction, and its effect into forming collaboration had not been sufficiently addressed by software development research.

It is challenging to identify dominating factors that affect collaboration due to the complexity of stakeholder interaction. This thesis addresses such a challenge. It discusses a systems approach to the evaluation of stakeholder collaboration within requirement collection of software projects. A generic approach has been developed to contribute to our understanding of the problem and support stakeholders' collaborative involvement.

Based on understanding the nature of collaboration between stakeholders in requirement collection, and the concept of perception and its contribution into forming collaboration, the *EStaC* (**E**valuation of **Sta**keholder **C**ollaboration) approach is developed. *EStaC* is presented here to describe an integration of multi-methodologies that supports capturing stakeholders' perspectives, and therefore systemically it captures the essence of collaboration within its context.

EStaC contributes to the crucial phase of requirement collection with the ultimate objective of extending it to include means of improvement of stakeholder collaboration. It promotes the development of two modes of analysis, the design and diagnosis, which both involves using the principles of the Viable System Model.

The novelty of this work is specifically considered with the development of *the EStaC* approach because unlike other approaches, it focuses on the social act of interaction from a stakeholders viewpoint, by applying systemic strategies and cybernetic driven principles with concepts of fourth generation evaluation.

The research recognises evaluation of stakeholder collaboration as an important aspect in the requirement collection process in any software development. It concludes and supports the incorporation of such activities throughout various phases of requirement collection.

Declaration

I declare that the work presented in this thesis is, to the best of my knowledge and belief, original and my own work. The material has not been submitted, either in a whole or part, for a degree at this or any other university.

Bareeq AlGhannam

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To my beloved parents

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Glossary

BPR	**B**usiness **P**rocess **R**eengineering
CBE	**C**ollaborative **B**usiness **E**ngineering
CLD	**C**ausal **L**oop **D**iagram
EStaC	**E**valuation of **Sta**keholder **C**ollaboration
FOSTERing	**F**oundation **O**rganizational Alignment **S**trategy Development **T**rust Building **E**valuation **R**enewal
FP	**F**oreign **P**rocurement
GAO	United States **G**eneral **A**ccounting **O**ffice
IT	**I**nformation **T**echnology
KMOD	**K**uwait **M**inistry of **D**efence
MEWSIC	**M**ethod **E**ngineering **W**ith **S**takeholder **I**nput and **C**ollaboration
OO	**O**bject-**O**riented
PISO	**P**rocess **I**mprovement for **S**trategic **O**bjectives
pisoSIA	**P**rocess **I**mprovement for **S**trategic **O**bjectives **S**takeholder **I**dentification and **A**nalysis
RC	**R**equirement **C**ollection
SD	**S**ystems **D**ynamics
SDLC	**S**tructured **S**ystem **D**evelopment **L**ife **C**ycle
SODA	**S**trategic **O**ptions **D**evelopment and **A**nalysis
SSM	**S**oft **S**ystems **M**ethodology
SW	**S**oftware **E**ngineering
VSM	**V**iable **S**ystems **M**odel
DOD	**D**epartment **O**f **D**efence
NCS	**N**ational **C**omputer **S**ervices

Chapter 1

1. Introduction

This research has embraced a constructivist paradigm, where I the author have engaged in the role of the evaluator. My working experience in the environment of the case study goes back to the years (1993-2000). This experience has promoted the initiation of the study which started in 2005, and facilitated my involvement. This is a brief introduction more elaboration on my involvement is presented in the empirical chapters of the thesis (Chapters Five, Six, Seven and Eight).

Software developers are increasingly turning today to the involvement of stakeholders for their development process with high expectations of better requirement collection for successful software projects. Research in this area is vital and has been addressed by many researchers over the past eight years. These researchers include Hokenhammar (2001), Luna-Rayes (2004), Coulin, Sahraoui and Zowghi (2005), Furhling, Steinhauser, Hoff and Dunbar (2007), whom are a few of many others. This focus in research is evident in the development of the many techniques available that attempt to optimise the requirement collection process through stakeholder involvement. Such techniques include but are not limited to WinWin (Park, Port, Boehm and In, 1999), Participatory Design, Rapid Application Design, Multiview (Avison and Wood-Harper, 1990, as cited in Wood-Harper and Wood, 2005) and Requirement Encapsulation (Furhling et. al, 2007). Stakeholders offer the opportunity to increase software success by targeting hidden requirements and considering wider perspectives (Hokenhammar, 2001).

Requirement elicitation is a major phase in requirement engineering, which is recognised to be critically important to the overall development process and plays a key role in the success or failure of the project (Damian, 2003; Hickey and Davis, 2004; Sommerville, 2005). This is known to be a very complicated process (Coulin, Sahraoui and Zowghi, 2005).

Research shows that poor requirement elicitation is a major cause of software development failure, and that collaborative approaches need to be extended to current requirement elicitation to increase the opportunities of successful software development (Abran and Moore, 2005; Coulin, Sahraoui and Zowghi, 2005).

I believe that smooth requirement facilitation depends, in part, on the collaborative manner in which the stakeholders were involved during the requirements collection phase. This is supported by the literature as the work of Price and Cybulski (2005) consider requirement elicitation as a

> *profoundly collaborative task that relies on effective communication and interaction between all participating stakeholders*
> *(Dark and Shank, 1997, cited in Price and Cybulski, 2005)*

My reasoning is also supported by the increase call of stakeholder collaborative system development methodologies (Whitehead, 2007), and the fact that requirement collection deals with stakeholders' perspectives and relationships at different levels of detail (Kotoyana and Sommerville, 1998; Van Zanten, Hoppenbrouwers, and Proper, 2005).

Literature shows diverse definitions of the terms *stakeholder*, this research will adopt the most commonly used definition of stakeholder developed by Freeman (1984) which refers to

> *group or individual who can significantly affect or are significantly affected by an organizations activities*
> *(Freeman, 1984)*

Recent research recognises the importance of collaboration and planning for collaboration in critical activities (Tabaka, 2006; kamal et al., 2007), specifically in requirement collection, that is because software developers have faced difficulties in using strategies that involved collaborative involvement of stakeholders (Fruhling et al., 2007). Fruhling et al. argue that collaborative design techniques reflect the underlying assumption that stakeholders will engage in a collaborative manner during implementation; this is not necessarily the situation that practitioners experience in practice, where they

> *get lost in the complexity of the methodologies, …lose sight of goals… or ...stakeholder numbers become unmanageable* ...
>
> *(Fruhling et al., 2007).*

This last problem eventually leads to conflict, that occurs between stakeholders most of the time, which hinders collaboration and complicates the requirement collection process.

There is no agreement on a general theory of collaboration (Longario, 2005); nevertheless Wood and Gray (1991) have come up with a definition that is accepted by many researchers, and will be adopted in this research:

> *Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain*
>
> *(Wood and Gray, 1991)*.

In this research I believe that evaluation and intervention are essential to promote collaboration, which is in compliance to findings in similar research involving collaboration between inter-organisational agencies in e-government, in which it is called *management control* (Hu, Cui and Sherwood, 2006). That is because intervention and evaluation have significant affect on transforming a process state to better practice (Reynolds, 2008).

The evolution in evaluation which led to the Fourth Generation of Evaluation is said to have changed all the rules and issues that should be accommodated in the evaluation design. In the past, people under evaluation were not engaged in the design process of the evaluation (Guba and Lincoln, 1989). Alternatively, crucial aspects to stakeholders affecting the problem under investigation were overlooked, and were not considered for evaluation.

In this thesis, I argue that existing collaboration evaluation methods insufficiently consider stakeholders in the requirement collection of software projects. The incorporation of different perspectives of collaboration is important because these stakeholders are involved in the project for a variety of reasons and stakes (Beer, 1994; Chevalier, 2001). For requirement collection, the understanding of the interrelated dynamics of stakeholders to reinforce their collaboration is particularly important.

The main goal of this research is to investigate to what extent existing approaches can be integrated to develop a synergetic approach that supports the analysis and evaluation of stakeholder collaboration within the requirement collection of software projects. The particular perspective that I support is constructive, reflecting the derivation of collaboration definition from the stakeholders involved, reflecting their perceived experiences.

1.1. Collaboration in Requirement Collection Overview

The term collaboration in requirement collection refers to the social interaction in which the stakeholders are involved during the requirement collection of software development (Wilson and Howcroft, 2000; Alvarez, 2002; Luna-Reyes, 2004; Coulin, Sahraoui and Zowghi, 2005; Storey, Cubranic and German, 2005; Price and Cybulski, 2005). Requirement engineering as a process goes through several stages (Sommerville, 2000) such as:

1. Feasibility Study
2. Requirement Analysis
3. Requirement Definition
4. Requirement Specification

The above stages consist of iterative activities and involve continuous interaction between stakeholders resulting a requirements document that satisfies all parties involved. Thus various stakeholders work towards shared consensus for the software requirement document (Price and Cybulski, 2005). This need to involve stakeholders in the development process calls for a better understanding of the collaborative interaction between groups involved in software development (Alter and Ginzberg, 1978; Gottesdiener, 2003; Luna-Reyes, 2004).

Good collaboration frequently increases conflict resolution, and that is often a key requirement in a software collection process. Sommerville and Ransom (2005) produced a set of guidelines that could improve the requirement engineering process, two of which are presented in Table 1.1.

ID	Guideline
04.03	*Identify and consult system stakeholders*
05.04	*Plan for conflicts and conflict resolution*

Table 1.1. A Caption of the RE Guideline for Good Practice
(Source: Sommerville and Ransom, 2005)

One of the major obstacles recognised in requirement elicitation is maintaining an agreement on the requirements from the stakeholders and validating them (Nuseibeh and Easterbrook, 2000).

> *These difficulties are compounded by a number of contextual issues, including contractual and procurement issues, including political and social milieu in which the introduction of a new computer system changes the nature of work and the organization*
>
> *(Nuseibeh and Easterbrook, 2000)*.

Many researchers consider collaboration in requirement collection as a complex relationship between stakeholders (Coulin, Sahraoui and Zowghi, 2005). This complex relationship is affected by factors of cultural and political inference (Chozos, no date; Nuseibeh and Easterbrook, 2000; Jones, 2005; Price and Cybulski, 2005; Fruhling et. al 2007). These social, cultural and political issues that influence interactions between stakeholders need to be examined (Hengest and De Vreede, 2004). Alvarez, (2002) claims, "*Requirement elicitation is a discursively mediated social process"*. The internal structure of collaboration in general is dynamic, and consists of an interaction of individuals through a process of feedback that binds the individuals into the collaboration process. The environment in which the experiences evolve is perturbed by the changes in the system, which then feed back into the system behaviour (Jones, 2005). Therefore, there is a need to focus on understanding collaboration.

While current methods described in the literature for evaluating collaboration identify the involvement of multiple stakeholders, they fail to address the integration of these multiple views into constructing what is important to their collaboration, without losing the complexity of the interaction context in which they are embedded (as will be analysed in Chapter Two). The Evaluation Handbook in W.K. Kellogg Foundation Website recommends the use of a constructivist paradigm in evaluation design. It argues that this provides a better balance of understanding of evaluation, which is achieved by focusing on who are the people involved in the evaluation. It further argues that meaning is lost when using a hypothetico-deductive paradigm, this being the dominant approach in evaluation research. A constructivist approach using ethnography and systems principles is said to have been successful in developing an evaluation meta-methodology for stakeholder co-operation developed from research by Ramage (1999) on system design.

1.2. Problem Statement

Requirement collection is the first step in any software development and the most important, as it has great impact on the outcome of the requirement engineering process which consequentially affects the success of the overall software project (Luna-Reyes, 2004; Chisan and Damian, 2005; Sommerville, 2005). The following sections provide the basis for defining the research study problem.

1.2.1. Motivation and Need for this Research

Many software projects fail even after using tools that identify success and risk factors (Luna-Reyes, 2004). This failure and the need to involve stakeholders in the development process calls for a better understanding of the collaborative interaction between groups involved in software development (Gottesdiener, 2003; Luna-Reyes, 2004; AlGhannam, Deeks and Davison, 2006). It seems evident that in software development the smooth transition from old to newly redesigned systems depends, in part, on the collaborative manner in which the stakeholders were involved in the development of the software project. This is especially important during the requirements collection phase, because it deals with stakeholders' perspectives and relationships at different levels of detail (Kotoyana and Sommerville, 1998). However, as pointed out in the introduction of this chapter there is no agreement on a general theory of collaboration and as a result, Wood and Greys 1991 definition of collaboration is still being referenced to best define it.

A better understanding of how the process of collaboration evolves is crucially significant and will aid the requirements collection process. A context specific approach is needed for evaluating the collaborative nature of stakeholders, identifying intervention points to maximize collaboration and promoting acceptance to change in software projects (AlGhannam, Deeks and Davison, 2006). It is important that the approach can be integrated with any planning of software development process or business process reengineering.

The following sections provide the basis on which this research has been conducted into the problem of stakeholder collaboration in requirement collection.

1.2.2. Gap in Literature

Literature shows the need to involve stakeholders in the system development process (Sing and Kotz, 2003; Luna-Reyes, 2004). This need is evident in the diverse methodologies available that emphasise stakeholder collaboration, such as Soft Systems Methodology (SSM) (Checkland and Scholes, 1990), Process Improvement for Strategic Objectives (PISO) (Deeks, 2000) and Strategic Options Development and Analysis (SODA) (Von Mullekom and Vennix, 2000). In addition to the techniques presented in the introduction, other methodologies have embedded collaboration within their processes, such as Collaborative Business Engineering (CBE) (Hengest and De Vreede, 2004). None of the above methodologies go further into elaborating upon the collaborative relationship that unfolds between participating stakeholders.

Stakeholder Collaboration research within Software development is an uncharted territory that needs more attention (Luna-Reyes, 2004). Although collaboration between stakeholders is highly recognised and called for in many software development processes, there is little foundation of research or guidance given on how to achieve such collaboration let alone evaluating it (AlGhannam, Deeks and

Davison, 2006). The literature fails to provide a framework to underpin software development practitioners with the act of stakeholder collaboration evaluation as part of their planning strategy, either no evaluation is conducted or *ad hoc* procedure is used. Therefore it is considered to be unexplored area and better understanding is demanded by investigating alternative ways of knowing and understanding. I believe this is the case because although there is a considerable amount of research covering collaboration in general, nevertheless the term collaboration is still difficult to standardise (Reilly, 2001; Longoria, 2005).

Current methods described in the literature for evaluating collaboration identify the involvement of multiple stakeholders, but scarcely address the integration of these multiple views into shaping a systemic context specific evaluation of stakeholder collaboration. This kind of evaluation paradigm that involves stakeholder viewpoints is recommended to provide a better understanding of a problem (Guba and Lincoln, 1989). Most evaluations are descriptive; for instance Svendsen (1998) developed a six step framework called the FOSTERing stakeholder relationship, which was a guide for organisations to follow to benefit from maximum stakeholder collaboration. She has described stakeholder collaboration as an integrated management approach that focuses on building relations based on long-term organisational goals, missions and values. Another example is the collaboration evaluation framework (Klein and Adelman, 2005); this work provides a descriptive evaluation of collaborative environments by making specific consideration of the technological arrangement with reflection of situation self awareness. Further elaboration on collaboration research is discussed in Chapter Two.

The work presented in this thesis is particularly concerned with how the social act of collaboration is constructed and evolves; the need for stakeholders' different perspectives encapsulates patterns of collaboration constructing a unique collaboration model and should influence the design of the evaluation approach to stakeholder collaboration.

1.2.3. Contribution and Significance

I provide a generic approach that uses an integration of methods and methodologies for capturing the stakeholders' perspectives of their collaboration process during software requirement collection, and use this approach as the basis for evaluating their collaboration throughout their requirement collection phase. I call it the *E*valuation of *Sta*keholder *C*ollaboration (EStaC) Approach within Requirement Collection.

1.2.4. Purpose:-Where can EStaC be Used?

The work I present is particularly concerned with how multi-perspective stakeholder involvement in software development should influence the design of collaboration evaluation approaches and methods.

In general, requirement collection starts with the identification of potential relevant stakeholders that need to collaborate in order to produce the requirement document. EStaC will allow the deficiencies affecting collaboration to be highlighted and addressed where they are particularly sensitive to social, political and organisational cultural issues. This work proposes an integrated approach that can be used in the planning and monitoring of requirement collection, which is shown to systemically capture the essence of collaboration within its context. It provides a visualised structure that can help project managers to identify intervention points that should lead to better stakeholder collaboration.

The focus of EStaC is to establish, in depth, understanding of the collaboration process, which enables the evaluator to develop intervention points to be used in the project. I see EStaC as an initial stage of any software development project, used as an integral part of the planning phase or throughout requirement collection.

1.3. Aim of the Research

As explained above, the aim of this research is to evaluate the process of stakeholder collaboration within the requirement collection phase of a software development by developing a suitable methodological approach.

1.4. Research Question

In order to fulfill the aim of the research in the terms already described, an evaluation of the collaboration of stakeholders needs to be achieved by the use of an approach that encapsulates the complexity of the problem and models their interaction. Criteria that shape the conception of collaboration are to be encapsulated and the impact of their interaction needs to be examined. Thus we need to find an answer to the following question:

> *Can a suitable approach be developed to evaluate the collaboration of stakeholders involved in the requirement collection of software development?*

As the research progressed other questions evolved which will be addressed later in the thesis, throughout the chapters. A mapping of these evolving questions is presented in the thesis structure shown in Figure 1.1 of (Section 1.7.2).

1.5. Objectives

In order to achieve the aim and answer the research question, a set of objectives needs to be achieved:

1. Research current philosophies and methodologies in stakeholder theory, collaboration theory and systems theory.
2. Develop criteria to evaluate stakeholder collaboration based on these philosophies and methodologies.
3. Critically evaluate and analyse the current methodologies of stakeholder collaboration in reference to criteria developed.
4. Develop a new collaboration evaluation approach that satisfies criteria developed.
5. Evaluate the new approach developed.

1.6. Originality and Novel Contribution

Because of the complicated nature of the problem, work in this thesis represents a multidisciplinary research that has been conducted based on an integration of disciplines from collaboration, stakeholder and systems theory. The understanding of two concepts has influenced the direction of addressing stakeholder collaboration. These concepts are constructivism of perceptions (which is the foundation on which the approach is based) and abduction (based on the ontology of logical reasoning of the phenomena). Total understanding of collaboration is perceived differently under different context, thus it is constructed according to that specific context. As an output, the approach "*E*valuation of *S*takeholder *C*ollaboration" (*EStaC*) has been developed; where a cybernetic model has been used in structuring an integration of systems methods and stakeholder analysis methods in combination with constructive evaluation concepts.

The novel contributions are:

- Development of criteria to evaluate stakeholder collaboration in software requirement collection.
- Development of an approach to evaluate stakeholder collaboration within software requirement collection.

1.7. Plan of Thesis

The work in this thesis is particularly concerned with how stakeholder perspectives of collaboration should influence the design of collaboration evaluation and the need to involve relevant stakeholders in the evaluation process. This work is presented in nine major parts as shown in Sections 1.7.1 and 1.7.2. The conceptual research framework is shown in Figure 1.2 (Section 1.7.3).

1.7.1. Roadmap:-Chapter Description

Table 1.2 presents an overview of the chapters covered in the thesis and how they relate to the argument of the research. It also gives an overall description of the chapters structuring the thesis layout.

Argument	Ch #	Chapter Topic
The collaboration between stakeholders in the requirement collection phase of a software development project is a complex process that depends on the dynamic interaction between relevant stakeholders and is affected by unlimited factors	1	Introduction Collaboration of Stakeholders in software requirement collection
However the interpretation of dynamic interaction of stakeholders often reflect the analyst's own conception and his analysis of the situation at hand, rather than the inputs of the many diverse stakeholders involved in the collaboration under evaluation. Current methods described in the literature for evaluating collaboration identify the involvement of multiple stakeholders, but fail to address the integration of these multiple views into constructing what is important to their collaboration without losing the social and political complexity of their interaction.	2	Critical review of current practices that involve the evaluation of stakeholder collaboration
By treating the collaboration process as a system with feedback, as a subsystem of the environment in which it belongs and as a system that consists of subsystems, we can model the dynamic interaction of stakeholders according to their perception of what motivates the collaboration process, and thus a better understanding of their conceptions is achieved by considering their interrelations with their environment.	3	Critical review of available system models, methods and methodologies
I provide an approach that uses multiple methods and methodologies for capturing stakeholders perspective of their collaboration process,	4	An approach for evaluating stakeholder collaboration in software requirement collection
and use this approach as the basis for evaluating their collaboration throughout their requirement collection phase.	5	A research strategy
	6	Case Study One
	7	Case Study Two
	8	User Assessment
This approach is shown to systemically capture the essence of collaboration within its context, give a way to better understanding the process and guidelines for intervention to be used in the planning phase and throughout the requirement collection process.	9	Conclusions & Further Research

Table 1.2. Thesis Roadmap

1.7.2. Thesis Structure Model

Thesis structure showing key research questions and the progression through the thesis with each research question mapped to thesis chapters is shown in Figure 1.1.

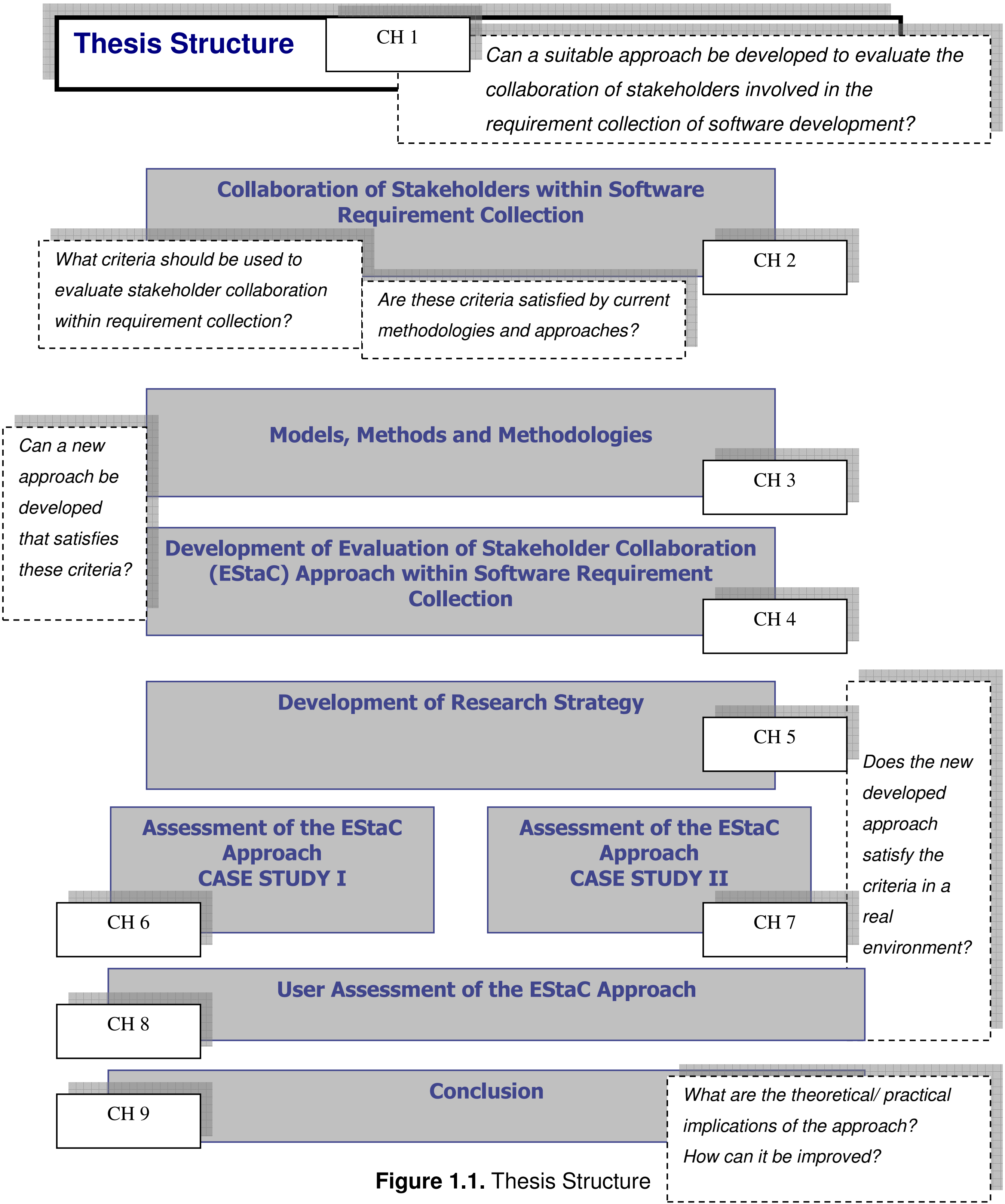

Figure 1.1. Thesis Structure

1.7.3. Conceptual Research Framework

The conceptual research framework is shown in Figure 1.2. It represents key conceptual stages of this study associated with outcomes, giving indication to chapter coverage.

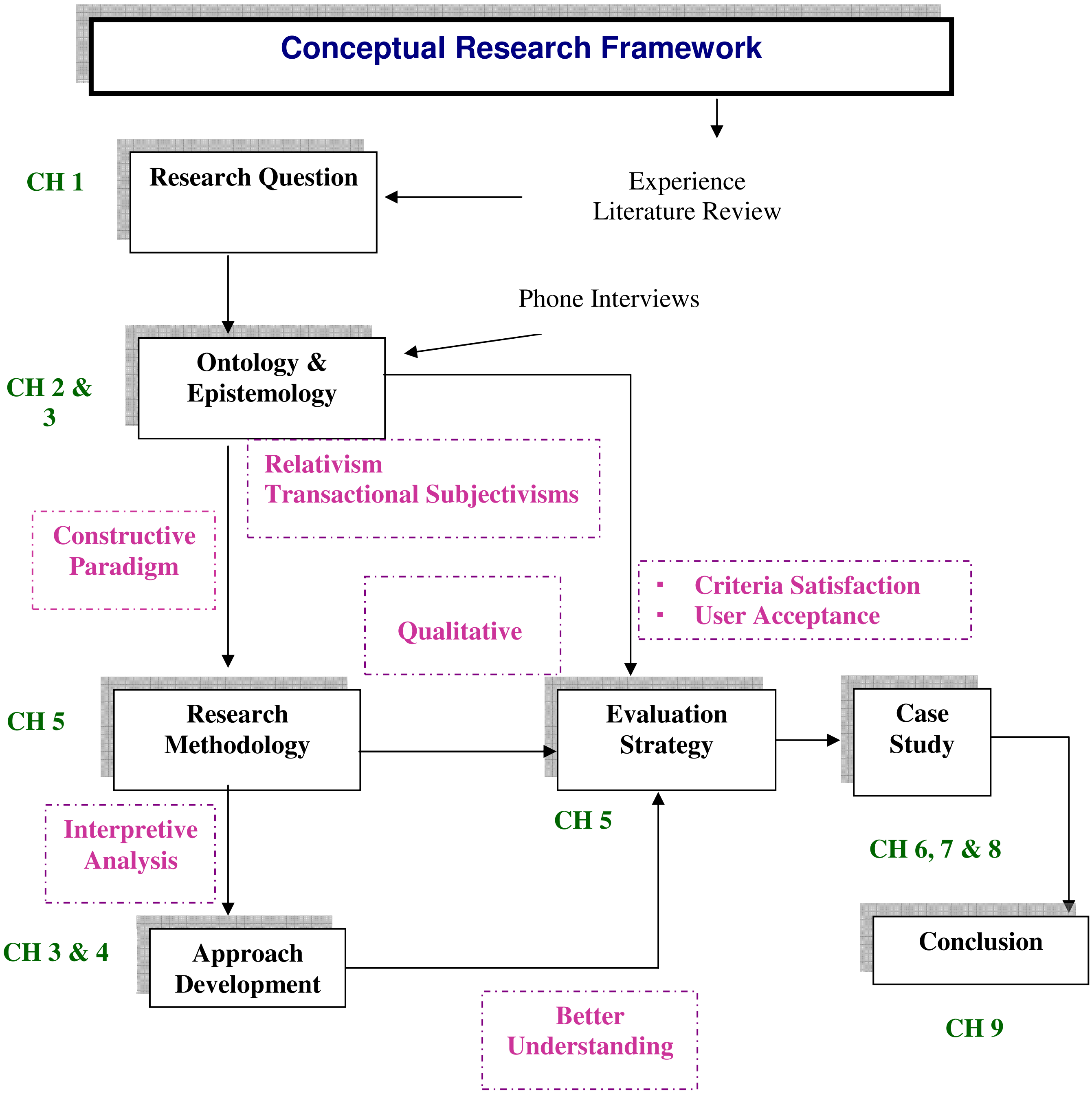

Figure 1.2. Conceptual Research Framework

1.8. Summary

This chapter has presented an overview of the thesis work, which involved the plan, structure and chapter description. An overview of stakeholder collaboration in requirement collection is presented. Research in the area shows that, a gap exists in evaluation methods particularly developed, for the purpose of gaining an in depth understanding of the collaboration process between stakeholders during the requirement collection phase. The novel contribution of the thesis work that is covered in the coming chapters is presented, giving emphasis on areas of potential use of the approach.

Critical analysis of the involvement of stakeholders in collaboration within requirement collection settings of software development is given in the next chapter.

Chapter 2

2. Current Practices Involving Stakeholder Collaboration

2.1. Introduction

In Chapter One the importance of stakeholder collaboration within requirement collection of software projects was discussed, as was the need to develop an evaluative approach that diagnoses the collaboration from different perspectives. Some researchers have developed and tested different approaches and theories in this area. Key among these developed are: Systemic Evaluation for Stakeholder Learning (Ramage, 1999), The Dynamic Theory of Collaboration (Luna-Reyes, 2004) and Collaborative Engineering (Fruhling, et. al 2007), which are discussed later in this chapter.

The purpose of this chapter is to determine a set of criteria, which provide a means of evaluation of these approaches and theories. These criteria are developed by examining the literature of collaboration going back to its ontology and philosophical background where new criteria for evaluation are developed. Current theories and approaches are then critically analysed against the new criteria and conclusions given.

2.2. The Ontology of Stakeholder Collaboration in Requirement Collection

Literature shows that stakeholders are involved in a social interaction during the requirement collection of software development (Wilson and Howcroft, 2000; Alvarez, 2002; Luna-Reyes, 2004; Coulin, Sahraoui and Zowghi, 2005; Storey, Cubranic and German, 2005), and that social factors impact the success of the overall software development (John, Maurer and Tessem, 2005). Requirement Engineering is recognised to be critically important to the overall development process playing a key role in the success or failure of the project. One of the major recognised obstacles is the need to maintain an agreement on the requirements from the stakeholders and validating them as they go through contextual issues affected by a series of social and political problems (Nuseibeh and Easterbrook, 2000), that involve gaps in communication (Kilov, 2004).

Some methodologies have embedded collaboration within their processes, such as Participatory Design, Rapid Application Design, Requirement Encapsulation (Furhling, et. al, 2007), Participant Stakeholder Evaluation (Giordano and Bell, 2000), Collaborative Business Engineering (CBE) (Hengest and De Vreede, 2004) and Method Engineering With Stakeholder Input and Collaboration (MEWSIC) (Edwards, Thompson and Hardy, 1998). However, none of these go further into elaborating upon the collaborative relationship that unfolds between participating stakeholders. A need to understand the nature of collaboration is in order. This gap and the need for further understanding lead to an expansion of the research questions to include:-

> *What criteria should be used to evaluate stakeholder collaboration within requirement collection?*

To answer that question a general understanding of the word collaboration must be discussed. I believe that the definition of collaboration depends on the concepts and techniques adapted to analyse it, therefore the criteria for evaluating it should be consistent with its nature. Using analytical thinking collaboration could be viewed as a perfect system that is analysed in term of its parts as a machine; where the parts are considered independent sets (Gharajedaghi, 2004). When thinking about collaboration evaluation we could divide it into separate parts that construct it and evaluate each part according to some criteria. For example it is common to regard collaboration as the amount of participation and communication between stakeholders or the amount of questions asked during a session. Some criteria could be assigned and set against a target such as a minimum amount of interaction or the number of questions asked during a session. The target might be reached but still stakeholders could be suffering from low collaboration. This made scholars think that collaboration is too complex to degrade it into just one or two constructs because it involves groups, and groups need to be treated as complex systems (Akrivou, Boyatzis and McLeod, 2006).

Systems thinking states that the properties of the parts can only be understood in terms of the whole as opposed to analytical thinking, this provides an alternative way to understanding the nature of collaboration (Checkland, 1981). The context is just as important as the problem under analysis. Taking collaboration from its context undermines it and loses its holistic value. This is similar to other complex problems as many decisions fail as a result of focusing on certain parts in isolation of the whole which complies with findings discovered through the definition of Quantum Theory where certain particles when analysed in isolation produced no useful information while analysis conducted as a whole was successful and gave significant meaning which is cited in Eltemsahi (2001).

The term collaboration in software development is associated with stakeholders. Software development is affected by diverse cultural factors that impact the progress of the project (Borchers, 2003), because culture impacts the communication styles between individuals (Massey, et al., 2001). Therefore I believe that in order to understand collaboration, the social, cultural and political issues that influence interactions between stakeholders need to be examined (Hengest and De Vreede, 2004). Also, an insight must be gained into the interactions that occur between individuals (Jones, 2005). I strongly agree with the opinion which emphasises that evaluation must be conducted using qualitative tools distributed over time because the social action of individual collaborations unfolds through time, affected by accumulated values (Black et. al 2002).

In order to understand the nature of collaboration in its correct perspective, a holistic view needs to be established. Interdependency of constructs that contribute to the definition of collaboration need to be synthesised as it is impossible to evaluate collaboration from specific constructs in isolation; such isolated evaluation will have no meaning.

A review developed by Longoria (2005) supports the systemic perspective of analysing collaboration. It synthesises fifteen definitions of collaboration in the literature of multidisciplinary studies, and from these extracts three definitions on the basis of shared broad themes as cited offered by Graham and Barter, Mattessich and Monsey, and Wood and Gray. These shared themes are:

> *(1) the fundamental nature of collaboration is that of joint activity in the form of relational system between two or more organizations; (2) an international planning and design process results in mutually defined and shared organizational goals and objectives; (3) structural properties emerge from the relationship between organizations; and (4) emergent "synergistic" qualities characterize the process of collaboration.*
>
> *(Longoria, 2005)*

Literature shows that Wood and Gray's (1991) definition (given in Chapter One) is a key reference for collaboration; as it is referenced by most work in collaboration. Longoria (2005) argues this definition is considered the best so far by scholars, because unlike definitions offered by Graham and Barter, Mattessich and Monsey, she argues it does not specify an outcome for collaboration and it is informed by a conceptual framework governed by organisational relations. It therefore emphasises the realisation of collaboration being context specific, which I agree with.

The literature links collaboration to various constructs, characteristics or features, some scholars have key features in specific that they think influence the collaboration process (Cugini et al. 1997; Borden and Perkins, 1999; Head, 2004) and the most construct I found linked to is communication (Ellingson, 2002).

Communication is at the heart of software elicitation, and plays a major role in it (Price and Cybulski, 2005; Van Zanten, Hoppenbrouwers and Proper, 2005), because coordinating collaborative activities among a group requires communication (Beer, 1994; Warner, Letsky, and Cowen, 2003; Poltrock et al., 2003; Head, 2004; Deek and DeFranco, 2004). According to Visser (2007) and his employment of the Palo Alto approach to communication theory, "*it is impossible not to communicate"*, in any interaction that involves persons. He argues that communication can be verbal or non-verbal, intentional or non-intentional, it is in the expressions and behaviours, and these cannot be explained out of content.

Poor communication and lack of coordinated team work lead to expensive information systems failure, and the quality and ease of communication, and common language to discuss a project increases the effectiveness of collaboration (Jones, 2005). Collaboration and communication are vital for groups working together towards a common goal (Deek and DeFranco, 2004). Studies show that as the level of control behaviour in a team increases, performance increase (Henderson and Lee, 1992). As a result of collaboration many benefits are observed such as distributed learning, consensus building which diminishes interpersonal conflict, and cognitive synchronisation (Deek and DeFranco, 2004). Features of communication make it a necessary construct for collaboration; the approach developed must inherently support analysing communication as a necessary construct for collaboration, therefore I will not add it to the initial collaboration constructs list which I present in the coming section (which will serve as initial but not necessary constructs for the approach as will be given in Chapter Four).

Based on my review of collaboration in various fields, I have brought together what I considered to be initial constructs required for appropriate collaboration. Critically analyzing these constructs synthesized issues discussed later in Section 2.4 that lead to the derivation of the criteria developed for evaluating stakeholder collaboration presented in the same Section 2.4. The Initial Collaboration Constructs (Base Constructs) are:

- **Knowledge Sharing:** When considering collaboration the first thing that comes to mind is communication, as there will never be collaboration without means of communication for the purpose of knowledge sharing (Beer, 1994: Ramage, 1999: Chevalier, 2001; Lerdahl, 2001; Poltrock et al., 2003; Luna-Rayes, 2004; Noble, 2004; Price and Cybulski, 2005; Smith, S., 2005; Zhang, Faerman, and Cresswell, 2006). Knowledge is very important for effective collaboration (Noble, 2004) because this requires the correct transfer of perceptions between actors involved (Luna-Rayes, 2004; Zhang, Faerman, and Cresswell, 2006). This eventually leads to a shared perspective between involved stakeholders.

- **Roles:** The subject of roles has been investigated by various researchers in relation to collaboration (Black et. al, 2002; Brown and Keast, 2003; Davison Deeks and Bruce, 2003; Head, 2004; Nobles, 2004; Owen, and Janz, 2005; Head, 2006). It is an important factor that affects a collaborative process because clearly defined roles of stakeholders involved in a project enhances the collaborative process because they evolve from the projects' shared goals and vision.
- **Interests:** Each stakeholder in collaboration has specific interests or stakes that are diverse. These interests could be on a personal or professional level. Whatever these interests are, they keep stakeholders engaged in effective collaboration (Beer, 1994; Chevalier, 2001; Vartiainen, 2003).
- **Trust:** Trust is considered by many researchers to be essential to collaboration (Beer, 1994; Ramage, 1999; Bendell, 2000; Brown and Keest, 2003; Luna-Rayes, 2004; Paul and McDaniel, 2004; Jones 2005; Price and Cybulski, 2005; Smith, S., 2005; Head, 2006) as it relates to past experiences that influence current attitudes and behaviours heavily sculptured by culture and the social presence of the stakeholders involved (Lowry et. al, 2007). Trust is commonly related to knowledge sharing as many theories have been derived relating the two but no general theory has been derived so far (Luna-Rayes, 2004).
- **Empowerment:** Empowerment is associated in the literature with collaboration (Beer, 1994; Lerdahl, 2001; Smith, S., 2005). In the context of requirement collection, it gives stakeholders the authority of power which enables them to give approval without going back to senior management; a research conducted by Smith (2005) proves that empowerment of stakeholders involved in health services improved collaboration between them which led to better quality of health services in NHS systems. Empowerment enables better collaboration as less time is spent on going back to get approvals.
- **Dialogue:** Dialogue is linked to collaboration (Senge, 1990; Ramage, 1999; Bendell, 2000; Chevalier, 2001; Halal, 2001; Lerdahl, 2001; Pereira, 2001; Smith, 2005; Bohm, no date; Jones, 2005; Longoria, 2005; Hu, Cui and Sherwood, 2006; Gajda and Koliba, 2007) as from its Greek origin it is translated "*through the meaning of the word*" (Bohm, no date). That is open unobstructed dialogue through conversation and communication allows the transfer of the perception of knowledge. Dialogue involves meanings that are

uncovered through collective insight under cultural differences, and it involves a sense of winning gained by all participants (Bohm, no date).

It is realised that these are not the only constructs that affect collaboration and that others might have stronger effect in certain context. That is why these are only an initial set, used as motivation factors in this study for the stakeholders to open up and submerge in negotiation. I have chosen these constructs because they were found in key literature (as presented previously) and thus would serve as initial or basic constructs for the work in this study. An empirical investigation of the constructs is presented in Chapter Five in order to consider their appropriateness as potential starting points for conceptualising the definition of stakeholder collaboration.

A further analysis of theories that underlie the philosophical background of collaboration given in the next section will further support the understanding and thus the extraction of criteria that can provide a means of evaluation of current approaches, methodologies and theories in stakeholder collaboration.

2.3. Philosophical Background and Epistemology

The next subsections present the philosophical background of collaboration through the various attempts of knowing collaboration through some developing theories and methodologies. A further detailed analysis of other key theories and methodologies involving stakeholder collaboration is given in Section 2.5 against the developed criteria of Section 2.4.

2.3.1. Theories and Methodologies of Collaboration

> *Collaboration is a process in which two or more agents work together to achieve shared goals*
>
> *(Jones, 2005).*

In order to achieve collaboration among a group an understanding of the interactions that occur between individuals must be established. There is continuous feedback (for example through conversation) between individuals in the process of collaboration. This has been recognised by Jones (2005) during development of his cultural theory of collaboration framework. He combined four system theoretic approaches (Burnham systems aesthetics, Wiener's cybernetics, Deleuze and Guattari's machinic Phylum and Maturana) to capture the interactive behaviour of collaboration between artists, system developers and the devices they produced and used. His work shows that the internal structure of collaboration in general is dynamic. It consists of an interaction of individuals through a process of feedback that binds the individuals into the collaboration process. The environment in which the experiences evolve is perturbed by the changes in the system, which then feed back into the system behavior. The cultural systems theory of collaboration shows how widely varying forms of collaboration can be described by a similar set of dynamics.

Amoroso and Reining, (2005) attempted to measure the effectiveness of collaboration. To do so they addressed certain aspects of collaboration technology effectiveness and offered both theoretical insight and practical implications.

Experiences from naval collaboration can be used to measure the effectiveness of collaboration (Noble, 2004): Here knowledge between team members is the key to effective collaboration. The paper introduced two concepts: "*knowledge enablers*" (which describes the type of knowledge that team members need), and a "*meta-knowledge*" (evaluative knowledge to base decisions on).

Team Syntegrity is a collaboration method developed by Beer (1994). It can be used within the Viable System Model (covered in Chapter Three) to achieve stakeholder consensus. It can also be used in any applications as a collaborative tool. The power of the model is achieved from the geometric shape of icosahedrons. The structure of meetings is based on the shape of the ICOSAHEDRON Structure, 20 icosa faces, 30 struts, 12 vertices. Team Syntegrity is a group process which facilitates team building, innovation and planning. It is non-hierarchical so that communication can be open and syntegrity can be captured.

Inductive Model of Collaboration (Butterfield, Reed and Lemak, 2004) approach calls for the need of involving the collaboration of stakeholders between three nuclear US plants. The research output provided an instrument that is used to examine why collaboration groups are formed between stakeholders and what are the outcomes from such process.

Analysing the work of Cugini et al. (1997), a method is presented that uses the concept of scenarios as a reusable tool to evaluate collaboration tools. Scenarios are used as tools to direct system usage. The idea is to use scenarios to capture collaborative environments. The collaborative environments may be subdivided into collaborative activities. These activities have collaborative capabilities that provide services. In order to facilitate the services technology is used. Classification of collaborative activities is one way of getting in control of the fuzzy complexity of collaboration. Many measures were derived to evaluate collaboration at various levels of abstraction of the framework suggested. One measure that is worth notable is awareness, making knowledge of participators, their roles, and their contribution. This signifies that collaboration is an interlinked process influenced by interlinked activities which made me look at the design process as a whole, try to divide it into sub activities, try to define services that may aid the activities. Just as scenarios were used to evaluate collaborative activities, patterns (discussed in Chapter Three) could be used to evaluate collaboration as well. The significance is the inclusion of the context in which the activity is encapsulated which adds a sense of quality to the data and adds the required analysis as well.

In relevance to requirement collection in software development, reaching consensus regarding the requirements documentation is a goal (what ever the methodology or theory used) and thus further discussion of its relation to collaboration is presented in the next section.

2.3.2 Collaboration and Consensus

It is significant to be aware of other terminologies that are naively confused with collaboration. Table 2.1 shows a matrix developed by Brown and Keast in (2003); varying terminologies of cooperation, coordination and collaboration are linked to networked arrangements.

Structure	Integration Relationship	Duration	Goals/ Perspectives	Structured Linkages	Formality	Risks/Rewards
Networking	Cooperation	Short term	Independent Outcomes, Participating organizations remain autonomous	Movement in and out by members, loose flexible links	Informal	Low risk/ modest reward
Network	Coordination	Medium term; depends on previous working relations	Joint planning and programming But members remain autonomous	Some stability of members, medium links and often central hub	Informal/ Formal	Increase in risk and benefits up to a point
Network Structure	Collaboration	Longer term	New systems and operations Highly interdependent with sharing power	Members move outside traditional functional areas, tight links	Formal	High risk/ high reward

Table 2.1. Networked Arrangements (Source: Brown and Keast, 2003)

Following Brown and Keast's (2003) classification, collaboration involves a strong commitment between the stakeholders as opposed to cooperation and coordination, this they have described as an "*aspiration not a starting point*" in order to achieve long term shared goals.

Head (2004) analyses what are the prerequisites and dynamics of effective collaboration. From his work nine dimensions were identified for effective collaboration:

1. *Leadership*
2. *Team composition*
3. *Clear roles and responsibilities*
4. *Resourcing and funding*
5. *Inclusive communication within the team*
6. *Efficient organizational support*
7. *Trust and mutual respect*
8. *External liaison with sponsors and stakeholders*
9. *Review and evaluation*

The defined dimensions overlap with some of the criteria I want to use in defining collaboration, which supports my decision of choice presented in Section 2.2. Head (2006) stresses on the distinction between the terms collaboration, cooperation and coordination, he argues that it is a complex situation that requires a special "*partnership*" between the stakeholders.

In requirement collection, this partnership between stakeholders is achieved when consensus is reached by them. Studies show that consensus is a cognitive stage in team collaboration that eventually leads to achieving the team goals (Warner, Letsky and Cowen, 2003). In negotiating requirements of an information system, it is recognised that diverse factors influence the processes (Price and Cybulski, 2005). Basically there are four types of problem solving styles in any collaborative arrangement that involves groups such as stakeholders**:** Win-win, where both actors achieve their required goals; Win-lose and Lose-win, where only one actor achieves his required goals; and Lose-lose were no actor achieves the required goals (Filley, 1975). Win-win is the ideal situation that collaboration aims for; however in a real environment involving different stakeholders with different goals, interests and perspectives, this can be very difficult to achieve. Filley (1975) views consensus as an outcome of a win-win style of problem solving or conflict resolution were goals are satisfied through integrated decision making methods. Consensus is a form of compromise which stakeholders need to reach for the sake of achieving the goals of the requirement collection process. Therefore, goal identification is viewed as a crucial task in any collaboration and must be incorporated at the very beginning. This is especially important during requirement collection. Goals of the organisation must be clearly specified and unambiguously understood to reach consensus through collaboration between stakeholders involved. I say this because according to Brown and Keast's classification of collaboration in Table 2.1., consensus must be reached to assure a win-win solution. As cited in (Ruhe, Eberlien, and Pfahl, 2002), Boehm et al. WinWin spiral model assists stakeholders in creating such solutions in requirement collection, they have added a level of stakeholder preference to support decision making of the selection of the requirements.

2.3.3. Stakeholders and Collaboration

As could be depicted from the discussions in the previous sections of this chapter the analysis of collaboration could not be investigated without the underlying involvement of stakeholders that perform the collaboration act.

The term *stakeholder* was "*first recorded in history in 1708 to mean a bet or deposit*" (Chevalier, 2001). The concept of stakeholder theory as it is used nowadays can be traced back to Barnard in 1938 (Andriof and Waddock, 2002). It was a term that was originally used in organisational life. After Freeman's definition in 1984 scholars integrated the stakeholder thinking to be used in business, governmental, political, economic, civic and environmental studies. The philosophical foundation naturally matured and unfolded to be used in information system (Pouloudi 1999), systems thinking and requirement engineering as well (Ramage, 1999). Extending the definition of stakeholders presented in the introduction of Chapter One to the domain of system design and development, a stakeholder would be any group or individual who will use the system, affect the system or be affected by the system (Davison, Deeks and Bruce, 2003). Involving stakeholders in the system design process is widely seen in participatory design approaches (Furhling, et. al, 2007). The IEEE Recommended Practice for Software Requirements Specification document indicates that the involvement of stakeholders throughout the development process contributes to quality criteria (Hokenhammar, 2001). This is also the case for model building; stakeholders are called to be involved from early stages to facilitate collaborative arrangements of complex systems (Mostashari and Sussman, 2004).

Systems thinking and requirement engineering are using the term as well (Ramage, 1999). Ignoring stakeholders during system development (especially requirement collection) is an inherent defect in many software engineering approaches such as the Structured System Development Life Cycle (SDLC) and Object-Oriented (OO). This is rectified by the spread of more stakeholder participatory design and requirement elicitation methodologies pointed out in Chapters One and Two. The literature points out to the importance of identifying relevant stakeholders in requirement collection, identification of stakeholders at an early stage of a project is crucial (Elias, Cavana and Jackson, 2002). However, most information systems development methodologies and software development processes, especially those that involve stakeholder interaction, offer little guidance regarding stakeholder identification and do not go further into analysis. Although a tremendous amount of research is conducted in this area, however scarce work is done to find a specific approach (Pouloudi and Whitley, 1997; Sharp, Finkelstein and Galal, 1999); Davison (2006) concludes that development methodologies such as ETHICS, SSM, Multiview, Structured Analysis, PADM and BPR do not provide explicit knowledge on how to conduct stakeholder identification and analysis. Thus I contend that they do not further offer the explicit know how of the unfolding of collaboration between involved stakeholders.

In this research the focus will be stakeholders involved in the development of a software system. Stakeholders involved will face the challenge of accepting how the new redesigned processes need to be performed. These stakeholders are key elements in any requirement collection of software projects, because they provide diverse viewpoints to consider (Van Zanten, Hoppenbrouwers, and Proper, 2005) as will be presented in the coming section of this chapter. An evaluation of collaboration could not be considered without a realisation of the relevant stakeholders involved.

Stakeholder theory has begun to focus towards a more network-based stakeholder engagement of collaborative relationships that foster mutuality and interdependence rather than a management view (Halal, 2001; Andriof and Waddock, 2002). This need has surfaced after the recognition of interdependences of power relations between stakeholders engaged in a process. Successful projects in IT require high collaboration between participants (stakeholders) (Black et. al, 2002). The road to understanding stakeholders is through understanding their collaboration (Sexty, 2004). Thus collaboration has been used as a mean of facilitation (Black et. al, 2002) and infusing creativity (Lerdahl, 2001) among stakeholders engaged in a system design process. To achieve collaboration researchers recommend that aspects of social capital should be investigated (Black et. al, 2002; Andriof and Waddock, 2002).

The development and use of diverse participatory design methodologies and techniques for requirement collection (Furhling, et. al, 2007) indicates a trend to involve the stakeholder in a collaborative manner. Research indicates incorporating the right person at the right time is crucial to design change in processes. Work conducted by Davison demonstrate that their involvement has a positive affect on the design process, this was shown through the use of a stakeholder identification and analysis matrix; which engages the right people in the design process (Davison, Deeks and Bruce, 2003). Literature shows evidence that key stakeholders enable project acceptance and satisfaction (Hokenhammar, 2001). Making sure that all stakeholders are involved in the early process of design gives a sense of partnership. For this partnership to be fruitful, collaboration must be maximized between all involved parties. Evidence from a computer simulation shows that stakeholder collaboration in general increases benefit to all those involved (Halal, 2001); the simulation represents the social and economical relationship between stakeholders in a corporate business firm. The author argues that the results depends on the accuracy of simulation and therefore finds further support to his claim through extensive surveys and evidence from further literature. Collaboration is also a key asset to creativity in a design team (Lerdahl, 2001, Fischer, 2004).

Stakeholders are normally from diverse backgrounds of roles and characteristics. Conflicts in stakeholder objectives slow down the process in a project (Flak and Nordheim, 2006), therefore to get the most of stakeholder involvement in system design their collaboration is vital. Stakeholder Analysis has evolved from the need to manage stakeholders in a more collaborative partnership. Collaboration may be achieved through investing in social capital (Halal, 2001), which in this research I am referring to as the social constructs.

Stakeholder collaboration in a system being designed is a dynamic process which involves feedback. The collaboration is visible in the form of dialogue; flow of information shared between the stakeholders in order to produce the requirement documentation. It is affected by standard criteria (the process of requirement collection) as well as organisational specific criteria, both tangible and intangible.

Once these have been identified and recognised an instrument for evaluating collaboration may be established.

I believe that it is important to evaluate stakeholder collaboration during requirement collection of any system. This gives the organisation the explicit knowledge to which values boost the collaboration of stakeholders, and gives indications of constructs that reflect collaboration both horizontally across the organisation and vertically within the smallest group or subgroup. These aspects enable decision makers to encapsulate what influences collaboration in a group of stakeholders and thus the power to intervene in order to ensure smooth system change (Reynolds, 2008), which can be used as a powerful planning tool. This need for intervention is recognised as *"contingencies for designing interventions"*; where it leads to creative collaboration (Lerdahl, 2001). The literature shows that effective collaboration between stakeholders needs to be planned (Pereira, 2001; Leanard, 2002), as in the case of agile software development (Tabaka, 2006). In order to engage in such planning through evaluation, specific approaches need to comply with suitable criteria that consider the nature of stakeholder collaboration within a software requirement setting; which are covered in the next section.

2.4. New Criteria for Evaluating Stakeholder Collaboration within Software Requirement Collection

Critical analysis of the nature of stakeholder collaboration, in addition to how we know to understand what stakeholder collaboration means was presented in the previous sections of this chapter. This analysis unfolded the following issues to be considered in an approach that evaluates stakeholder collaboration within a requirement collection setting:

First, there is no question that collaboration is a complex problem. It is fuzzy and chaotic in nature and there is no precise consensus on the definition of the problem itself. No clear input, no clear output and no clear methodology to investigate it.

Second, collaboration deals with social factors (Lowery et al. 2007) in uncontrolled environments. Full implication of social, cultural and political issues is vital for encapsulating context specific constructs are artifacts.

Third, there are basic constructs that build collaboration in every environment, and there are context specific constructs and artifacts that shape collaboration interconnected and feed back into the process of collaboration which can perturb its environment.

Fourth, means to resolve boundary definition must be considered especially the human boundaries who are the stakeholders.

Synthesising the issues outlined above specific criteria can be extrapolated. The first issue indicates collaboration being complex this leads to the need of an evaluation approach that is able to view collaboration in a holistic manner and able to handle complexity. Dealing with social factors is the second issue and it indicates that the evaluation needs to be qualitative and sensitive to depict context specific social, cultural and political problems, incorporated from the different perspectives of the stakeholders in collaboration. The third issue reflects the feedback nature of constructs that form collaboration, this leads to the criteria of incorporating non-linearity and feedback. The last issue relating to boundary definition indicates a need to specifically identify the stakeholders, which represent the human boundary of the collaborative system. Therefore based on the four issues outlined above, the following criteria were developed for analysing methods and approach that evaluate stakeholder collaboration within software requirement collection:

- Depict context specific social, cultural and political issues
- Provide mechanism to comprehend complexity
- Identify relevant stakeholders
- Incorporate Non-linearity and feedback
- Incorporate different perspectives of stakeholder collaboration
- Be holistic
- Emphasise the quality of data collected

In the next section these criteria will be considered in critically analysing chosen current methods, methodologies and theories in stakeholder collaboration, where a summary of the analysis is shown in Table 2.3 (Section 2.6).

2.5. Evaluation of Existing Practices Involving Stakeholder Collaboration

Existing methods, methodologies, theories and approaches cover a range of stakeholder collaboration aspects. For the purpose of investigating what can be covered by the developed criteria in Section 2.4, three key paradigms are chosen: Systemic Evaluation for Stakeholder Learning (Ramage, 1999), The Dynamic Theory of Collaboration (Luna-Reyes, 2004) and Collaborative Engineering (Fruhling, et. al 2007). They were chosen because they look into stakeholder collaboration from three different perspectives: methodological, theory building and approach embedment. An analysis of them is given in the coming sections.

2.5.1. Systemic Evaluation for Stakeholder Learning SESL (Ramage, 1999)

Ramage (1999) developed through his PhD research a meta-methodology that evaluates cooperative systems which he called Systemic Evaluation for Stakeholder Learning (SESL). By the term system he specifically states it to be any system (not just technology based cooperative systems) such as a group or a team in the process of design.

This methodology is chosen to be analysed even though it specifically refers to "*co-operative*" systems not collaboration. From Brown and Keast classification (2003) in the Table 2.1, I recognise that there is a difference between these two terms (as collaboration involves more commitment, trust and shared goals), however, I will consider it as a synonym because from the Ramage description of the nature of cooperation he goes on to define it in a way similar to Brown and Keasts classification of collaboration (2003) which involves shared goals, understanding and commitment.

Ethnographic research was used to develop the meta-methodology. The evaluation can be applied to any design domain based on evaluating the learning of the team which are the stakeholders involved in the design process. It presents a means to evaluate the stakeholder co-operative interaction by the amount of learning shared between them, where learning is regarded as an ongoing process that does not end. The development of the methodology was based on a combination of disciplines including system theory, stakeholder theory and learning theory. The methodology developed is based on five fundamental steps for good evaluation:

1. Identify the type and purpose of the evaluation;
2. Decide what is the system to be evaluated;
3. Determine who are the stakeholders;
4. Observe & analyze (the heart of the process), concurrently formulating a set of key questions;
5. Encourage various forms of learning (such as reporting back to stakeholders).

This meta-methodology calls for the use of various available systemic methods. It specifically calls for the involvement of stakeholders and the incorporation of their perceptions by identifying them through stakeholder maps. The evaluators' knowledge of available systemic tools gives the means for the methodology to be holistic. It is context specific and incorporates social, cultural and political factors.

I believe that comprehension to complexity could not be covered gracefully without the evaluators' knowledge of the Viable System Model presented in the next chapter. The same applies to visualising interrelations through non-linearity as the methodology strongly calls for the use of systemic tools without any particular specifications to what to use.

2.5.2. The Dynamic Theory of Collaboration (Luna-Rayes, 2004)

From the literature I have identified one research project that investigates the problem of analysing stakeholders particularly involved in the domain of software development (specifically in the requirements collection phase), developed by Luna-Reyes (2004). It has addressed the complicated nature of collaboration using system dynamics. This research relies on the two constructs of trust and knowledge sharing in its investigation of collaboration; pointing for further testing and exploration of other changes in the model structure. It is a notable attempt to better understand the complication of collaboration in the requirements collection phase of software projects.

It was developed and tested in an intergovernmental information systems project in the domain of social welfare; its aim being theory building. It looks at stakeholder collaboration as a system and takes a systemic approach into understanding the inter-relationships. This developed the Dynamic Theory of Collaboration; it analyses collaboration of stakeholders based on knowledge sharing and trust using system dynamics as an analysis tool, it relied on grounded theory for its structure and evaluates collaboration by summing the participant's engagement, termed "*stocks of knowledge*". The study explores the promotion of knowledge sharing, collaboration and trust in the context of a progress by varying the levels of initial knowledge (Black et. al, 2002; Cresswell et. al, 2002).

The study concluded just as Jones (2005) discussed in (Section 2.3.1) that collaboration is a dynamic process that unfolds through time, making explicit consideration of the participants' needs and objectives, and thus designs a facilitation of their own work. This promotes the development of a structured methodology in which collaboration may be measured throughout different points in the project process. The study emphasises that direct empirical measure of collaboration is a challenging task.

The theory developed through the use of system dynamics visualises the interrelations of constructs and artefacts shaping the collaboration of stakeholders involved in the projects through non-linearity and feedback. Social, cultural and political factors incorporated through the involvement of stakeholders, however there is no specific mechanism used to extract such factors from the project. The theory developed through system dynamics is context specific. However it lacks the means of specifically defining the involved stakeholders; it also lacks a mean to comprehend the complexity of the collaborative process.

2.5.3. Collaboration Engineering Process (Fruhling, Steinhauser, Hoff and Dunbar, 2007)

The US Military at USSTRATCOM developed a collaboration engineering process to design requirement elicitation in software development projects. The key element was to enable stakeholders with different perspectives to give valuable expertise information to the requirement process. Its main advantage is that it gives alert notifications to the stakeholders to any cultural and political changes in the environment to enable them to make changes in the requirements.

A User Alerts/Events Notification system is secured on the wide area network in the Department of Defence (DOD) of the United States. It provides awareness by signalling alerts of events related to cultural and political issues in the environment. Requirements are collected in an asynchronous approach over all the system users taking the contribution of events into consideration.

Sessions of requirement collection validation are then conducted, involving diverse stakeholders of both military and civilian background. These session started by a validation of predefined requirement followed by brainstorming of new requirements. What is known to them as "thinkLets" are used by the facilitator to promote collaboration in the requirement collection process; which were fundamental patterns of collaboration processes (Table 2.2). Six patterns of collaboration are identified and used throughout the process; Table 2.2 presents these patterns.

Pattern	Description
Generate	Move from having fewer concepts to having more concepts
Clarify	Move from less to more shared meaning for the concept(s) under consideration
Reduce	Move from having many concepts to a focus on fewer concepts deemed worthy of further attention
Organize	Move from less to more understanding of the relationships among concepts
Evaluate	Move from less to more understanding of the utility of priority of concepts toward goal attainment
Build Consensus	Move from having more disagreement to having less disagreement on course of action

Table 2.2. Collaboration Patterns (Source: Fruhling et al., 2007)

A sequence of "thinkLets" is used to validate current requirements and elicit new ones, which provide an easy to follow processes that promote the communication between the stakeholders. It provides a facilitator with minimal experience to design an effective collaborative process of requirement collection.

Knowledge sharing was highly promoted through the process of collaborative engineering, shared understanding between stakeholders is encapsulated by the use of the "thinkLets"; multiple stakeholders were able to work on the same artefact in the same time, which supported the shared understanding. The "thinkLets" are technology independent, and had two specific roles in the approach: First, they allow repeatable results to be reused by practitioners. Second, they map facilitation techniques to a practitioners own process, transferring facilitation experience to practitioners.

The approach is a collaborative process of requirement collection, which provides a design for collaboration between stakeholders, yet no clear process for evaluation and detection of collaborative deficiencies is evident. The social nature of collaboration is depicted, however the approach does not emphasise what collaboration constructs are important, and what is essential for promoting the collaboration. Stakeholder relations are diminished in the beginning through asynchronous requirement collection, yet they were felt during the requirement validation sessions as stakeholder groups of diverse power are grouped, and rearrangement of meetings was needed. Stakeholders were distinctively selected according to their role in the mission; however, there was no evidence of involving any stakeholder identification process in the approach.

2.6. Summary of Evaluation against the New Criteria

Table 2.3 presents a summary of the evaluation of the current methodologies and theories of stakeholder collaboration against the developed criteria. This analysis does not indicate any preference for one method over another; it is meant only to show to what extent the methods cover the criteria developed in Section 2.4.

Current paradigm Criteria	SESL Ramage (1999)	Dynamic Theory of Collaboration Luna-Rayes (2004)	Collaboration Engineering Fruhling, Stienhauser, Hoff and Dunbar (2007)
Type	Meta-Methodology	Theory	Approach
Depict context specific social, cultural and political issues	Calls for use of systemic tools without indication to what to use	No specific mechanism Group modelling sessions and interviews used	Gives notification alerts to stakeholders
Mechanism to comprehend complexity	Not specified	Not specified Can become very complicated	Comprehend the complexity of changing requirements
Identify relevant stakeholders	Calls for stakeholder identification without specifying a certain method (gives indication of mind maps)	Not specified	Seven stakeholder groups according to role, with no indication to use of stakeholder identification
Incorporate Non-linearity and feedback	Calls for use of systemic tools without indication to what to use	Use of CLD and stock and flow diagrams	Not Specified
Incorporate different perspectives of stakeholder collaboration	Supports stakeholder perceptions	Group modelling	"thinkLets" are used to capture stakeholder perspective related to requirements collected not the collaboration itself
Holistic	Being holistic depends on the evaluators knowledge of systemic methods	Not holistic	Being holistic in the sense of requirement collection, but not in the sense of being collaboratively aware
Emphasis on the quality of data collected	Supports quality data	Supports quality data	Supports quality data

Table 2.3. Evaluation of Current Methodologies, Theories and Approaches against the New Developed Criteria

Synthesising the shortcomings of the selected paradigms in Table 2.3 indicates a need for a specific approach that accommodates criteria developed in Section 2.4. More emphasis is provided in the next section.

2.7. A Need for a New Approach for Evaluating Stakeholder Collaboration in Requirement Collection Phases of Software Development Projects

The need for a systemic approach arises in order to gain a broader perspective and thus better understanding. Different states of a complex system such as stakeholder collaboration can be evaluated such that internal states can be observed and controlled. Dong (2004) asserts that this provides a practical real time analysis of team collaboration process compared to discourse analysis and psychometric evaluation. A crucial holistic perspective provides a way of uncovering overlooked factor that could be crucial to a specific collaboration.

Elicitation of requirements for software projects and information systems is considered one of the risk factors that project managers have to deal with to reduce the probability of failure. Requirements analysis involves a series of activities that require stakeholders to work collaboratively to achieve a shared goal, this being the production of the requirement documentation. Collaboration evolves from a complex process of interlinked relationships between stakeholders. To evaluate this complexity, a new systemic approach is needed and the next two chapters cover its theoretical underpinning and development. Multi-methodology is used to build a complementary approach called the EStaC approach (presented in Chapter Four), which covers more criteria than the current methods, theories and approaches covered in this chapter for stakeholder collaboration, as well as stand alone systemic methods and methodologies presented in the next chapter. The EStaC approach is compared against current methodologies based on criteria developed in Section 2.4 as well as the Mingers-Brocklesby framework for mapping methodologies developed in 1996 that is discussed in Chapter Three.

The following reasoning (extracted from the analysis given in this chapter), calls for the need of a new systemic approach to evaluate stakeholder collaboration within requirement collection:

- Collaboration of stakeholders within a software development process in general is a social problem. It is vital to take account the full implication of social, cultural and political issues for encapsulating context specific constructs that are affecting collaboration.

- Collaboration is a complex problem consisting of dynamic interactions that are achieved through stakeholder inter-relationships that are not independent; they are interconnected and feed back into the process of collaboration which can perturb its environment.
- The approach developed must be context specific, in order to consider constructs that shape the collaboration from the stakeholders perspective in a specific context.
- The approach must be holistic, to include the entire picture. It must be able to focus on the details without losing the context of other influencing factors in the outer picture.
- Since this topic is uncharted territory, an emphasis on qualitative data is beneficial.
- The approach must provide a mean of uncovering relevant stakeholders which are the focus of study.

2.8. Conclusion

This chapter has shown that while the literature emphasises the importance of collaboration between stakeholders in the requirement collection phase, there does not exist a general theory for collaboration. Research in the area of collaboration however shows that there are various attempts of relating appropriate social constructs. Synthesising the theoretical literature an interpretive approach was used to elicit a set of base criteria as potential variables or constructs that conceptualises the formation of stakeholder collaboration. These basic constructs in combination with a new systemic view to the problem that are presented in Chapter Three, provide a better way of evaluating collaboration as opposed to current methods, methodologies and theories available. This new approach is presented in Chapter Four as the EStaC approach.

Chapter 3

3. Models, Methods and Methodologies

3.1. Introduction

In the previous chapter, three current methodological approaches were discussed for evaluating stakeholder collaboration. These were found to be beneficial but the need for further research in the problem was substantial. Criteria for evaluating evaluation techniques of stakeholder collaboration were also discussed and the current methodologies were evaluated against these criteria. A need for a new methodology that incorporates these criteria is called for at the end of that chapter. In this chapter an overview of systems and evaluation is presented, followed by a critical review of some specific methods, methodologies and models that may be used as tools to analyse messy problem areas related to systems. What is different about these tools is that they are all generic. This implies that different people carrying them out may provide a different perspective and thus produce different ways to analysing the problem, this being depending on the context in which the analysis resides and the experience of the evaluator. This may be a point for criticism in many sciences because replication is impossible and process tracing is difficult to conduct; however when used to understand complex problems, better solutions are reached. The rationale of the research paradigm utilised to engage in such tools is presented. New perspectives to a problem may motivate better solution development. The tools are in the form of models, methods or methodologies used to aid people in structuring, visualising and analysing systems. Each tool plays a different part in inferring the analysis and evaluation of the problem under investigation. These tools are then evaluated against the criteria in Section 2.4 in order to combine them in way to achieve synergetic solutions presented as the EStaC approach. The literature shows evidence of the feasibility of such approaches of integration as better ways of understanding was reached (Eltimsahi, 2000; Schwaninger, 2004; Tansley, 2005).

3.2. Systems & Evaluation

Ramage (1999) was investigating co-operative systems and refers to evaluation using terms brought from educational, social and organisational research, as activities that allow us to judge innovative programmes in terms of:

- *Starting assumptions*
- *Implementation processes*
- *Outcomes*

(Elliot Stern cited in Ramage, 1999)

Evaluation has evolved and several paradigm shifts have affected the process leading to the fourth generation of evaluation, which stresses the involvement of the user to define what is being evaluated and for what purpose. It is fundamental in evaluation to understand and clearly define what is being evaluated. The combination of activities, people and artefacts being evaluated can be identified as a system; which is a

> *set of interrelated components that function together to achieve a common goal.*
>
> *(Wu and Wu, 1994)*

A system can be a combination of people, technology and the context in which they reside. It is crucially important to set the boundaries of the system under evaluation. In social situations such as stakeholder collaboration, boundaries are vague due to the fuzzy nature of the problem; several perspectives can be used for evaluation purpose such as: group dynamics, psychology, organisational culture, communication mediums as well as other different perspectives that can be found in the literature (Ramage, 1999). Ramage (1999) stresses the importance of using theories from multiple sources and the incorporation of users' perspectives and avoiding the dominance of the views of experts. He finds it dangerous in evaluation to use a stream that is too narrow, as important aspects can be overseen and wrong results can be obtained.

It is challenging to decide what factors of stakeholder collaboration need to be analysed and evaluated. Looking at it as a system, we can evaluate it as a whole, consideration of interrelations and dependencies are realised. But factoring out the significant aspects to stakeholder evaluation is a difficult task to achieve; a need to manage this variety arises. How can we do that? In order to solve that question, we need to get a basic understanding of models, methods and methodologies, followed by a critical review of influential examples found beneficial and are used in the integration approach.

3.3. Basic Understanding of Models, Methods & Methodologies

A developing baby in the complexity of life is surrounded by infinite variety. God has given him/her the sophistication to deal with this variety by filtering out what is essential for him/her to deal with life at each stage of development. A baby starts his/her life by filtering out three basic needs; to be fed, slept and cleaned; simplified models of the real world are constructed in the baby's mind, giving meaning to reality. As the baby gets older, his/her needs and experiences in life add up to the mental models already developed creating his/her perception of life. Feedback relations and indirect effect of cause is realised as an individual matures and experience is accumulated. This concept of models can be applied to visualise any complex system; models provide means to deal with fuzzy problems, however the challenge is to filter out the essential factors that are necessary for each problem definition.

Models are realised as powerful tools and used for management by decision makers based on available information. The limitation of mental models depends on the limitation of the human mind; analytical tools and computer simulation is used as an aid to study complex models. The ultimate goal for modeling is to focus on different factors that might have weakened the system behavior and to plan for future development (Eltemsahi, 2000; Elf, 2002). Models come in various forms; there are mental models and mathematical models which can both be analytically studied or simulated. Simulation can be either continuous or discrete (Eltemsahi, 2000). Early traditional system modeling is based on block diagrams; it is based on three main components: input, output and feedback, all linked with a Transfer Function (TF) defined that controls the behavior of the system.

Models are representations of perceptions of reality and are usually used within methods or methodologies. There is a distinction between a method and a methodology, the first being more specific to certain activities and the second being more general. A method can be used within a methodology just as a model can be embedded within a method. I will now provide a definition for both method and methodology. A method is the specific activities such as techniques and models that enable an individual to deal with a problem (Mingers, 2000), where as a methodology represents the more abstract level of guidelines that govern the activities (Mingers and Brocklesby, 1977).

Pruyt (2006) in the System Dynamics Society Conference constructed a framework on a paradigmatic level that shows how we can look at System Dynamics from basic assumptions of ontology and epistemology. His presentation provides an excellent overview of how methodologies and methods branch from paradigms, their meanings linked with an example related to SD. He shows that there are other distinctions to a methodology;

> *meta- methodology is a framework for choosing between methodologies and for matching and mixing methodologies* while *a multi-methodology is a (new) methodology consisting of the combination of (parts of) other existing methodologies*.
>
> *(Pruyt, 2006)*

He also shows that a paradigm is the root to any method or methodology; this is shown in Table 3.1 and that a field such as SD can spread over different paradigms; what paradigm to follow depends on the specific issue under investigation. I consider this to be a very powerful conclusion, consistent with my own, which dictates the research methodology of this study and the way the EStaC approach is developed. Paradigms are discussed in more detail in Section 3.4 of this chapter.

Concept	Meaning	Examples
Paradigm	Coherent set of meta-theoretical (ontological, epistemological, praxiological, methodological, nature-of-society, human-nature, ..) assumptions which constitutes a distinct world-view	Postpositivism
(philosophical or sociological) theory	Coherent explanation of (social, material, personal, ..) life by a distinct philosophical or sociological school of thought	Gidden's structuration theory
Meta-methodology	meta- methodology is a framework for choosing between methodologies and for matching and mixing methodologies	Multimethodology
Multi-methodology	a (new) methodology consisting of the combination of (parts of) other existing methodologies.	Adaptive Control methodology
Methodology	structure set of guidelines or activities to assist people in understanding taking research or interventions	Mainstream SD methodology
Method	*Structured set of processes and activities that include tools, techniques, and models,* that can be used in dealing with the problem and problem situation	Mainstream SD method
Technique	Specific activity that has a clear and well-defined purpose within the context of a methodology	Stock-flow diagram, numerical simulation
Tool	artefact, often computer software, that can be used in performing a particular technique'	Vensim, Stella

Table 3.1 Different Integrations of Paradigms (Source: Pruyt, 2006)

Models, methods or methodologies are all means to analysing and evaluating systems. They help us to grab the heart of the problem in order to help understand it by means of analysis. Each provides a different level of flexibility to the user depending on the details provided to perform the activities. Models provide a more visualised approach to handling the problems that can be beneficial for the user. Different details of concepts and theories behind the models, methods and methodologies provide different levels of control for the user to analyse the problem.

3.4. Current System Models, Methods & Methodologies for System Evaluation

The term paradigm became popular in 1970 by Kuhn as he defines it as assumptions and concepts about how things work, providing tools to:

- Examine problems

- Understand situations
- Propose solutions under certain circumstances

A paradigm defines the way things are done and the techniques used to achieve them. According to Cresswell (1994) five assumptions were proposed to differentiate between paradigms: ontological, epistemological, axiological, rhetorical, and methodological. Other researchers such as Denzin and Lincoln in (2000) proposed four: ontological, epistemological, axiological and methodological. They called them a "*paradigm net*"; this net dictates the unique way in which a research is undertaken and how discoveries are revealed and interpreted (Boulton, et. al, 2005).

Pruyt (2006) states that a paradigm constitutes a world view, as he argues it is defined by a set of meta-theoretical assumptions, which is broader than the ones presented by Cresswell (1994) and the one by Denzin and Lincoln in (2000). Distinct examples of these assumptions include but not restricted to:

- Ontological
- Epistemological
- Preiological
- Methodological
- Nature-of-society
- Human-nature

Thus according to Boulton (2005), in order to define a research paradigm we must be able to answer the following questions:

What is the nature of reality? , enables us to identify the ontology of the matter,
How do we know reality? , to determine the epistemology,
How will our morals and values affect reality discovered? , to determine the axiology,
How do we find out what we know about reality?, in order to decide on the methodology.

Cresswell (1994) argues that there exist two paradigms: positivism (mainly quantitative data to test a hypothesis) and interpretive (mainly qualitative and associates the setting with the observation into meaning) making positivism objective while interpretive is subjective. Within the qualitative research interpretive paradigm scholars have further defined four paradigms: positivism, post-positivism, critical theory (critical and feminist post-structuralism), constructive-interpretive (constructivism). Positivism and constructivism are considered the two extremes within these four structures where positivism tends to discover the only reality that exists, constructivism tends to construct multiple realities; according to constructivism there is no reality, it is only in the mind of those who live it.

This subdivision of paradigms is distinctively presented by the framework developed by Burrell and Morgan in 1979 shown in Figure 3.1 which has subdivided the paradigms into *"Four Paradigms*" which they call: radical humanist, radical structuralist, functionalist and interpretive.

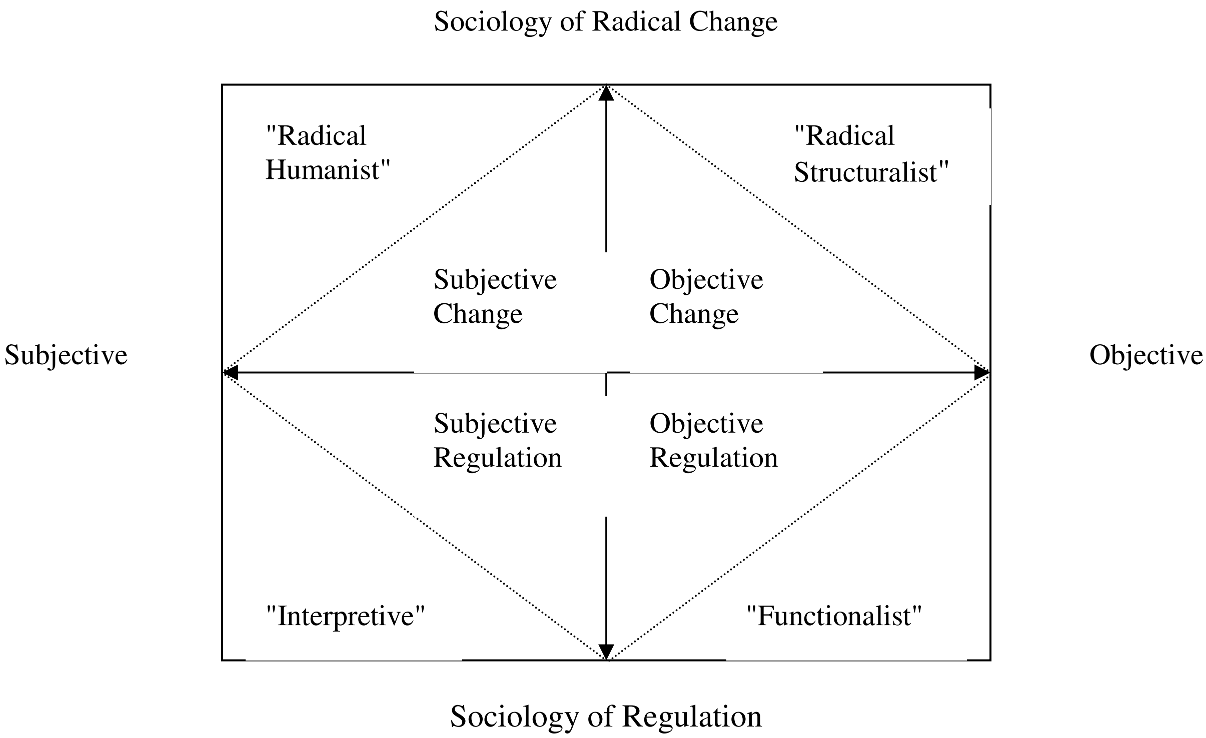

Figure 3.1. The Framework of "*Four Paradigms*". Source (Burrell and Morgan, 1979)

A research paradigm might be distinctive to fit within a specific paradigm or it might not be as definite as researchers blend paradigms to suite specific types of research as applied in the Maori research paradigm which is particular for health research. This blending is causing blurring between paradigms (Boulton, et. al, 2005). As a researcher I find myself in favour of the paradigm distinction developed by Cresswell to support the research methodology used in the development of the approach, as will be seen later in Section 3.10 of this chapter and in Chapter Five.

In the next sections, selected systemic tools are presented: pisoSIA, System Dynamics, Viable System Model, Soft System Methodology and Design Patterns (Detailed description given in Appendix A). Followed by reflections on how they fit criteria developed in Section 2.4. A reflection of how they would be integrated is discussed giving implications to the theoretical development of the EStaC approach presented in Chapter Four.

3.5. pisoSIA Method

As part of her PhD, Davison (2006) developed pisoSIA; a stakeholder identification and analysis method that had structured procedures with specific intention to be used in the information systems development field. It utilizes a matrix (shown in Table 3.2) to identify and analyse stakeholders in the information gathering phase of an information system redesign process. It was developed to understand the level of influence each stakeholder has on the project and their relevant priority and interests. The matrix was developed as an enhancement tool to be used with Process Improvement for Strategic Objectives (PISO) projects. Nevertheless it can perfectly be applied on its own in association with other systems that are related to stakeholder issues.

3.5.1. Description of pisoSIA Method

The matrix (shown in Table 3.2), was first launched and used successfully by Masters students at the University of Sunderland (Davison, et al., 2002).

Stakeholder Groups	Stakeholders	Stakeholder Attributes			Stakeholder Influence	Indicate Changes	Potential Area for Negotiation
		Power	Legitimacy	Urgency			
System Engagers The main stakeholder groups directly affected by the project. Those who carry out, are served by, or serve a process.							
Facilitators Those responsible for aiding the system development and negotiating with other stakeholder groups. Those guiding the PISO method who may be initially gathered together because of the pending project							
Outside Agencies Consists of Government or other regulatory bodies who may be the impetus for the impending system change. Could also include suppliers or contractors not apparent in area of change but could indirectly affect project.							
Decision-Makers Management body who would ultimately enable any change to be implemented. Likely to act on results of PISO analysis and be responsible for if and how changes occur.							

Table 3.2 pisoSIA® Matrix (Source: pisoSIA® Course Manual)

The matrix is accompanied by a series of notes that guide the user into identifying the stakeholders according to groups. The matrix divides the stakeholders into the following four groups:

- ***System Engagers*** are direct stakeholders; who are directly affected by the project or has an affect to the projects.
- ***Facilitators*** are interface stakeholders; who guide the project and negotiate with other stakeholders.
- ***Decision-Makers*** are indirect stakeholders; who allow the change to go ahead.
- ***Outside Agencies*** are indirect stakeholders; who are causing the change or set guidelines that might apply to; such as outside IT consultants.

Guidelines are used for the identification of stakeholders and relating them to each stakeholder group (Davison and Deeks, 2004).

These groups are later described with attributes according to their power, legitimacy and urgency. pisoSIA uses an enquiry based approach to associate each stakeholder with attributes. Seven stakeholder influence types are then recognised according to how many attributes each stakeholder holds. These types are tabulated from pisoSIA® course manual and shown in Table 3.3.

	Power	Legitimacy	Urgency
Dormant	✓		
Discretionary		✓	
Demanding			✓
Dominant	✓	✓	
Dependent		✓	✓
Dangerous	✓		✓
Definitive	✓	✓	✓

Table 3.3 Types of Stakeholders Influence

The method goes further by analysing potential areas for system change related to each stakeholder within each group identified in the Matrix, by including means to allow users to recognise where possible conflicts of interest could occur between stakeholders. This is a subjective judgment and different users may produce different results. A holistic view is required from the stakeholder to include all possible areas of conflict.

The knowledge gained from the matrix in relation to each stakeholders' influence enables the user to come up with a prioritisation for stakeholder negotiation meetings; where schedules are associated with the potential area for negotiation. The use of this matrix in many projects involving information system redesign of National Healthcare System cases in the North East of England gave visible indications of its importance in managing change.

3.5.2. pisoSIA Method Strengths

Reports of using pisoSIA in association with PISO (Davison, et al., 2002; Davison, Deeks, and Thompson, 2002; Davison, Deeks, 2003; Davison, Deeks, and Bruce, 2003; Davison, 2006) indicates that it acted as an enhancement as several benefits were observed. First, it provided means of identifying the relevant stakeholders that need to be involved in the process re-engineering and categorised them in comprehendible groups. Thus it provided a means for the facilitator to analyse the stakeholders and indicate potential conflict that acted as an aid to system change. Second, interests and influence of the stakeholders on the project were captured indicating potential negotiation between stakeholders, which when used by different users may bring different perspectives, and facilitates resistance to change and avoids conflict. This consideration of the stakeholders' impact on the system makes the evaluator consider prioritisation of stakeholder meetings and thus timely implementation of system is achieved (Davison, 2006). Third, pisoSIA method can be used in stakeholder related projects other than process reengineering as discussions with Davison revealed its use by police officers in the north east of UK for scheduling tasks.

Personal use of pisoSIA revealed that it is simple and easy to use with minimal training. The question oriented guidelines in the pisoSIA course manual help to identify the relevant stakeholders in each group. This ease of use was also found by users of the methods (Davison, 2006). I find the method user oriented, different users may add different perspectives and get other results unlooked for. Also, dynamics is a feature reflected from pisoSIA personal use because at various project lifecycles, stakeholders identified are different as stakeholder involvement in the project evolves over time.

3.5.3. pisoSIA Method Limitations

Davison (2006) recognises that although pisoSIA highlights an interaction between stakeholders for avoiding conflict and change negotiation, it provides no guidance when conflict occurs; it also lacks guidance of interpersonal relationships between stakeholders. The nature of system boundaries and the effects on stakeholders is another limitation recognised by the author and a need for enhancement is considered.

The subjective judgement to recognise where possible conflicts of interest could occur is recognised as a limitation (Davison, 2006). However, I look at it as strength, making the method user oriented as presented in Section 3.5.2.

I find the method lacking non-linearity supports because there is no mechanism in it to synthesise and handle non-linear relations. It needs more work on stakeholder interrelationships to ensure their effective engagement (Davison, 2006).

There are no documented reports on prioritising stakeholders with the same attributes, although discussion with Davison revealed that in some applied cases, stakeholders took the initiative of marking a rank instead of a tick inside the matrix to distinguish between stakeholders that might have higher or lower power, urgency or legitimacy. Some have also used multiple ticks to indicate higher rank.

3.5.4. Concluding Remarks on pisoSIA

It is important to use pisoSIA or other stakeholder identification methods in the preliminary phase of stakeholder collaboration evaluation to specifically identify the human boundary. This identification of stakeholders for understanding complex systems in general is called for and employed by the literature (Elias and Cavana, no date; Tansley, 2005). Using pisoSIA in particular, is relatively easy if compared to other tools such as the approach presented by Tansley (2005), as pisoSIA presents results in a graceful tabular form versus the dynamic mind maps suggested by the latter. In pisoSIA stakeholders are identified in comprehendible groups with appropriately associated naming that are used in system development when compared to naming conventions used in other methods that involve stakeholders, such as SSM CATWOE scheme presented in Section 3.6 and stakeholder identification instrument developed by Vos and Ackterkamp (2004).

Identified stakeholders can then be analysed according to their influence, and potential conflict can be recognised in order to smooth collaboration. Stakeholder groups can then be mapped to the other systemic methods that will be utilized to continue the evaluation process.

It is recognised that stakeholders within a project lifecycle are not static. Their roles, attributes and viewpoints might change according to the dynamics of the context. Stakeholder analysis using pisoSIA can be repeated throughout a project lifecycle, as more information becomes available and new issues arise. Thus several snapshots of the matrix can be developed as projects progresses.

3.6. Soft System Methodology (SSM)

Soft System Methodology was developed by Peter Checkland (1981). He argues that available hard methodologies neglect important social, cultural and political factors found in soft problems that have major impacts on the final outcome. Hard methodologies are appropriate for handling structured problems with specific input and output. They are often based on reductionism, which is inadequate with dealing with the social complexity of problem solving. Checkland (1981) developed the Soft System Methodology (SSM) specifically to deal with the fuzzy nature of soft problems. Soft problems deal with people related issues. Important aspects such as culture and politics are fed into the analysis and considered essential in shaping the solution. SSM analyses the problem within its context and thus provides context specific solutions. It incorporates the multiple views of stakeholders into analysing the problem and shaping the solution.

3.6.1. The SSM Stages

SSM conventionally consists of a seven stage model shown in Figure 3.2:

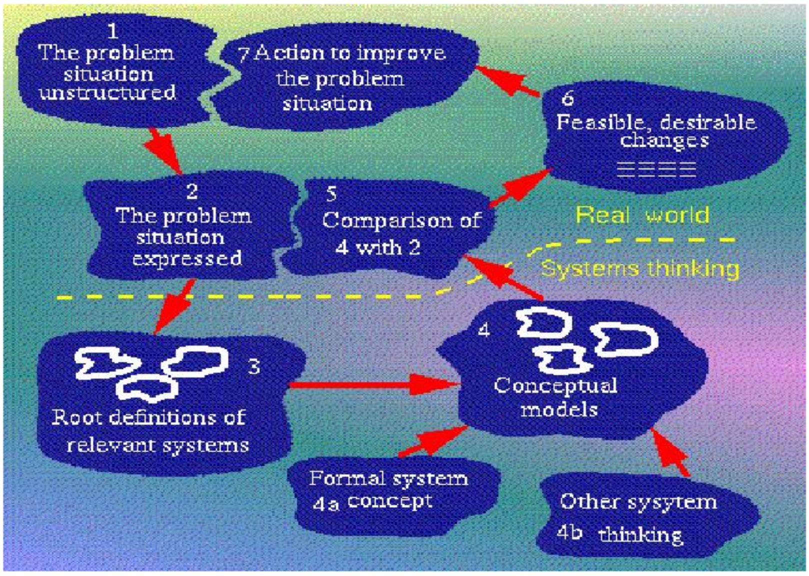

Figure 3.2. The Conventional Stages of SSM (source: Checkland, 1981)

Stage 1: The Unstructured Problem Situation

This is the stage where an initial call of investigation of a problem or a chance for improvement is realised by someone.

Stage 2: The Expressed Problem Situation

In this stage information concerning organisational structure is gathered by an analyst to help understand the problem situation. Information found in Stage 1 and Stage 2 is used to build iconic representations in the form of cartoon like rich picture accompanied by comments as shown in Figure 3.3. It is used as a communication tool between the analyst and the system users to collect as many perspectives as possible. These are used to emphasise captured social, cultural and political issues in the system.

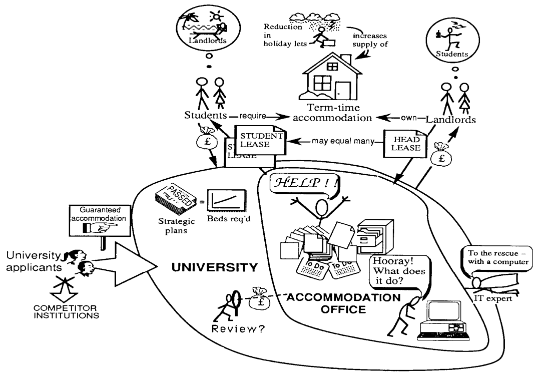

Figure 3.3 Example of a Rich Picture.
(Source: Available at: http://oldwww.cs.aau.dk/~jeremy/resources%20files/SSM.PPT#10/ Accessed 24 February 2007).

Stage 3: The Root Definitions of Relevant Systems

Root definitions are textual statements that define important elements in the system under study. What is known as a CATWOE acronym is used in this stage to provide an idealised view for the output of the system by focusing on necessary elements that define a human activity system from a certain perspective. Six elements are included in the root definition: Customers, Actors, Transformation Process or Activities, Waltanschauung or World View, Owners and Environment. Each task described in the root definition should be associated with an element.

Stage 4: The Formal Systems Conceptual Model

In this stage a conceptual model of the system is developed from the different stakeholders involved. The conceptual model expresses how an ideal system should perform. Different perceptions, ideas and methodologies can be suggested and negotiated.

Stage 5: Comparing Conceptual Models with Reality

Comparison between the conceptual model (Stage 4) and the real model (Stage 2) is performed at this stage. A debate is generated about the alternative changes to the system.

Stage 6: The Action to Improve Problem Situation

Desirable alternative of changes to the system are discussed at this stage. Changes can be in structure, procedure, or in attitude.

Stage 7: The Implantation of Desirable Changes

This stage involves the actual implementation of the desirable changes to the system. The feasible solutions are put into action according to the implementation procedures decided on in Stage 6.

3.6.2. The SSM Strengths

SSM can analyse complex problems that involve social, political and cultural issues, overseen factors affecting the system under study are encapsulated. It forces the user to look for more than a technical solution, with the ability to emphasise on change, by focusing on a desirable system which makes it goal driven (Checkland, 1981).

Scholars find SSM stakeholder oriented, because different stakeholders give different perspectives, thus more than one solution can be achieved, and this opens the door for creativity (Eltemsahi, 2001).

Rich pictures exceed the boundary of language, this gives a better understanding of the problem. That is because pictures enable users to visualise the system, therefore close the communication gap between user and the analyst.

SSM has the ability to enforce dialogue between stakeholders (specifically in the Stages 5 to 7) to negotiate alternative changes to the systems, because choosing the appropriate change and discussing means to achieving these changes is embedded in SSM implementation.

SSM can be applied to various situations that need analysis; the possibility of using SSM ranges from the corporate decision making of technology use in companies to the very personal decision of choosing a new career. SSM generally starts with problem definition within a human related context to represent a system. Then, the real world situations are questioned by comparing them to conceptual models. Result of the comparison dictates an action to improve the real world situation. The process is iterative and the cycle begins again (Checkland, 1990).

3.6.3. The SSM Limitations

The use of CATWOE schema to identify the principal participants (stakeholders) and associate them all with possible root definitions is sometimes difficult. Some people find that difficult to do as some concepts are not understood and others are used for other concepts understood by the language (Bergvall-Kareborn, et.al, 2004). The difficulty in using the CATWOE is also recognised by other researchers in the literature (Mobach, van der Werf and Tromp, 2000; Eltemsahi, 2001). In software development process, its use may lead to misunderstandings due to the unusual association of element names to different definitions. Stakeholder groups defined by pisoSIA are more appropriate to a software development context.

SSM does not have the means to comprehend complexity in a graceful manner. If the problem is big and complicated, using SSM can be difficult to comprehend. SSM also lacks the ability to identify what is causing the problem from the diagram in complex situations; which makes it inefficient in synthesising non-linear relationships (Eltemsahi, 2001).

3.6.4. Concluding Remarks on SSM

SSM is based on system thinking and is used to provide a holistic view of the system under study. It naturally looks at the problem within its context, where social, cultural and political factors are recognised. It pays considerable attention to the people involved in the problem, their interpretation of the situation and judgment about it according to their standards and values that are shaped by culture and background experiences. This blend of culture and background experience is unique from one person to the other.

Rich pictures visualise problems in a very easy to use and affective way. It can be used in an integrated fashion with other methodologies to emphasise the cultural context in which a problem is embedded in. It also enforces dialogue within its use which is one of the basic factors for collaboration as discussed in Chapter Two.

Compared to pisoSIA group naming, I find SSM CATWOE scheme -which can be used to define stakeholders (Eltemsahi, 2001) - less appropriate to associate with software development stakeholders and more difficult to apply (as shown in Section 3.6.3).

3.7. Viable System Model (VSM)

In the 1960s Stafford Beer developed the Viable System Model as a tool to be used in human organisations to diagnose problems and improve performance. It was an outcome of him performing operational research and cybernetics in the British steel industry in the 1950s. By mimicking the functions of the most intelligible system in the world; which is the human nervous system (especially the brain), and how the muscles are managed in the human body; he was able to develop a management cybernetic model (Beer, 1981). It is used to diagnose survival issues in systems; he claims that all self-organising systems

> *share the aim of continuing to exist, at least until the time when their purpose has been achieved*
>
> *(Hilder, 1995).*

VSM is based on cybernetic fundamentals; it was created in the context of the work done by Ross Ashby, Norbert Wiener and Warren McCulloch (Espejo, 2003). It is a radically different way for which organisations can be diagnosed to visualise deficiencies. It looks at the structural and communication problems of an organisation in a holistic way and helps design a more efficient one that will ensure the viability of the organisation. This unique feature is shown to be powerful because its basic principles go back to cybernetic foundations. These principles are appreciated in analysing messy problems as applied in the negotiation of the (2002-2003) peace talk in SriLanka (Solomons and Moscardini, 2006).

VSM works by looking at an organisation as a whole system that is composed of three elements shown in Figure 3.4: operation, environment and meta-system.

- **E** represents the Environment
- **O** represents the Operation
- **M** represents the Metasystem

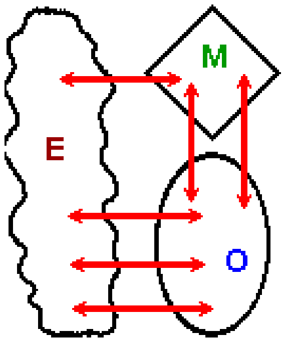

Figure 3.4: Simple Viable System Model Diagram.
(Source: Available at: http://www.bogacki.co.uk/C7TER_fig_1.htm/
(Accessed 15 March 2006))

3.7.1. The VSM Systems

VSM is composed of five interacting subsystems shown in Figure 3.5; the arrows indicate the various ways that the three parts interact. Each arrow may have several aspects; it may be information, or physical elements such as trains or trucks. The interacting systems are used to define the structure of an organisation in a recursive manner.

System 1 is basically composed of the operational units which are primary activities. System 1 is the reason for the organisation to exist (Hilder, 1995). Each activity is a viable system of its own.

System 2 is the regulator that ensures stability and conflict resolution of primary activities in system 1. It prevents oscillation in system one by making sure activities are consistent with protocols and standards; which promotes homeostasis. System 2 provides the co-ordination mechanism in the organisation.

System 3 is responsible for the control and optimisation of the internal present activities in System 1. It makes sure that all the regulations in System 2 are performed accordingly. It has a special audit function called Three Star (3 *), its main task is to look after System 1 performance and make sure that targets specified by System 3 are fulfilled. Optimisation is achieved by System 3 targeting synergy.

System 4 monitors the environment for changes and predicts what can happen in the future that might affect the system to remain viable or not. It also collects information from System 3, system performance measures and future changes are blended and then communicated to System 5. Future changes are also communicated back to System 3.It deals with adaptation, forward planning and strategy. There must be a balance between System 3 and System 4; they must be able to absorb each other's variety.

System 5 is responsible for identity and policy decisions within the organisation and authority. It must communicate with System 4 to ensure that the organisation adapts to the external environment.

(Cybernetic Eyes Website, 2001)

The Viplan software (Espejo, 1999; Espejo, Bowling and Hoverstadt, 1999) provides a means to structuring identity statements in System Five.

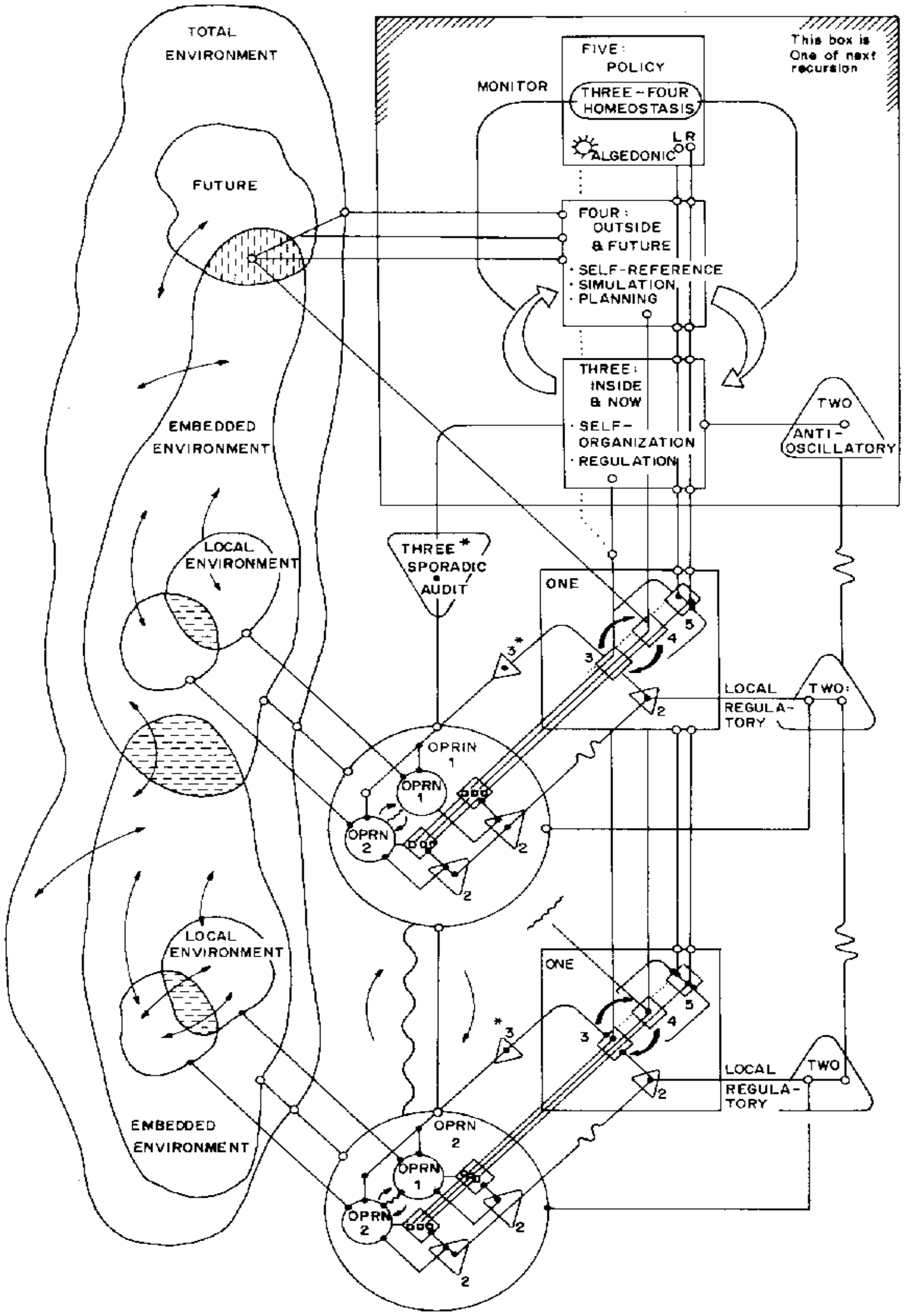

Figure 3.5: The Viable System Model Original Diagram.
((Sources: http://www.greybox.uklinux.net/vsmg_2.2/1qguide.html/
Accessed 15 March 2006))

There are several features that make the VSM distinct:

First, the concept of recursion (Figure 3.6); VSM recognises that smaller systems are embedded within the operation element of the main system which can be modelled using an identical cybernetic description, and these smaller systems have smaller systems embedded as well, and so on just like a Russian doll. These different systems are embedded at different levels of hierarchy which he calls as *"cybernetic isomorphism*" (Beer, 1979). The aim is to diagnose at which level of recursion the problem is in focus, and identify other levels that the problem may interact with. In that case the user of the model must focus on the level of recursion where he identified the problem, and looks at it in the context of one level below it and one level above it. Each level in turn consists of a complete viable system. Recursion is a very important tool that is used to comprehend complexity as no other tool deals with it in such a comprehendible way. It looks at the details of the system in focus and at the same time keeps in mind that it is part of a complex system and that it also consists of complex systems. The lowest level of recursion in an organisation is the human user; which in turn is a viable system itself. Figure 3.6 shows recursion expressed in two forms.

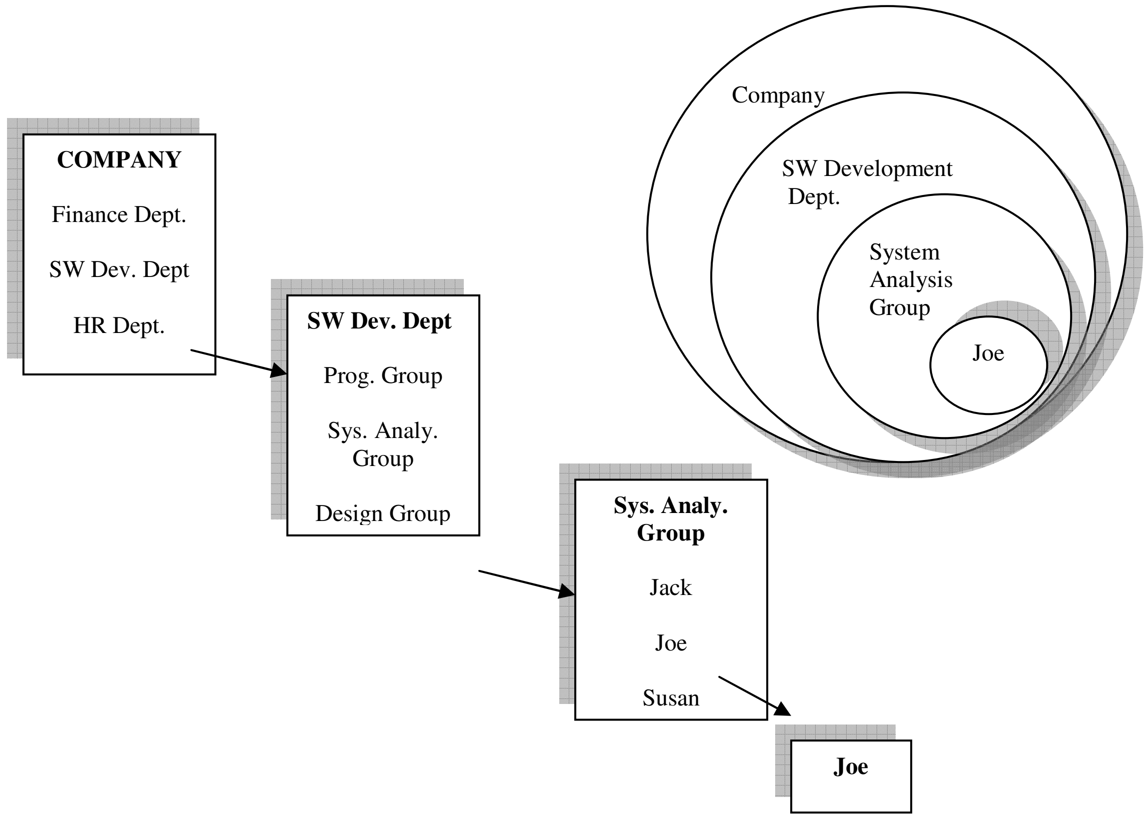

Figure 3.6. Two Ways of Expressing the Concept of Recursion

The second feature that distinguishes the VSM is its incorporation of Ashby's Law of Requisite Variety which states that

> *Variety in the control system must be equal to or larger than the variety of the perturbations in order to achieve control*
>
> *(Ashby, 1956).*

This incorporation of variety led him to develop the first principle of organisation which states that

> *Managerial, operational, and environmental variety, diffusing through an institutional system, tend to equate and should be designed to do so with minimum damage to people and to cost*
>
> *(Beer, 1979).*

Variety is a measurement of complexity that is expressed in comparative terms. It is the number of possible states which a system can be in. For example a light switch has variety =2 (on& off), while a light dimmer has infinite variety. If this law is applied to an organisation, then for the system to survive it has to be able to cope with unexpected disturbances in its environment. In summary, the operation must have equal or higher variety than the environment and the management must have equal or higher variety than the operation in order for the organisation to be viable. This balance is achieved by either amplifying or attenuating the incoming/outgoing variety, possibly by imposing new rules or relaxing rules that already exist, but only within the capacity of the channel (Ashby, 1962).

Third, structure; having the five interacting systems embedded in a recursive manner is a powerful way of structuring complex systems in a comprehendible way.

Fourth, information flow; there is great emphasis in the model for communication channels that provide vital information for each system. This information must be in the right place at the right time. Communication can be transferred in any form through people or artefacts. I relate this to what Pouloudi et al. (2004) refers to as the "*human"* and "*nonhuman stakeholders"*.

For the system to be viable it must structurally have two key mechanisms; cohesion and adaptability. These two mechanisms must be operated in every level of recursion. They are required so that the individual parts of the system can work in syntegration and be able to cope with the changes in the surrounding environment. System 3 ensures cohesion, System 4 ensures adaptation and System 5 ensures closure (Espejo, 2003).

3.7.2. The VSM Strengths

The VSM is used in two ways; to diagnose problems in the system and to design a new system. It concentrates on focusing on critical success factors rather than monitoring every detail (Eltemsahi, 2000). Strengths of the VSM found in the literature by Eltemsahi (2000) are presented.

Dealing with complexity in a comprehendible way not available by other methods or methodologies, its power derives from the two cybernetic concepts associated with VSM, which are recursion and variety. It deals with complexity by looking at problem on focus without losing the vital factors that affect it from other levels. Variety enables it to cope with changes effecting the system by means of amplification and attenuation.

The VSM diagnoses problems in communication and structure that can alter viability especially in a system with defined goals. Two way channels shown in the VSM between all the components, provide means of communication which opens the way for positive dialogue which is the solution for any potential conflict.

I find the VSM inherently reflective in diagnosing problems and finding potential solutions; the model structure gives a sudden impact to the practitioner and infers ways of possible prevention by visualisation of the complex system structure.

3.7.3. The VSM Limitations

VSM lacks consideration of human aspects such as feelings and emotions and thus no consideration to individual behaviour (Business Process Transformation website, 1996); as it provides no guidance in how to deal with the task or with the social and behavioural issues related to these tasks.

Although there is a stress in identifying the stakeholders and including them in the appropriate systems in the different levels of recursion, I was not able to detect a mechanism within the VSM for identifying the stakeholders involved.

I found that the VSM was not simple at the beginning of my research because it uses difficult terminologies that can be traced back to biology and mechanics. Some training is needed for the VSM to be used, as well as an introduction to basic cybernetic terminologies. These cybernetic terminologies can be traced back to simple common sense if the terminologies are written in simpler language.

3.7.4. Concluding Remarks on VMS

VSM is a powerful tool that can provide good structure to help visualise a complex problem. It can emphasise the details of a problem in focus without loosing the complexity of the context, this is done by the use of recursion. Also, concepts such as variety attenuation and amplifications can be used to emphasise what is important at each level of recursion and how can we deal with it, they provide other means to handling complexity. Communication and the role it plays is heavily emphasised by the model and is an added advantage. However, simplification of terminologies needs to be addressed. The VSM will be highly significant in structuring the collaboration problem of stakeholders, enforcing standards of communication, which I believe this communication appears to be the backbone of collaboration. Its division of the system into operation and meta-system and its emphasis on proper channels of communication between them and the environment is beneficial in evaluating communication deficiencies between stakeholders and ways of intervention. It is also the only available model that can handle complexity well without losing the context in which the problem is embedded, through the employment of recursion, which goes back to cybernetic principles.

3.8. Systems Dynamics

Systems dynamics developed by Jay Forrester is a tool that is used for modelling and simulation of complex dynamic problems. Forrester encompasses the concept of feedback which was first developed for engineering systems; he used them in system dynamics models to infer causality. The concept of feedback in closed-loop systems is extended to be used successfully to understand biological systems as well as open-loop social systems. The social system is very complicated and is classified under the class of "*multi-loop nonlinear feedback systems*" (Forrester, 1971). System dynamic computer models are used to reflect actual system behaviour according to a predefined model structure and decision making policy rules. As a result, future dynamics of interaction within the model is reliably achieved (Richardson and Pugh III, 1981). They are also used for evaluation of systems as the case of the railway system (Homer, Keane, and Lukiantseva, 1999) and monitoring progress by set targets in Newman, et al. (2003).

3.8.1. The Systems Dynamics Modeling Process

Table 3.4 shows the system dynamics modelling process recognised in the literature. These modelling processes recognised in the literature use one approach but are divided into different phases that eventually lead to the same result.

<table>
<tr><th>Randers (1980)</th><th>Richardson & Pugh (1981)</th><th>Roberts et al. (1983)</th><th>Wolstenholme (1990)</th><th>Sterman (2000)</th></tr>
<tr><td rowspan="2">Conceptualization</td><td>Problem Definition</td><td>Problem Definition</td><td rowspan="2">Diagram Construction & Analysis</td><td>Problem Articulation</td></tr>
<tr><td>System Conceptualization</td><td>System Conceptualization</td><td>Dynamic Hypothesis</td></tr>
<tr><td>Formulation</td><td>Model Formulation</td><td>Model Representation</td><td rowspan="3">Simulation Phase (stage 1)</td><td rowspan="2">Formulation</td></tr>
<tr><td rowspan="2">Testing</td><td>Analysis of Model Behaviour</td><td>Model Behaviour</td></tr>
<tr><td>Model Evaluation</td><td>Model Evaluation</td><td>Testing</td></tr>
<tr><td rowspan="2">Implementation</td><td>Policy Analysis</td><td rowspan="2">Policy Analysis and Model Use</td><td rowspan="2">Simulation Phase (stage 2)</td><td rowspan="2">Policy Formulation and Evaluation</td></tr>
<tr><td>Model Use</td></tr>
</table>

Table 3.4 System Dynamics Modelling Process Recognised in the Literature (Source: Luna-Reyes, 2004)

Whatever the process adopted for the system dynamics, the conceptualisation phase involves the production of a mental model. This model is called a Causal Loop Diagram (CLD). It shows the key variable of the system and what is causing each variable in a feedback representation. Mental diagrams or models can be developed and used to show cause and effect as shown in Figure 3.7. Forrester described mental model as assembled relationships in the human mind that evolve over time perceived differently by different participants (Forrester, 1995).

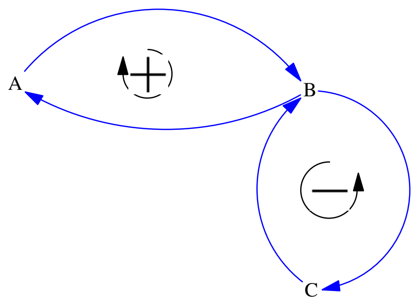

Figure 3.7 A Causal Loop Diagram.

Kim (1992) provides simple guidelines to follow in order to draw a causal loop diagram. Arrows are used to indicate the direction of the cause. A sense of how the system may behave can be envisioned from the diagram, a sign can be added to the arrow head to show if the cause and affect are positively proportional or negatively proportional. The behaviour of the loop is obtained by multiplying all the signs in a loop. A positive feedback loop is called a reinforcing loop and has an exponential behavior, while a negative feedback loop is called a balancing loop and has what is called a goal seeking behavior. CLD's are considered a very sophisticated tool on its own and can be used to formulate causal analysis of a problem or phenomena. This was demonstrated by Cavana and Mares (2004); a policy was reconstructed by the use of systems thinking and causal loop diagram and then suggests the use of causal loop diagram for policy interventions and analysis. Kirkwood (1998) explains how these graphical notations can present circular relationships of cause-and-effect that are difficult to be explained verbally.

CLDs are sophisticated system thinking tools that can be used separately to enhance the understanding of interrelationships, interdependencies and dynamic interaction of situations. They can be used for the sole purpose of capturing the dynamic cycles of influence and the facilitation of stock and flow diagram (Burns and Musa, 2001). They are mental models used in the conceptual building process of a problem, CLD analysis can then be used to analyse the behaviour of the system. A study (Smith, E., 2005) shows that the use of CLD alone provides better understanding of complicated situations by making the dynamics of its nature more clear. A study by Jambekar (no date) also show the significance of CLD's in communicating world views of the participants as documented by previous studies of the same author in 1995 and how these views could be used for considering intervention to influence and improve process quality. CLD have also been used successfully as learning tools for chemical engineering students to gain insight to the logical procedure of a system in order to better understand it and construct models to solve its problems (Haraldsson, Belyazid and Sverdrup, 2006). CLD's are found significant when used for detailed system descriptions and stand alone policy analysis (Homer and Oliva, 2001). Elias (2006) used shared mental models to analyse environmental conflicts between stakeholders, where results from his research give reasonable indication to the power of CLD in better understanding complex social problems.

The literature shows that there is no precise way of transforming CLD to what is called Stock and Flow Diagram, however Binder et al. (2005) attempted such a way in order to offer guidance to transformation to what is called the formulation phase.

In the formulation phase, a system dynamic diagram is drawn. The diagram is based on relationships between two main elements which are stocks and flows (Figure 3.8). A stock is a thing that could be accumulated through time (drawn by a rectangle). While flows are rates that move between stocks and causes changes in the level of the stocks (drawn by a pipe). When a flow moves from stock A to stock B, then it increases in A by the same amount it decreases in B. To control the change an influence may be added to the diagram and connected such that its affect can be constant or related to an equation that uses other elements in the diagram.

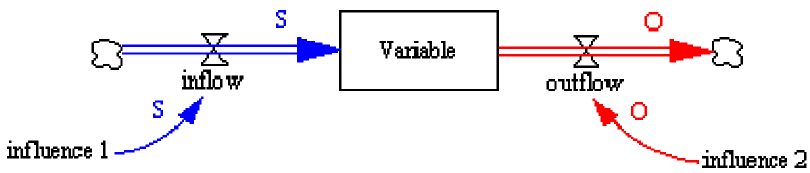

Figure 3.8 The stock and flow diagram
(Source: http://www.systems-thinking.org/stsf/stsf.htm. Accessed [16 March 2006])

Units are an important issue in system dynamics simulation, stocks and flows must have the same units per time period. Considerable care must be taken at this phase because the results of the simulation are as good as the model built. The model must be built for a specific reason; the model must show the key elements that are causing the problem and their interrelations. A model must be tested before using it for any policy formulations (Sterman, 2000).

System dynamic modelling has been used for many fields, one of which is modelling software process (Raffo and Wernick, 2001). It has been especially used to the development of agile software (Cao, 2004). Collaboration in requirement collection of software projects was also modelled using system dynamics (Luna-Reyes, 2004).

System dynamics can model tangible (hard) and intangible (soft) variables. However, soft variable need to be quantified following some kind of measurement rule. Some measurement rules used in the literature are questionable. These include variables taking values ranging (0-1) with non-linear relationships with parent variables, correlation, regression, cluster analysis and multiple classification analysis. These techniques cannot verify inferred causality (Ossimitz, 2002). An established and acceptable rule for measuring soft variables is by setting an index of some kind; such a measurement will collect perceived values for a construct between 0-100, where 0 is absence of construct and 100 is total fulfillment (Caulfield and Maj, 2002; Elf, 2006). Ossimitz (2002) argues that system dynamics would be enriched if soft variable measurements are achieved through the use of quasi-quantitative techniques and structural equation modeling. He also argues that if quantification is not feasible qualitative system methodologies that develop qualitative models should be used instead of system dynamics. On the other hand, other authors argue that by omitting soft variables essential influences may be missed (Sterman, 2000; Caulfield and Maj, 2002).

A good bibliography of System Dynamics is given by Sastry and Sterman (1992); where influential papers, books, games and software programs are listed according to the authors' views. This vast variety of work indicates the purposefulness of system dynamics in a variety of fields.

3.8.2. Systems Dynamics Strength

SD is used to show the dynamic interaction of variables, feedback is incorporated into the model formulation process through time. It provides the ability to model and simulate a system by the use of software. This makes it able to analyse unrepeatable situations using computer simulation. The analyser can develop what-if scenarios to replicate the same situation, having the power to change specific variable to serve the study questions. Which enables the evaluator to finds predictions for some problems that have well defined numerical factors. A model can be simulated even with the lack of qualitative information by using table functions in software packages. Intangible variables can be measured qualitatively and entered into system dynamics software; graphs are then produced to analyse the interrelated variables. It looks at all systems as the same (physical or social), as levels or rates. However, controversy exists between practitioners in accordance to the incorporation of qualitative data in system dynamics models; this is presented in the next section.

Analysis of what is actually causing the problem can be spotted. Indirect effects can be analysed and the root of the problem can be visualized, because system dynamics deal with the non-linear relations by incorporating time delays and table functions.

3.8.3. Systems Dynamics Limitations

The results of the methods are as good as the model developed. If the model was constructed improperly, then poor results will surely be obtained (Sterman, 2000). Therefore it is good practice to first define the goal of the models use, and then according to that the model is validated accordingly.

Finding incompleteness and contradictions in the system is time consuming and challenging. Some scholars find system dynamics not easy to use if the evaluation proceeds to the simulation level; as it is a highly technical process that needs heavy training (Williams, T., 2002). I find it lacking a way of relating variables to reality, which is challenging in complex situations, where the interrelations of factors involving the problem are complicated, and ambiguity in results can be obtained.

There is no mechanism of drawing both system and human boundaries. And no specific mechanism for encapsulating social, cultural and political constructs for a system.

There is no means of guidance on how to articulate and define the problem. This is a challenge if the problem involves many stakeholders, means must be incorporated to reflect on the relations between the factors and diagnose potential problems.

There is a big debate between researchers on whether to include soft variables in the model (Richardson, 1999), I believe that soft variables are important, since if any one is omitted a holistic approach is no longer applicable. A modeler must use his/her experience in whether to use soft variables and in what way, depending on the problem. Also, if the model is purely qualitative, quantifying it is an exhaustive procedure that requires expertise as well as another information system to collect and translate the data.

3.8. 4. Concluding Remarks on System Dynamics

System dynamics' distinct feature is that it recognises feedback and inter-relation of components in a system. It realises that cause and effect in complex open loop problems is not a one to one process, rather it is a chain of events affected by unlimited factors. Conceptualisation of these factors is achieved through the use of CLDs. In complex situations a modeller is faced with the challenge of identifying these factors. In a complex problem like stakeholder collaboration, evaluation factors of collaboration are inter-related and connected in a feedback loop. It is important to capture the factors that define collaboration according to stakeholders in developing the CLD. System dynamics does not provide any guidance into achieving this end; this is where the requisite variety of VSM needs to be utilised.

3.9. Design Patterns

The term *"pattern"* in its modern form was derived from the writings of the famous architect Christopher Alexander who has written on the topic as it relates to urban planning and building architecture (Alexander, 1977). He believes that problems and solutions appear repeatedly and that the knowledge and experience gained from them can be used to infer workable solutions to similar problems in the future. He used Design Patterns as a structure to capture these problems and solutions so that both architects and non-architects can use these design patterns to build better houses. He states that

> *Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.*
> *Each pattern is a three-part rule, which expresses a relation between a certain context, a problem and a solution.*
>
> *(Alexander, 1977)*

A Collection of patterns and the rules to combine them into an architectural style are used to define a pattern language. Pattern language is intended as an abstract generic tool which is originally used to capture proven solutions of reoccurring problems; instances of different patterns captured are called vignettes. Scholars argue that Patterns need to work together in order to build a system, and a sense of structure must be in order for them to do that (Winn and Calder, 2002).

Application of the pattern may lead to different solutions depending on the situation and the user. The pattern is meant to present problems encountered in a specific domain and how practitioners solved the problem. Structurally a pattern language can change over time by modifying, adding, or deleting patterns (Alexander, 1977).

3.9.1. The Use of Design Patterns

Historically, a pattern as described and used by Alexander was documented in London back in the seventeenth century showing patterns used for book keeping and calculating yield values such as in the case of real estate book keeping (Vokac, 2004). Its growth has made people from different fields inspired to make use of the pattern structure.

Alexandrian patterns inspired software developers to use them to resolve recurring problems encountered throughout the software development process (Appleton, 2000). They are expected to provide a vocabulary for discussing structures larger than modules, procedures, or objects (Coplien, 1996). They were also popular in the Human Computer Interaction (HCI) field and utilised by the HCI designers, who often use non-software examples to help provide a common understanding between designers (Borchers and Thomas, 2001). By establishing common language early in the design process, communication between designers is facilitated throughout the project life cycle.

In complex design situations a Pattern Language is considered a *"lingua franca"* between stakeholders (Erickson, 2000). In his paper, Erickson initiated the high potential of using Pattern Languages to create a common language for any social activity. His idea was triggered accidentally from overhearing a wedding consultant discussing her common reoccurring problems in weddings with a friend and how she was able to overcome these problems by finding solutions for a perfect wedding from previous experience of workable solutions of problems in other weddings. He managed to use Patterns to find solutions for reinventing social life in a small town about to be come a ghost town in the US just by ethnographic finding put into patterns. He managed to find out what truly represents social life to the town people in order to re-plan and renew the city. He calls other researchers in investigating the use of Pattern Languages in other domains such as self-organising communities, collaborative work, and environmental problems (Thomas, 2001; Thomas, et al., no date).

Other domains that recognised Design Patterns and made use of them are group meeting facilitation, e-learning (Bergin et al., 2001), GSS (Group Support Systems) design and software development (Hagge and Lappe, 2004). Collaboration Patterns were specifically developed for GSS design in a research by Hengst and Adkins in (2007). Several Pattern work shops are becoming more popular; where experienced Pattern writers from various domains shepherded new writers and audited developing Patterns so that they can be used in confidence by others such as in PLoP conferences; which are held all over the world. Topics covered by these conferences shows the wide spread of Patterns use in different domains, giving confidence to practitioners and showing potential difficulties.

However, the wide use of patterns shows that solutions are not always generated. This difficulty was addressed by Alexander himself and suggestions were given from him through the further generation of what is called a *"Sequence*". He argues that Patterns can also be written in a sequence which can unfold, sequences are algorithms about a process that resemble recipes in a cookbook (Alexander Website, 2006).

Patterns were also used for means other than encapsulating problems and solutions. By doing so, I believe that a user avoids the controversy raised of whether a solution can be reached from the use of Patterns. Lancaster University developed a Pattern framework (Martin and Sommerville, 2004) to document abstracts and generalisation of ethnographic findings to present reoccurring work behaviours in cooperative work interaction (Martin, et. al (2001). Each Pattern framework is enclosed with instances that describe the occurrences of the pattern in different work environments called vignettes. Their use of Patterns was not to encapsulate solutions of reoccurring problems; they were more interested in capturing the social context of cooperative behaviour to be used by cooperative groupware designers. Their aim was to design more sociable groupware (Martin and Sommerville, 2004). They used the patterns in a descriptive sense rather then an inscriptive problem solution sense as it was originally developed by Alexander. They are used as means of capturing ethnographic patterns from the fieldwork in a fast and affective manner, as they were used for rapid ethnography documentation tools. For this specific pattern templates were developed for capturing collaborative arrangements (example shown in Appendix A). Studies from social networks factored out the key elements needed for designing cooperative works, these elements were stated as Pattern headings in the Pattern framework. Patterns capture the details of longitudinal observation in less time and in easy to read structure.

In Summary, Design Patterns have evolved, a variety of forms exists starting from the original Alexandrian Form (given Appendix A). A short overview of them is included in the thesis "On the Practical Use Of Software Design Patterns" By Vokac in 2004. Whatever the form it usually can be traced back to a problem, a solution and a context no matter what the heading is. An associated diagram or picture is always added which makes the pattern more approachable. There is no right or wrong way to right a pattern, it always depends on the use of the Patterns and what available information is considered useful.

3.9.2. Design Patterns Strengths

Patterns compared to guidelines, always give more details in relevance to the context and related resources and artefacts. Examples are included in the Pattern and pictures are used to make the Pattern more approachable. Workshops are available all over the world for pattern writing. Design Patterns are found appealing because of the following characteristics.

They give an immediate connection between activities and artefact (Erickson, no date). The reason is that Design Patterns are inherently reflective; a detailed description of the problem, setting, solution and artefacts gives the reader enough details to trigger reflection. The use of a picture always gives a sudden impact that attracts the user and almost immediate relation is made to the Pattern.

Design Patterns are generic, may give different scenarios when used in different situation. Vignettes are recorded showing different use of the generic Pattern.

Design Patterns can be used to link ethnographic findings from the fieldwork to design (Martin and Sommerville, 2004). This makes ethnography more approachable by limiting the time and information needed to be gathered as they were used in rapid ethnography.

Many applications of Design Patterns in the literature makes it not limited to a specific domain, many fields have adapted it by adding and removing headings as appropriate.

3.9.3. Design Patterns Limitations

Having a set of excellent Patterns does not make a user an expert (Alexander, 1985; Gabriel, 1998) because some Patterns do not lead to solutions and might not guarantee a perfect solution (Alexander, 1985; Gabriel, 1998). Researchers are developing tools to help archive patterns and recover them for use in specific problems, this is specifically developed in the software design field (Vokac, 2004).

Structuring a Pattern Language is a challenging task because first, a Language must compose structure to make sense (Winn and Calder, 2002), and second, needs time to collect a corpus of Patterns and then build a Pattern Language from them. The same could be said for developing generic Pattern forms from available instances, Shepherding in Pattern workshops is recommended for further reliability.

This concept of patterning can be related to systems clearly through the concept of fractals. Fractals same as patterns generically define larger and larger composures of systems. The different combinations of fractals can lead to different system composures.

3.9.4. Concluding Remarks on Design Patterns

Design Patterns are generic tools that can be used for documentation and design purposes. In their original form, they consist of a problem, a context and solution associated with a diagram or picture is used as a mean of infering a solution for problems from previouse workable situations. The wide spread of its use has evolved over time, changing forms and purpose. In the descriptive sense as used by Lancaster Unversity I can make use of Design Patterns adapting the form developed by them. My purpose will be to enforce integrity in the approach developed by grounding collaboration factors attenuated from stakeholders to actual patterns of collaboration found in the case study. Design patterns will be used as a tool of validation as well as linking factors to actual fieldwork wich is lacking in most sytemic methods and methedologies.

3.10. How Can a Synergetic Integration be Achieved?

Collaboration (as discussed previously in Chapters One and Two) can be perceived differently by different stakeholders, where various factors can pool into its construction. A comprehensible way of analysing collaboration is through the use of models, however what variables to include in a model is a challenge. Tools from cybernetic, system dynamics and systems thinking where constructivism is used are integrated with stakeholder analysis to provide an integrated solution of how to elicit and identify the key factors that are affecting collaboration on a specific group within a specific context.

The research work is based on theories developed from a combination of fields: Collaboration Theory, Stakeholder Theory and System Theory. As explained in Chapter Two, a systemic approach is taken by treating the collaborative activity between stakeholders as a system itself with feedback. Different paradigms which were presented in Sections 3.5, 3.6, 3.7, 3.8 and 3.9 are integrated in the development of the EStaC approach (referenced earlier in Section 1.2.3 and presented in Chapter Four) and used for analysis. The rationale behind the paradigm constructivism adopted for this research is presented in the next section; which influenced the research methodology.

Integrated solutions are highly appreciated in the literature as better approaches to a problem solution. Such approaches bring solutions with new insight (Eltemsahi, 2001; Pfahl, 2001; Moscardini, Brewise and Meek, 2002; Schwaninger, 2004; Tansley, 2005; Searles, 2006). Powerful features in different paradigms discussed previously in this chapter are considered to be combined in order to develop the EStaC approach from a multi-methodology perspective. Aspects of pisoSIA, SSM, VSM and CLD's all make important contributions to the development of a new approach that is used to evaluate stakeholder collaboration within requirement collection of software projects. The EStaC approach is shown in Section 4.6 to satisfy the criteria developed in Chapter Two for stakeholder collaboration evaluation within requirement collection.

3.10.1. Research Methodology Rationale

Deciding on the right research methodology; to find a way to critically analyse this kind of problem was quite challenging at the beginning and was not easy to reach. The nature of the problem under study (discussed in Chapter Two) enforced the direction by which it was analysed and the direction of methodology used for approach development (further explanation in Chapter Five). Although I realise that I am not conducting an action research, my implementation of a pilot study of the initial approach framework (discussed in Chapter Five) had an impact on the final EStaC framework developed in Figure 4.1. This is only natural as the work in this thesis adapted methods of qualitative constructivism as the researchers' beliefs, values and experiences blends with the research result (Boulton, et. al, 2005). The rationale behind that choice is presented in the rest of this section.

Critical evaluation of the problem of collaboration of stakeholders was conducted and presented previously in Chapter Two. Current approaches and evolving approaches of evaluation, design and diagnosis used within other fields were critically analysed and presented in previous sections of this chapter. Synthesising the theoretical literature (in Chapter Two) an interpretive approach was used to elicit a set of base criteria, that I call *basic* or *initial constructs*, as potential variables or constructs that conceptualise the formation of stakeholder collaboration used as base criteria and constructs in Phase Two (Collaboration Definition) of the EStaC approach (shown in Figure 4.1) which included: Knowledge Sharing, Roles, Interests, Trust, Empowerment and Dialogue. These base constructs were supported further by empirical reflection of practitioners in the field as will be shown in Chapter Five.

Vital issues related to the realisation of the nature of stakeholder collaboration within requirement collection are extracted from my previous discussions in the previous Chapters One and Two, and the following summarises this analysis:

First, stakeholder collaboration within requirement collection in software projects is a social problem. This realisation unfolds the discussion for the rest of the issues extracted.

Second, there are basic constructs that build collaboration as a social process in every environment, and there are context specific constructs and artifacts that shape collaboration perception to those who experience it. The developed approach must be specific enough to incorporate any specific condition and holistic enough to include the entire picture. A mean to attenuation must be included to filter out what is important in defining the system boundary. Also a mean to amplification must be included to come up with ways to handle the system through intervention.

Third, these collaboration constructs and artifacts are not independent; they are interconnected and feed back into the process of collaboration which can perturb its environment. A means of showing causality must be incorporated in order to identify the root and decide on the proper action to intervene.

Fourth, stakeholders' viewpoints are important to defining collaboration, an identification of exact stakeholders is required. The approach must be precise enough to evaluate the collaboration process as well as identify potential risk from specific stakeholders.

Fifth, the collaboration process is dynamic and the new approach must emphasise that it can be throughout the process of requirement collection and that results might be different according to the status of the variables that construct it.

Sixth, full implication of social, cultural and political issues is vital for encapsulating context specific constructs and artifacts that shape collaboration.

Seventh, collaboration is a complex problem that is seen as a system striving for viability. It is a system that is composed of a number of stakeholders; these stakeholders are engaged in different relationships within their environment. Their engagement is caused by interrelated variable constructs. In order for their collaboration to be viable certain processes must be performed so that the interrelated constructs (that form the collaboration process between the stakeholders in the project) maintain a certain level of existence. In cybernetics terminology, these processes are called *"homeostas"* (Leonard and Beer, 1994).

Collaboration is a complex problem (Rhoten, 2002), I argue that it can be viewed as a system itself, consisting of dynamic interactions that are achieved through stakeholder's inter-relationships. The best way to comprehend this complexity is by solving the problem from a systemic perspective by the use of systemic tools. This kind of approach is adapted from complex environmental systems, where systems perspectives are perfered to develop models (Couclelis, 2000, Rhoten, 2002), and appropriate models of evaluation can be developed to incorporate the unique nature of a complex problem (Makolm, 2006).

Since this research deals with human factors in uncontrolled environments, it is clear that a replication is impossible. Although simulation is an option and can be used to provide a controlled environment for the study to conduct our experiments, it was dismissed based on the reasoning discussed in Section Three of this chapter. Therefore Charles Peirce's abduction (1979) is used to build reasoning in the results of the developed approach emphasising on logic and coherence (discussed in Chapter Four). Consistency of results will not be considered as the approach is generic and context sensitive. A variation in results depends on the stakeholders involved and their past experiences; therefore consistency is not a feature that we need to look for. However results are critically analysed and compared to other findings in the literature as will be presented in the approach implementation in Chapters Six, Seven and Eight. The approach's final output which is the intervention points will be critically analysed by practitioners (according to their practical experience) in the specific project as there is no other means to evaluation, more elaboration is presented in Chapter Five.

Evaluation as a process was carefully considered. Looking at different ways of evaluation and deciding on an appropriate one was crucially important and affects the final output reached. After researching into different direction from psychometric measures through discourse analysis and analysing purely quantitative measures of collaboration using social capital values I have come to the conclusion of using an integration of systemic ways in combination with stakeholder theory using concepts of constructive fourth generation evaluation as most appropriate in critically analysing a problem which is inherently chaotic such as stakeholder collaboration evaluation.

The complex nature of stakeholder collaboration in requirement collection and the need for involving different perspectives called for a constructive approach for evaluation to be employed. The constructive evaluation paradigm (based on the ontological assumption of relativism, epistemological assumption of transactional subjectivism and the methodological assumption of hermeneutic-dialecticism) was the shell of an integration of systemic tools with stakeholder theory. Constructivism complements the fourth generation of evaluation which is chosen to set the concepts that were followed for evaluating stakeholder collaboration. Because the general aim of the fourth generation of evaluation is better understanding through the involvement of who are being evaluated, as opposed to older generations that evolved from pure measurement with no stakeholder involvement as in the first generation of evaluation. The fourth generation (Guba and Lincoln, 1989) evaluation has characteristics matching the nature of the problem under focus and it also fits smoothly into the main steps for evaluation specified by Ramage (1999), which studies the similar problem of co-operation but on a higher meta-level. Further elaboration on this matter is discussed in later sections. The decision to use constructive evaluation complies with similar research in designing collaboration for networked learning environments in higher education, as it is considered a social process embedded in a social and political context (Pereira, 2001).

I think it is important for evaluation of stakeholder collaboration within requirement collection to use paradigms that have proved to work in different contexts, this contention is supported by the fact that paradigms consisting of ideas and practices in the evaluation of human systems *"wear out"* (De Greene, 2000). This chapter has critically analysed different paradigms that have been used in practice, emphasising the power of each one and understanding their limitations. The concepts behind these paradigms are based on system theory which is a holistic way to understanding the problem. By appreciating the power in each and understanding their limitations, they are integrated in a complementary process; the way in which these paradigms are combined will be discussed in later sections.

It is crucial to use a multi-methodology framework to develop the approach, strengths in current practices are thus combined and a new approach developed that covers more dimensions than individual practices used alone. The literature shows many examples where methodologies were combined and enhancement is achieved over single use of each paradigm alone (Eltemsahi, 2000; Moscardini, Brewis and Meek, 2002; Bustard, et. al, 2005). Mixed methods were also found beneficial in solving complex problems such as the development of e-government projects which involve the development of large software project in complex setting (Gil-Garcia, 2006; Gil-Garcia and Pardo, 2006).

3.10.2. Paradigms Behind the EStaC Approach

System thinking is the basic paradigm used in the approach. It sets the fundamentals of a way for understanding complex settings from a holistic perspective. It produces strikingly different results from traditional analysis especially when the system under study is multi-loop and dynamically complex. It lends itself naturally to the problem under study and enables the evaluator to comprehend the complexity of the matter just as Forrester in (1971) discussed its ability to see through complex structure. Systems theory in this approach is supported by cybernetics and system dynamics. Both are tremendously known to lead to evolutionary solutions for reoccurring problems. Theories from cybernetics, system dynamics and systems thinking give new insight to solving problems by introducing new ways of thinking. Literature shows the incorporation of these practices for evaluation purpose (Williams, B., 2002; Currie, Joyce and Winch, 2006).

Many systemic practices are available and were discussed in previous sections of this chapter. Soft System Methodology (SSM) was specifically developed to analyse problems with social and political issues (as discussed in Section 3.6). The Viable System Model (VSM) shows a different way for organisations to be diagnosed to visualise the understanding of viability issues and problems (as discussed in Section 3.7). System dynamics (as discussed in Section 3.8) offers the development of mental models CLD which is considered to be a mature methodology on its own of understanding causal influence of problems (Wolstenholme, 1982). Using cybernetic tools, different states of a complex system such as stakeholder collaboration can be evaluated such that internal states can be observed and controlled. Dong (2004) believes this provides a practical real time analysis of the team collaboration process, compared to discourse analysis and psychometric evaluation. These systemic tools are complemented by the use of pisoSIA (as discussed in Section 3.5) which clearly identifies stakeholders that are the core of collaboration in software requirement collection. Design Patterns (as discussed in Section 3.9), which I believe can be classified as a methodology (since they are actually a set of guidelines) to help people capture and undergo action. They are reoccurring problems that can happen in certain domain, and that their documentation infers practitioners in the domains to undergo potential workable action according to experience and history. Detailed analysis will be discussed later (Chapter Five) showing how to use them in this study and in what way.

In compliance with the constructivist paradigm adopted in this study (Section3.4), the fourth generation of constructive evaluation is called for; stakeholders' perspective is crucially important and is influential to the preliminary process of problem and goal definition (Guba and Lincoln, 1989). Principles from it when adapted and integrated with other systemic paradigms a new approach for evaluating stakeholder collaboration emerge; which is discussed in detail in Chapter Four as the EStaC approach. Figure 3.9 presents the research framework followed by a more detailed framework in Figure 3.10.

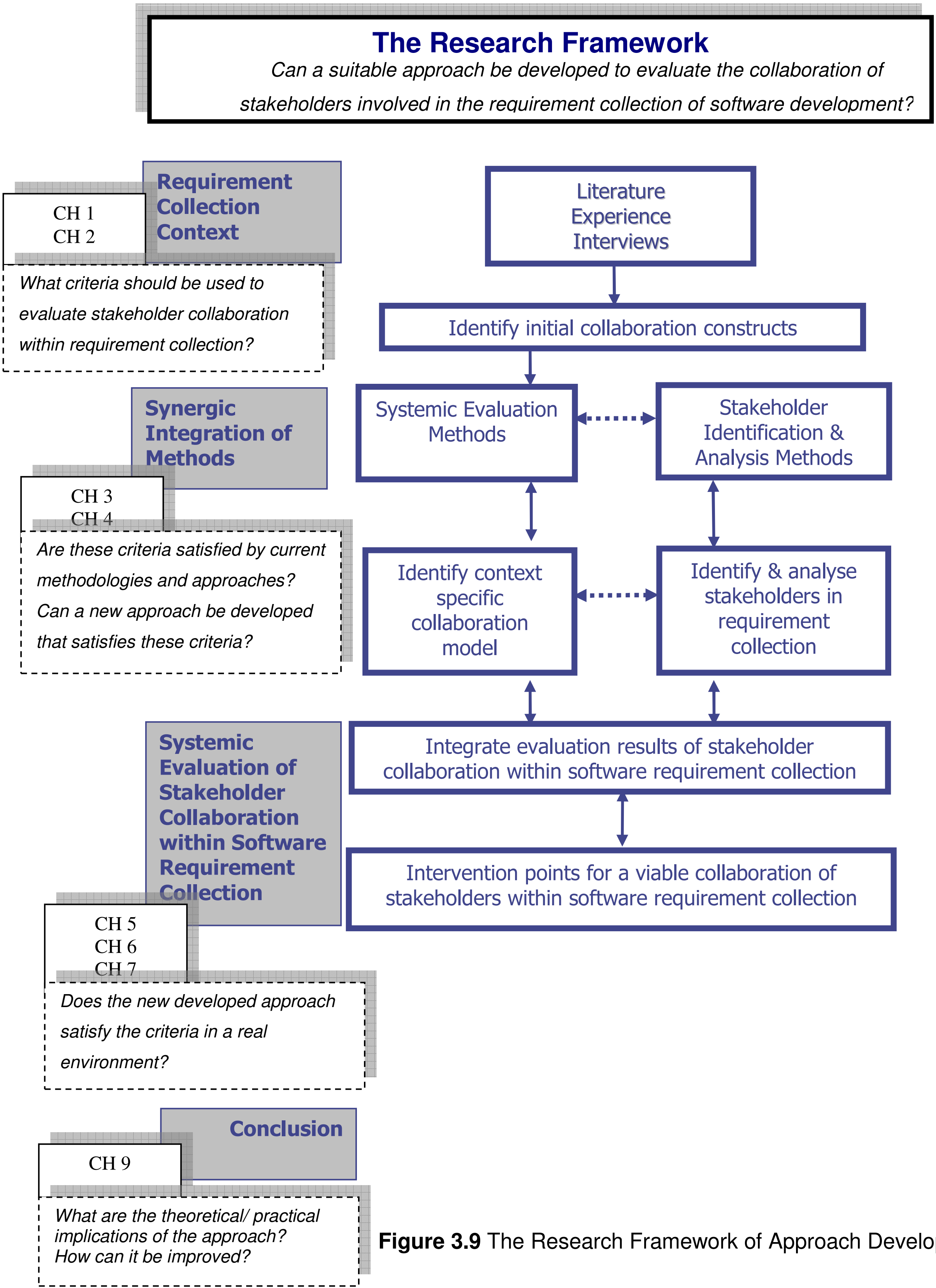

Figure 3.9 The Research Framework of Approach Development

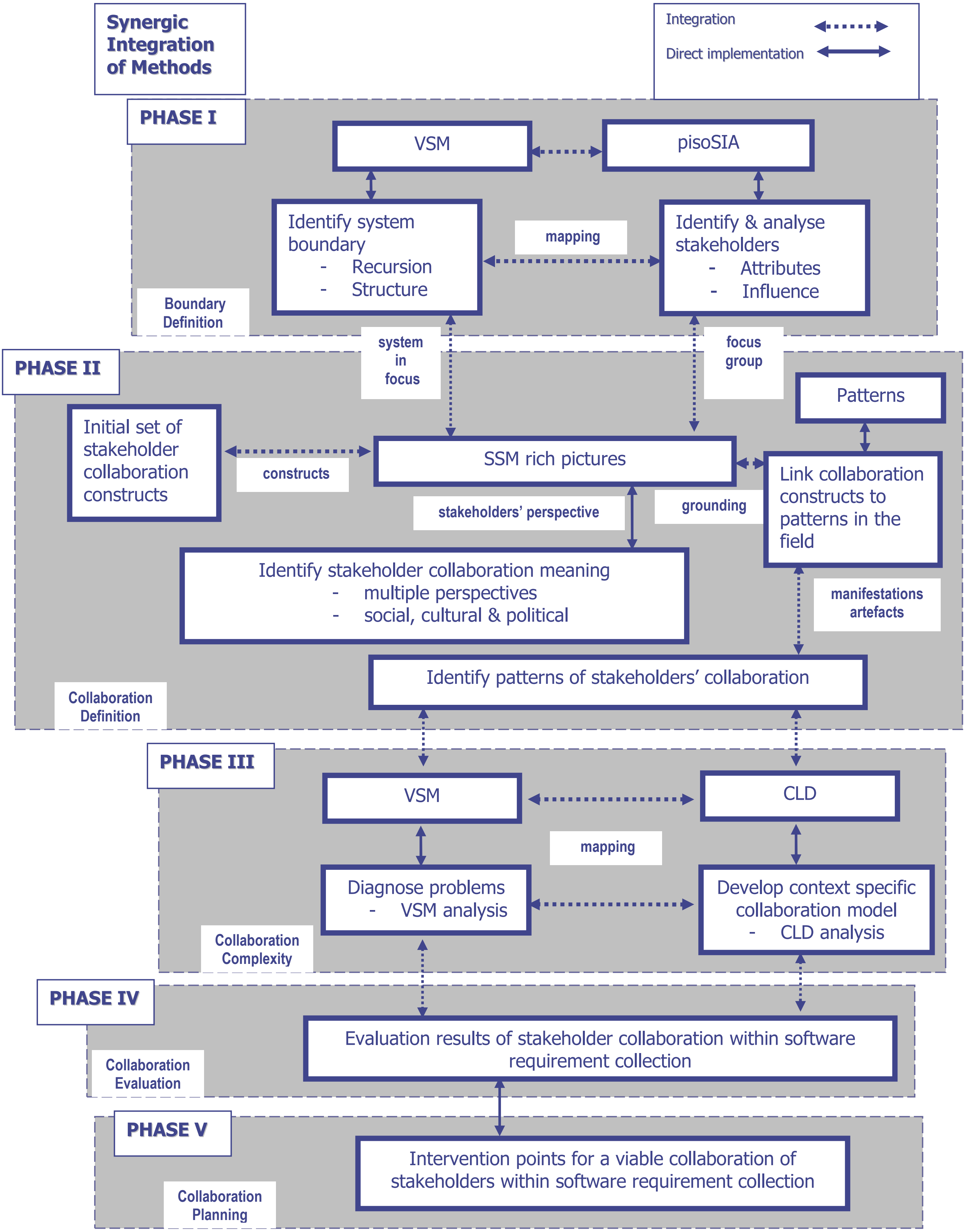

Figure 3.10 The Developed Approach Detailed Framework

Figure 3.10 shows the theoretical underpinning that led to the development of the EStaC Approach that is presented in Chapter Four. It illustrates a detailed presentation of the EStaC Approach Framework that is given in Chapter Four. It explains the overall process based on different concepts integrated from the different methods, methodologies and models presented throughout this chapter. A detailed description of the EStaC Approach phases is presented in the next chapter in Section 4.3. A more user friendly outline of EStaC is shown in Figure 4.1; which is further discussed is Chapter Four.

3.11. Conclusion

Powerful models, methods and methodologies used for different system evaluation purposes have evolved from new paradigm shifts. New ways of thinking are leading the way for new approaches for evaluating complex problems. In this chapter, some of the most influential models, methods and methodologies from distinguished paradigms within systemic fields were discussed. These powerful models methods and methodologies can be used by different organisations for the purpose of evaluation and design of evaluation approaches for stakeholder collaboration within requirement collection. The literature shows the major benefits gained from the use of these methods, it also shows that each has its own limitations. They are chosen such that they will be integrated in complementary fashion in Chapter Four in order to develop the EStaC Approach. Strengths and limitations of each were critically analysed, highlighting how specific characteristics could be used in the development of the EStaC approach.

Literature shows examples that pisoSIA is a stakeholder identification and analysis method that is powerful in identifying all relevant stakeholders in a simple and easy to use framework. It analyses them in two ways; it finds their interests and looks into conflict areas and where negotiation might be useful.

SSM rich pictures help extract social, cultural and political problems associated in the environment of stakeholder collaboration within requirement collection as will be seen in the next chapter. Conflict areas identified using pisoSIA need to be emphasised and stressed, and ways of negotiation and intervention also needs to be discussed between stakeholders to come up with the constructs that define collaboration according to their perceptions and the context into which the collaboration is evolving. SSM rich pictures can serve this aspect.

It is also vital to understand the affect of each construct on the total system and how it is affected by other constructs. CLD is vital to show these relations in an easy, logical and comprehendible manner. Rules of CLD evaluation can be used to evaluate these constructs and their affect on collaboration as a system.

VSM diagnoses the problems from the aspects of what threaten its viability. It visualises the structure of what viable collaboration should be based on and what communication channels need to be constructed between them. It will also be very beneficial in handling the complexity of collaboration by looking at it as a recursive system nested within a recursive system.

Design Patterns used in the descriptive sense, can find collaboration patterns from rapid ethnographic findings to enforce validity to the CLD building.

The EStaC approach as presented in Chapter Four is developed by integrating the paradigms presented in this chapter. Their description is provided, and their points of usefulness and integration were discussed. The use of cybernetic tools uncovers the complicated nature of stakeholder collaboration within requirements collection while the use of stakeholder analysis clearly defines the boundaries.

Chapter 4

4. Evaluation of Stakeholder Collaboration within Requirement Collection (*EStaC*): A New Approach

4.1. Introduction

In the previous chapter, paradigms consisting of powerful models, methods and methodologies used by different organisations were analysed. An integration of these paradigms was called for in order to develop a specific approach from a multi-method perspective that can satisfy the criteria developed in Chapter Two.

Based on the points stated, and the theoretical underpinning presented in chapter three, a new approach was developed. It is a combination of processes adapted from different well established models, methods and methodologies. The integration is meant to be complementary; processes that showed strength in different paradigms are emphasised, while difficulties and limitations are overcome by integrating processes from others. This approach of reaching synergies between methodologies has been well recognised and made use of in the cybernetic literature as shown in the previous chapter.

This chapter discusses the new developed approach which is called the EStaC approach. A description of the new approach is presented and the rational behind the concepts and choice of research method is discussed and critically analysed. An evaluation of the approach is presented at the end.

4.2. The EStaC Approach

A detailed description was illustrated in the *Detailed Approach Framework* in Section 3.10.2 shown in Figure 3.10; which shows the overall theoretical underpinning process of the EStaC approach based on different concepts from systems theory, collaboration theory and stakeholder theory. There was a need to make it more presentable for practitioners; a more user friendly and simpler outline was needed and developed as shown in Figure 4.1.

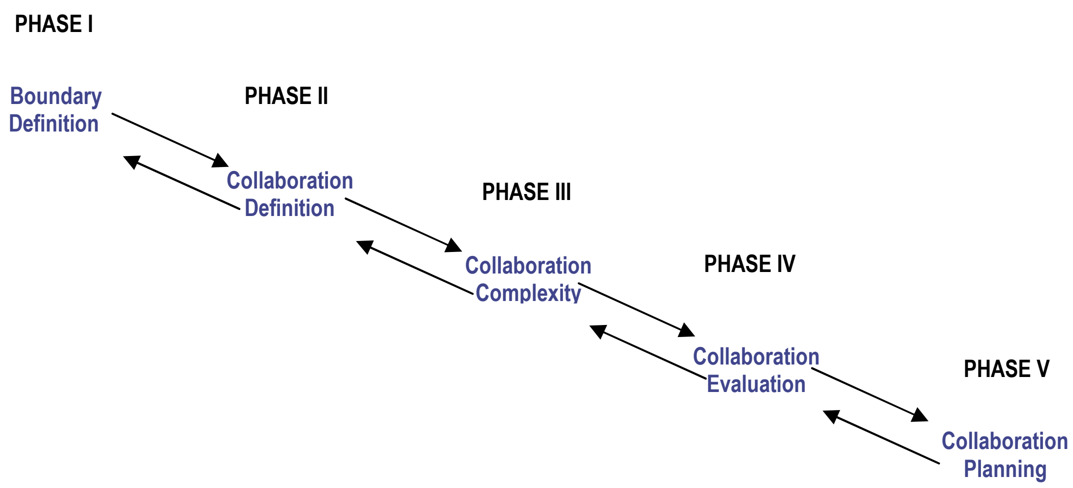

Figure 4.1. A Simple Outline of the EStaC Approach.

The EStaC approach consists of an integration process through five major phases as shown in shown in Figure 4.1. It is summarised as follow:

Phase 1: Boundary Definition

1.1. Understand the System

1.2. Structure the System Boundaries

1.3. Define Human Boundaries

1.4. Visualise the System Boundaries

Phase 2: Collaboration Definition

2.1. Define the Collaboration Constructs

2.2. Filter & Prioritise the Collaboration Constructs

2.3. Define the Collaboration Patterns

Phase 3: Collaboration Complexity

3.1. Draw Inter-relationships of Collaboration Patterns

3.2. Analyse Collaboration at Different Granularities

Phase 4: Collaboration Evaluation

4.1. Identify Collaboration Viability

4.2. Analyse Short and Long Term Behavior

4.3. Map Collaboration Patterns

Phase 5: Collaboration Planning

5.1. Perturb Findings

5.2. Final Analysis

5.3. Develop intervention points

A descriptive approach was adapted for evaluating stakeholder collaboration within requirement collection and was considered sufficient to give beneficial feedback to the evaluator. The work of Seng *The Fifth Discipline* (1990) is a distinguished example of purely qualitative analysis of system models by using CLD's associated with verbal descriptions to analyse learning organisations where managerial and economical aspects are analysed. Other practitioners such as Coyle (1999, 2000) with over 40 years experience in system dynamics and the first recipient of a system dynamics achievement award argued that that a practitioner should be wise enough to draw limits on when to quantify qualitative data and when to use qualitative data on its own. Coyle strongly supports his argument by an example of a quantified model that turned out completely different than the original claim it was supposed to model (Coyle, 2000). He also adds that quantifying multiple soft variables may confuse practitioners rather than enlighten them; a real world case supports this claim in addition to many citations in the literature (Coyle, 2001). Other researchers argue that quantification always add value even when the variables are not so clear but they should only be used when the budget and time permits (Homer and Oliva, 2001).

Quantifying the results is possible and inter-relationship connections may be evaluated in a greater depth. Researchers are still struggling on when to set the limits of quantifying qualitative models (Ossimitz, 2002; Richardson, no date). In this study, the decision of not quantifying the collaboration model was based upon the following:

1. The methodology is rigorous enough in constructing the collaboration model from the stakeholders and from the evaluation's environment, which gives enough confidence in the collaboration model under construction. Triangulation is heavily incorporated and stakeholder perceptions are linked to at least three vignettes from the field using specific protocols. This is a very important issue that practitioners have called for because systemic modelling efforts lack detail in describing the qualitative gathering techniques which have a central role in all levels of model development (Luna-Reyes and Anderson, 2003).
2. Quantification will not add any extra findings that might affect the answering of the research question; this makes it out of the research scope. This quantification process could be investigated in future research, developing a corpus of definitions for soft factors (collaboration constructs) and relating them to mathematical equations. This corpus can be added to a later version of the approach.
3. Evidence from the literature show that the quantification process of soft factors needs expertise in measurement rules (Coyle, 2001; Roy and Mohapatra, 2003), and that poorly quantified qualitative data will result models that are less significant than the qualitative data that they were derived from(Coyle 2001), which will reduce the possibility of making the evaluation approach accepted. From the literature, ease of use is one of the characteristics of a good evaluation method (Ramage, 1999).
4. The quantification process needs a good understanding of measurement rules, misinterpretation of the quantification process may lead to wrong results. That

is why quantifying a purely qualitative model is criticised by the literature (Ossimitz, 2002). Although there are some attempts in quantifying soft factors such as trust and knowledge sharing, however the process was exhaustive mainly using grounded theory (Luna-Reyes, 2004). Readings show that lots of the value gained from the qualitative data gathered might be lost during the quantification process, if no means of reliable quantification is available(Ossimitz, 2002). Ossimitz, a pioneer in system dynamics argues that qualitative methods in systemic situations where quantification is not so feasible should not be under estimated and credit should be given to their use.

4.3. Approach Description

Figures 4.1 illustrate the five phases that compose the developed EStaC approach to evaluating stakeholder collaboration within requirement collection. These phases evolved after numerous refinements, the development process will be discussed in detail in the next chapter as I consider it a crucial part of both the evaluation process and application process of the approach. My own reflection of early implementation of a pilot study definitely affected the final framework of the approach presented in Figure 3.10.

In association with the detailed methodology framework shown in Figure 3.10 and the simple EStaC outline in Figure 4.1, the following sections will give a description of each phase in EStaC, these phases are given means to return to any previous phase and make changes as new understandings are discovered. It also must be noted that the phases and stages within the phases are holistic and are developed in a complementary manner.

4.3.1. Phase 1: Boundary Definition

The first major step in evaluating stakeholder collaboration is to define the system boundaries. Boundary definition is essential in all system evaluation and need to be dealt with in the beginning. This phase is an investigation and understanding phase that makes use of both VSM and pisoSIA to define the boundaries of the system.

Phase.1.1. Understand the System

A preliminary investigation is essential to understand the problem and to identify a system in focus by analysing documentation and unstructured interviews to get an essential understanding of issues in the organisation; such as goals, roles, structures, influence and procedures. The challenges in the complexity of boundary definition that contribute to understanding a holistic perception of the system are gracefully handled through VSM by providing a means to comprehension through the distinctive concept of recursion; which is highly appreciated to focus on specific details without losing the holistic perspective.

Phase.1.2. Structure the System Boundaries

VSM provides a structure to visualise the boundaries of the system. All communication channels must also exist and have stakeholders to perform them. A deficiency in collaboration is immediately diagnosed and identified by completing the structure. Early warning signals are passed on to Phase Five to be documented as part of the intervention points in the planning strategy.

Phase.1.3. Define Human Boundaries

This is a very important phase, as it is sometimes difficult to identify all relevant elements within the system boundary. The pisoSIA matrix is applied to the system in focus; to ensure the full identification of relevant stakeholders. Grouping the stakeholders makes them more manageable and makes the choice of representative easier by making sure that a stakeholder is chosen from each group. Analysis of potential conflict prioritises the stakeholders and gives immediate attention to the evaluator to include them in the analysis. Some Stakeholders might be recognised in later phases. An evaluator can go back to any phase and repeat processes as new findings are revealed. This might be an exhaustive process; an evaluator must have the inner insight to initiate an end.

Phase.1.4. Visualise the System Boundaries

The evaluator then maps the stakeholders into the structure defined by the VSM. This step visually defines the system boundaries; the evaluator must ensure that all Systems one through five of the VSM exists in the VSM structure and has stakeholders associated.

Boundaries are specifically defined; pisoSIA identifies stakeholders which are the human boundaries that the system is composed of while VSM defines the system boundary that is represented by organisation structure.

4.3.2. Phase 2: Collaboration Definition

Focus groups of identified stakeholders are gathered to come up with a definition of collaboration based on their perceptions. Representatives are chosen from the identified stakeholders in the previous phase. A combination of two practices is used in order to understand the social, political and cultural issues that the nature of collaboration evolves from. These practices are: SSM and design patterns. Goals of the evaluation must be kept in mind and specified in a joint effort between the stakeholders.

Phase.2.1. Define Collaboration Constructs

As an initiation to participation an initial set of variables that characterise and may influence collaboration between stakeholders in requirement collection is introduced by the evaluator for the stakeholders to discuss. These constructs are used as motivation factors in the approach by the evaluator for the stakeholders to open up and participate in the form of story telling. The Initial Collaboration Constructs are:

- Knowledge Sharing
- Roles
- Interests
- Trust
- Empowerment
- Dialogue

SSM rich pictures (presented in Chapter Three) are used by the evaluator to help visualise collaboration as a system, the processes that lead to it are discussed between stakeholders and other key constructs influencing collaboration are then encapsulated as the negotiation between stakeholders evolve. Social, cultural and political issues affecting collaboration are emphasised due to the use of the SSM and collaboration related constructs are raised.

At this sub-phase communication may be viewed as a main construct by many stakeholders; I believe it is a manifestation of dialogue and it is inherently analysed by the approach. The approach intrinsically enforces communication by identifying communication deficiencies from Phase One structure. Communication can however be regarded as an entirely separate construct that can have tools and artifacts if stakeholders negotiate it to be.

This negotiation elicits the definition of collaboration according to the stakeholders' perception. There should be an emphasis on the importance of their opinion on how much they thought that these constructs shape stakeholder collaboration. Constructs or artifacts raised by the stakeholders are written down. Constructs not appreciated by the stakeholder group from the initial set should be removed and not forced on the group.

Phase.2.2. Filter & Prioritise the Constructs

The facilitator ticks beside the construct or artifact every time a participator in the group talks about a story or incident in relevance to it. At the end of all focus group meetings, elicited constructs and artifacts are filtered out by picking the ones that were ticked three times or more to be considered as initial collaboration patterns that need to be grounded as will be discussed in coming sub-phase of the approach. Prioritisation of these constructs should be obtained from the stakeholders. Different stakeholders under different context may regard what is important to collaboration differently. The methodology under development synthesis such differences and appreciates these perceptions.

Phase.2.3. Define Collaboration Patterns

Defined constructs are backed up by linking them to patterns in the field; this is done by using an adaptation of Alexandrian design patterns and Lancaster University collaboration design patterns (A design template is shown in Appendix A). Grounding constructs perceived by stakeholders using SSM to reality using design pattern templates is a crucial step, the evaluator needs to revisit the stakeholders and let them associate each construct to a context; a story or an incident that happened (which are called vignettes). It is crucial to extract from them the relevant details to encapsulate the richness of the situation. What happened? Where? When? Who was involved? How did the collaborative situation end? What type of communication medium used? A pattern template is used to document and record these incidents (vignettes). This is what I call *pattern mapping*, perceptions of collaboration constructs are mapped to encapsulations of real life incidents. Three pattern incidents are required for each construct. Triangulation is important in the design pattern realm which enforces validity and integrity to the developed pattern. Higher conceptual pattern can link to lower detailed level pattern; this linking is inherent in Design Patterns and provides a unique way of presenting rich descriptions with causality.

4.3.3. Phase 3: Collaboration Complexity

The complexity of collaboration is recognised and attenuated in this phase. Mental Causal Loop Diagrams (CLD) used in system dynamics (presented in Chapter Three) and system thinking concept are employed to conceptualise the inter-relation of constructs that that collaboration evolves from. CLDs are used to draw inter-relationships of collaboration patterns perceived by stakeholders (from the previous phase) in such a way that a structure influence is recognised between them. Levels of recursion defined in the first phase are a distinctive approach to dealing with complexity.

Phase.3.1. Draw Collaboration Inter-relationships

A conceptual layout of uncovered collaboration patterns are structured in inter-connected relationships using concepts in CLD. Collaboration patterns uncovered from the previous sub-phase evolve into a pattern language that uncover steps as "easy as *reading a recipe in a cookbook" (Christopher Alexanders' Pattern Language Website)*. There is a distinctive appreciation of viewing the CLD as an equivalent diagram of a higher level structure of a pattern language.

Phase.3.2. Diagnose Collaboration at Different Granularities

VSM is used to diagnose problems in collaboration at a specific level of recursion specified in the first phase, to help overcome the overwhelming complexity of the situation.

A mapping of inter-related collaboration constructs is established. Inference of relations is realised and problems that hinder collaboration can be identified to a specific system under focus. Recommendations to diagnosed problems are passed on to the next phase in order to analyse in relation to other findings.

4.3.4. Phase 4: Collaboration Evaluation

At this phase results from previous phases are passed on where the collection of findings are reevaluated and refined, all the issues from the different phases in the application of the approach are considered in a holistic manner. Analysis methods of both VSM and CLD are integrated to evaluate findings affecting the collaboration process. Analysis in this phase is conducted in both parallel and sequential manner.

Phase.4.1. Identify Collaboration Viability

VSM analysis is able to design collaboration and consider intervention points by confirming to the following:

- Stakeholders can be in more than one system filling more than one role; however an evaluator must make sure that this will not affect the system behaviour. Many roles given to a stakeholder is a sign for deplaning, than that stakeholder might not be able to perform the roles efficiently. The project manager must deploy resources efficiently over the VSM structure

- Missing communication channels between stakeholders will affect the viability of collaboration between them.
- Primary operations in VSM System One must be atomic, higher level interference must be minimum and not interfering with the ability given to the lower level to handle variety.
- Everyday activities in System Two must be met efficiently and deployed with resources.
- Synergy and optimal performance must be achieved, System Three ensures such synergy.
- Looking at the future ensures planning for disturbances that might affect collaboration. System four is in charge of these activities.
- System Five, ensures that policies are implemented according to goals identified

Phase.4.2. Analyse Short and Long Term Behavior

CLD behavioural analysis is used looking at negative and positive loops, finding ways to boost collaboration. Reinforcing loops of collaboration are desirable and ways of boosting should be considered. Both short and long term analysis when analysed can reveal findings that aid collaboration. Constructs are considered in relation to other constructs that affect and are affected by them.

Phase.4.3. Map Collaboration Patterns

VSM analysis passed on from the previous phases is integrated with Collaboration Patterns. This is conducted by mapping the CLD onto the VSM structure. The evaluator should integrate the analysis to management concepts of the VSM, link actions that can be specific to certain values that the organisation needs to embed into its culture. For example human relation courses can be employed such as empowerment courses in the case of low empowerment or the organisation can use informal ways of changing the attitudes of employees to boost their collaboration through social events with collaboration goals. Social events could also be a way of raising awareness to a project if awareness was found lacking from the analysis. This handling is what is known in cybernetics as variety.

4.3.5. Phase 5: Collaboration Planning

The last phase of this approach is a strategic planning phase developed from what has been uncovered and learned in the previous phases.

Phase.5.1. Perturb Findings

Warning signals from the previous phases are perturbed to feed into the final analysis which infers the final evaluation of the collaborative system in the coming sub-phase.

Phase.5.2. Final Analysis

Analysis concepts of VSM are taken into consideration integrating results from the previous phases. The evaluator needs to comply to essential recommendations from the VSM analysis in order to identify a viable collaboration plan. Also comparing archived collaboration patterns with the current situation in the organisation, the evaluator can use this practice of analysis to develop findings that can be passed on to the final phase of planning collaboration. Inter-relations of constructs are taken into consideration emphasising the social, cultural and political nature of the problem.

Phase.5.3. Develop Intervention Points

Stakeholder collaboration is planned for by developing intervention points and recommendations for a viable requirement collection process. The final analysis in the previous sub-phase uncovers intervention points that the practitioner needs to comply with. Sticking to these points makes sure that the collaboration between stakeholders is not obstructed during the requirement collection phase of the software development.

4.4. Benefits of the EStaC Approach

One of the greatest challenges in software development is getting the stakeholder to sign off the requirement documentation. The existence of numerous requirement collection processes and collaboration platforms have not eliminated the difficulties faced with stakeholders in requirement collection as it is deeply entwined with a web of factors not realised by either the analyst or the software development process used for requirement collection.

EStaC is highly beneficial in synthesising the collaboration process within stakeholders in software requirement collection. It gives a higher appreciation to the group of stakeholders involved and the context in which they are embedded. It is highly sensitive to social, cultural and political factors affecting collaboration, which is a major threat to the failure of software projects. Many current processes recognise this threat but fail to provide specific means to handle them.

The previous sections of EStaC description show that the integration of various methodologies and models is done in a way that emphasises the power specific to each in handling part of the problem. Stakeholder identification and analysis specifically identifies relevant stakeholders and analyses potential conflict points. Mapping these stakeholders onto the VSM structure relates stakeholders in projects to viability positions in the system.

Recursion is used at various levels to comprehend the complexity of the situation. It is context specific and can be integrated with any existing planning and management process of software projects. Several applications of the approach can be developed throughout the requirement phase; this application complements the dynamic nature of the problem.

Communication which is the backbone of collaboration is highly synthesised; missing communication channels are recognised immediately in the preliminary phase of boundary definition. This is a very important feature that enables project managers to set standards at a very early stage.

“*Now and then*”, a look into the future provides the evaluator to identify perturbs that might affect stakeholder collaboration in the project. A defined alliance with a planning group that analyses coming social, cultural and political issues that might affect collaboration ensures its viability.

EStaC can be applied to different granularities depending on the goals of higher management in the project. It can be applied to the project as a whole or it can be applied to certain parts of the projects.

The type of evaluation this EStaC undergoes is the fourth generation evaluation; it complements the nature of discovering the problem and fits well with approach phases as it blends with the SSM focus groups.

4.5. EStaC Approach Evaluation

Does EStaC provide the evaluator with information of sufficient value to assess the stakeholder collaboration process? Is this information what the evaluator really wants to know to assess the nature of collaboration between them? These are the questions we need to answer to prove evaluation and validity issues of EStaC. The first question relates to the epistemology of stakeholder collaboration, while the second question relates to its ontology. Both contribute to the methodology adopted for the development process.

To get an answer to the questions above, theoretical and practical validity issues are considered and presented in the next sections. Evaluation against the new criteria developed previously in Chapter Two is also investigated in Section 4.6.3 to show what dimensions can be covered by the EStaC approach that current practices fail to.

4.5.1. Theoretical Evaluation

From the literature review that I have conducted in my first year of study, I conclude that collaboration of stakeholders in a software requirement collection process is a social activity that is altered by varying constructs depending on who is involved, where it happened, when it happened and how it happened. In my research an approach is developed that can help us understand what are the important constructs that shape its perception according to a specific group in a specific context and how collaboration evolves between them. It is only natural that a constructivism approach is adapted. According to social constructivism, reality does not exist; it is constructed by the perception of the people who live in it which evolves from their shared experiences. Constructivism (discussed in Section 3.4) is consistent with the fourth generation of evaluation (Guba and Lincoln, 1989); its basic epistemological assumption is transactional subjectivism; where perceptions of reality depend on the interaction of stakeholders who engage in forming these findings, and the basic methodological assumption of constructivism is hermeneutic-dialecticism; which is a process that involves uncovering, finding meanings, confronting, comparing and contrasting situations that involve stakeholders (Guba and Lincoln, 1989).

EStaC development is consistent with the call for the need of observing systems and relationships; Espejo (1999) believes that we are in a paradigm shift toward methodologies based on self-construction and autonomy. I find myself agreeing with this need of constructive methodologies.

EStaC is also consistent with the framework developed by Ramage in 1999 for stakeholder cooperation evaluation; it stresses on uniqueness and context rather than repeatability, therefore any lessons gained from using the methodology "*can be said to be fulfilling the methodology*". He goes to further emphasis on the use of triangulation because of the nature of the situation. In this research triangulation is also emphasised by grounding the analysis with collaboration patterns found in at least three different situations which are assertions from reality.

According to Ramage (1999), there are five fundamental steps for good evaluation:

1. identify the type and purpose of the evaluation;

2. decide what is the system to be evaluated;

3. determine who are the stakeholders;

4. observe & analyse (the heart of the process), concurrently formulating a set of key questions;
5. encourage various forms of learning (such as reporting back to stakeholders).

These steps fit and complement the phases specified in the EStaC approach; the first three steps are incorporated in Phase One, the fourth step is incorporated in Phases Two through Four, The fifth step is incorporate in Phase Five.

Mingers matrix of mapping methodologies (Brockelsby and Mingers, 1999) provides convincing justification for mixing methodologies. I used it to show the wide coverage of dimensions that the integrated new approach covers compared to available practices shown in Chapter Three. The developed approach covers the dimensions shaded in Table 4.1.

		Phases of Interaction			
		Appreciation of …	**Analysis of …**	**Assessment of…**	**Action of …**
Problem Domain	**Social**	Social practices, power relations	Distortions, conflicts of interests	Ways of challenging and altering power structures	Generate empowerment and enlightenment
	Personal	Individuals' beliefs, meanings, emotions	Different perceptions and Weltanchauung	Alternative conceptualizations and constructions	Generate accommodations and consensus
	Material	Physical circumstances	Underlying Casual Structure	Alternative physical and structural arrangements	Select and implement best alternatives

Table 4. 1. Mapping Methodologies Framework. Source: (Brockelsby and Mingers, 1999)

4.5.2. Practical Evaluation

Practical evaluation of EStaC is conducted through the use of case studies. A case study approach was chosen in compliance with the qualitative nature of the problem under investigation. Also the literature shows its use in validating software evaluation research where invented evaluation methodologies are evaluated based on the guidelines developed by Yin (1994). Two characteristics need to be realised: the evaluators' intervention in performing the steps and the analytical skills of the evaluator (Lee, 2003). This realisation of uniqueness of implementation and result analysis makes a case study the best means for evaluation. It also provides better understanding of the developed approach or methodology.

Rules and procedures (shown in the case study design report in Appendix B) were defined prior to implementation in order to set the standards that were followed through out the research strategy presented in Chapter Five. Sticking to these rules and procedures ensured the practical validity of the case studies that are presented in Chapters Six and Seven.

The credibility of EStaC results are evaluated in Chapter Five Section (5.11) by employing abductive reasoning and through user assessment given in Chapter Eight. Feedback results from senior project engagers showed high appreciation of the practical value of using this approach as part of project management procedures. Most of the participants showed specific interest in wanting to use this approach in coming software projects. More details are shown in the case study user assessment in Chapter Eight.

4.5.3. Evaluation against the New Criteria

At the end of chapter three, a need for a new approach is raised to solve the problem. This call was based on criteria developed that intrinsically describe the inherent nature of stakeholder collaboration within software requirement collection. The EStaC approach is evaluated against these criteria.

This approach is scalable and can be applied to any degree of complication. The amount of evaluation undertaken depends on the goals of the evaluation preset by the project management. The use of recursion in VSM satisfies both scalability and the comprehension of complexity which are two of the criteria identified.

Social, political and cultural issues affecting the problem are synthesized affecting the collaboration evaluation formation. This is a very important criterion that is satisfied as stakeholder collaboration within requirement collection is recognized as a social process. SSM distinctively captures the social, political and cultural issues through the specific streams within its methodology. The incorporation of rich pictures visuals these issues in an easy to analyse manner.

Boundary definition is achieved through the use of both pisoSIA and VSM. Human boundaries are very important to this evaluation since their collaborative interaction forms the focus of evaluation. Human boundaries are identified and analysed through the specific employment of pisoSIA. The project boundaries consisting of the organisation structure are identified through the formation of the VSM. The mapping between VSM and pisoSIA completes the boundary definition.

Feedback is considered and is incorporated within the approach through the use of CLDs. Causal relations are shown, making the approach able to consider the actual constructs that are affecting collaboration through a series of non-linear cause and affect relations.

Holistic perspective is certainly achieved through the incorporation of VSM, CLD and SSM. The use of pisoSIA also brings a holistic perspective by including all the relevant stakeholders to be considered in the evaluation process.

This validation does not favour EStaC to other practices, it only points out that different levels of understanding can be uncovered and the degree they are uncovered depends on the goal of evaluation and the analytical skills of the evaluator.

4.6. Conclusion

Selection of the research methodology employed is justified by critically analysing the problem of stakeholder collaboration and coming to the best way to handle such investigation. Based on the ontology and epistemology of findings from the literature a methodological framework is based for investigating this research.

Notwithstanding the limitation given, EStaC represents a valuable contribution to the existing body of knowledge in both the software engineering and stakeholder fields, as it represents an evaluation approach which can be easily integrated with current practices of planning and management of software projects. It complements the nature of workflow in a software project and gives it defined structure that enforces quality and raises awareness between stakeholders to the upcoming project.

EStaC diagnoses problems that might hinder stakeholder collaboration in the requirement collection process of software development relying on common perceptions, common sense and triangulation. It is illustrated in the coming chapters; the framework consisting of the five phases that form it have been practically validated in the context of an implementation of an electronic government project in the State of Kuwait.

Chapter 5

5. Development of Research Methodology

5.1. Introduction

The aim of the research was to explore stakeholder collaboration evaluation within software requirement settings. An attempt was made to extract from the literature the diverse constructs that shape stakeholder collaboration (Chapter Two), no general agreement was found. Two decisions were made: First, elicit favourable criteria that characterize stakeholder collaboration within requirement collection, and then on the bases of these criteria develop an evaluation approach that satisfy these criteria. Second, elicit common stakeholder collaboration constructs from the literature as a basic starting point of a new approach that satisfies criteria developed. Although there are attempts of better understanding of stakeholder collaboration (analysis in Chapter Two) none showed that they satisfy the criteria developed to evaluate stakeholder collaboration. New paradigms of system design and evaluation was considered, and an appreciation of the potential gain each would offer on its own (analysis in Chapter Three). This motivated work to develop a hybrid approach that would integrate these paradigms in a synergetic solution (analysis in Chapter Three and Four). In addition, consideration was given to incorporate concepts of constructivist evaluation (Fourth Generation Evaluation) which utilises methodologies of the constructivist paradigm. As a result, different ways of integrating the paradigms were considered, to discover how to incorporate them to satisfy the collaboration criteria developed. This led to the development of the EStaC approach (shown in Chapter Four).

This chapter provides a description and defense of the chosen methodology adapted in this research. It explains the reasoning behind the use of various methods employed for data collection and analysis within the study. And sets the strategy employed in the case studies in Chapters Six, Seven and Eight.

5.2. Case Study as a Research Strategy

The literature in social research discusses the usefulness of using qualitative data to attempt the exploration of social problems (Yin, 1994). There is agreement that case studies provide the perfect platform for evaluation research as they present established protocols that can be used to uncover high quality data from social entities within a project (Bennett and George, 1997; Guba and Lincoln, 1992; Yin 1994; Brown and Gerhardt, 2002). Also the literature shows the use of case studies in validating software evaluation research; where new evaluation methodologies are evaluated based on the guidelines developed by Yin (1994) and suggestions of standardising rigor were considered (Blee, 2005).

This decision to use a case study is mainly based on the conceptual framework presented in the introduction in Figure 1.2. The research question led the way to consider the ontology and epistemology of the problem in order to develop a research methodology as discussed in Section 3.10.1 in Chapter Three. The basic ontological assumption adopted is relativism, which is the non existence of an objective reality. The basic epistemological assumption adopted is transactional subjectivism, which means that the construction of reality depends on the individuals who engage in forming the assertions. These two assumptions forced the research to employ a constructive paradigm. In order to absorb the full potential of constructivism, qualitative analysis is employed as it works well for the development of better understanding. Pirsig (1976) stresses the importance of restoring a sense of quality to our lives; he argues that the acknowledgment of the process in which facts are collected strengthens the empirical vision of the scientific process and makes it practically feasible. This argument supports the direction of the research method employed in this study. The process in which the data is uncovered is just as important as the actual implementation of the approach.

In addition, the following issues were considered in order to obtain a better understanding of stakeholder collaboration:

First; the approach should handle the *complex nature of stakeholder* collaboration within requirement collection by making it more visualised.

For the approach to be able to handle complexity, an integration of tools is used to satisfy that condition. VSM deals with complexity in a very distinctive manner through the concept of recursion. It exclusively looks at different levels of granularity within the context of the problem. My research found, no other practice that could handle this issue in the graceful way VSM does.

Inter-relations of constructs is another complexity that collaboration needs to deal with. Stakeholder collaboration is a non-linear problem, CLD's discussed previously provides a conceptual framework to structure the inter-relationships and visualise them in a comprehendible manner.

Second; the approach should *uncover hidden social or political issues* other means failed to, and provides a mean to validating these issues.

Requirement collection has been distinctively specified as a *social act of interaction between stakeholders* during which many context specific issues are at stake to ensure proper collaboration of stakeholders involved in the project. SSM provides easy to use procedures to uncover these soft issues used widely in a successful way, discussion groups with stakeholders probing on social, political and cultural issues that form collaboration between them. Rich pictures help the evaluator better visualise the problems and rewrite them in statements that stakeholders relate to categorising them into patterns of collaboration.

Design Pattern templates (discussed in Chapter Three) link collaboration patterns to the field providing means of adding quality to the approach that enforces validity which is a very important matter in model building and lacking in most approaches and methodologies. In this research, they are specifically used as rapid ethnographic templates.

Third; the approach *should distinctively identify stakeholders*, give them priority and analyse conflict areas that might hinder collaboration during requirement collection as they are the basic building blocks of collaboration.

Stakeholders are distinctively identified by the use of pisoSIA categorizing them into comprehendible groups. The influence of these groups accordingly defined gives the evaluator a means of prioritisation if required to gain approval and collaboration of specific groups before the other according to their power, legitimacy and urgency. Conflict areas between stakeholder groups can be visualised and means of avoiding such problems can be handled at the planning stage.

These three issues can be defined as success criteria for EStaC implementation. The context of the case study is used to find answers that help to critically analyse and validate them, because case studies can be used to help understand relations in a social setting (Yin, 1994). Rules and procedures for the case study design were defined prior to implementation in order to set the standards that were followed throughout the case study implementation. This is essential because qualitative research is often criticized due to lack of structured analysis that specifically explains it (Leedy, 1997). It was important to plan the case study, showing as much detail as possible of the procedures and standards employed in order to minimize research bias (GAO, 1990). These procedures and standards are summarised in the rest of this chapter and present a strategy employed for the validation of the research work. The implementation of the EStaC approach through the use of a case study has provided better understanding of it and provided ways of improvement by identifying limitations as will be analysed in the next two chapters. This type of evaluation is considered a formative evaluation; as constant learning is achieved through application that aims for identifying improvement during implementation.

5.3. Case Study Aim

The aim of the case study is to validate and evaluate the proposed EStaC approach in practice by application to test cases taken from the software development sector. The goal was to apply the proposed approach and test whether it satisfies the success criteria identified in the previous section to evaluate stakeholder collaboration during requirement collection within the domain of software development.

5.4. Case Study Objectives

In order to achieve the aim of the case study, a set of objectives were identified:

- Critically evaluate the EStaC approach: from the aspect of satisfying the defined success criteria.
- Critically evaluate the output of the EStaC approach against the perceived assertions of the participant stakeholders.

Figure 5.1 represents the case study framework. It evolved from step 4 presented in the conceptual research framework introduced (Figure 1.2) in Chapter One.

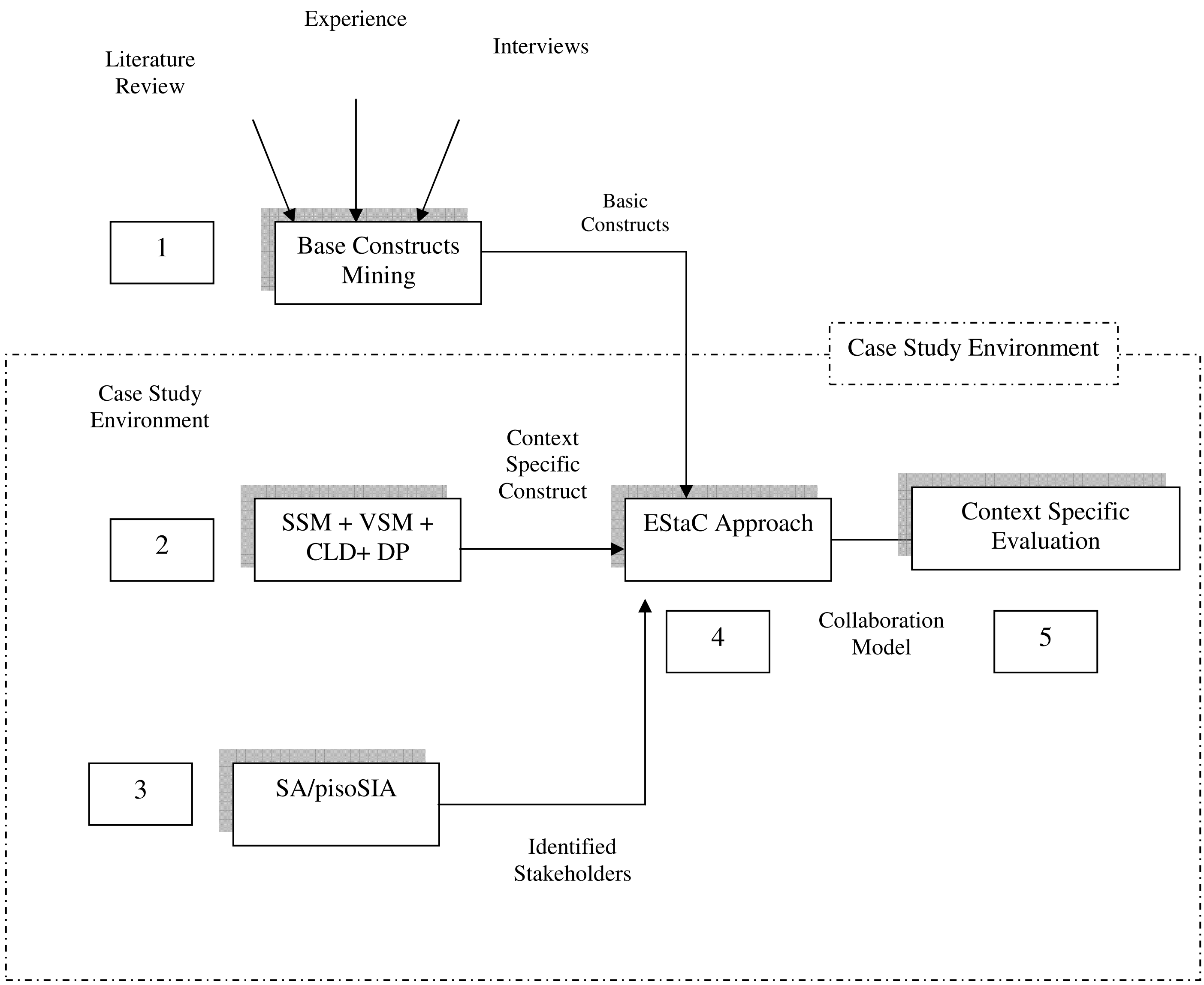

Figure 5.1. The Case Study Framework

5.5. Issues and Topics of Investigation

There are several issues investigated from the case studies for the purpose of critically analysing an answer to the research question and satisfying the objectives:

First, the basic collaboration constructs extracted from the literature were verified, this was done by engaging in preliminary group discussions with stakeholders and personal interviews with middle management within the software development sector.

Second, context specific collaboration constructs are developed by engaging in steps 2 & 3 of Figure 5.1 of the case study framework; which involves PHASE II of the approach by engaging in direct observation of group discussions and personal interview with stakeholders.

Third, inter-relation of context specific collaboration constructs were formed and grounded with data collected from the case study environment.

Fourth, perceptions of collaboration experiences are validated.

5.6. Case Study Type

To answer the research question an exploratory study was initially investigated. Exploratory studies usually seek to develop a hypothesis, propose further investigation or investigate outcomes (Yin, 1994). In this study, it seeks to consider whether an adequate approach can be developed for evaluating stakeholder collaboration during requirement collection of a software project. An important aspect is considering the view of better understanding of the process being developed between them. It was found that no general model of stakeholder collaboration was available in the field of requirement collection. This confirmed the need for development of a stakeholder collaboration evaluation approach to be used in this field. During part one, an exploratory study would be employed to try to investigate if a collaboration model or hypothesis could be formed. This served as an introductory phase to the research (Telliss, 1997a) that helped shape a proposition.

Research Proposition

Further investigation of exploratory phase of the study revealed that a combination of constructs could be inter-related to help better understand the collaboration process. This was an output of the exploratory study; a descriptive theory was initiated; a hypothesis of cause-effect relationship developed from using the combination of systemic procedures integrated in the EStaC approach to form the stakeholder collaboration models; which lead to the following research proposition.

> *The research proposition is that the collaboration of stakeholders involved in the requirement collection phase of a software development project can be evaluated from context specific collaboration constructs presumed by stakeholders characterized by inter-relations of cause and effect.*

In this research, a proposition was used to initiate a descriptive study. A descriptive theory formed a starting point, analysis techniques were then used to form a hypothesis of cause-effect relationship (Yin, 1994). Where constructs formed the model from the data and tested by the environment of the case under study.

Further research of tracing the cause-and-effect to patterns infers an explanatory study because the extracted patterns (encapsulated through observation, interviews and documentation) are traced over time (Yin, 1997).

The unit of analysis is a project chosen from a collection of projects forming a large software system during its requirement collection phase. A project is chosen because each involves its own cycle of requirement collection, which involves distinctive stakeholders.

5.7. Case Selection and EStaC Approach Implementation

As previously discussed, the nature of the problem in Chapter Two indicates that there is no feasible way of comparing two case studies (other than computer simulation which is dispensed at this point of the research for reasons stated in

Chapter Four). A replication of a case is impossible due to the following consideration:

- Time
- Rigorousness of the EStaC approach
- Dealing with human factors
- Uncontrolled environments

Therefore looking at similar research in the literature (Luna-Reyes, 2000), I decided to conduct two single cases. These were nominated by systems analysts involved in the project and were selected on the basis that they might give potential of rich interpretations as well as different outcomes of collaboration between stakeholders involved in the development process. This selection was not done in any way as to develop a comparison between the results of the two cases, but rather to show that the approach can adapt to different contexts and structures as conducted in similar research (Luna-Reyes, 2000).

The public sector of the State of Kuwait was selected as the area of application of the EStaC approach. The site chosen to conduct the case study was the Ministry of Defense of the State of Kuwait (KMOD). It was chosen based on the unique opportunity (Oates, 2006) it provides to study the combinations of diverse stakeholders involved. It is considered an example of a culturally, socially and politically complex system. The Military of Defense adds to the degree of complexity in having a diverse mix of civilian and military stakeholders' personalities. Personalities are recognized as factors that affect collaboration; this recognition is reached from my personal involvement in the Foreign Procurement project (shown in Chapter Six) as a specific stakeholder with dominant personality continuously blocked collaboration during sessions of requirement collection. This will not be covered in this study as it is beyond the scope of this research but is recommended in future work.

Convenience (Oates, 2006) was another reason to choose KMOD. Access to the site was officially approved in December 2005 and data for preliminary investigation was collected. The application of the case study to software development projects in KMOD was adequate in satisfying the objectives of the case study discussed in the previous sections.

Thus, the rationale behind selecting KMOD for investigating the collaboration of stakeholders within requirement collection of software development projects is summarised as follows:
First, KMOD was in the process of developing a huge software project of automating all departments, linking them into one workflow and then linking the whole internal project to the gateway of the e-government project of the State of Kuwait.
Second, I had a diverse option of sub-systems (which are considered as projects) to choose from and the time phase of requirement specification collection scheduled for the KMOD projects overlapped with the time frame scheduled for the validation phase of the research study.
Third, the KMOD environment provides a diverse combination of stakeholders that ensures a culturally, socially and politically complex system.

The actual selection of the case studies within KMOD was conducted after several discussions with systems analysts of both KMOD and the developer team of the software house where a number of projects within the Automation System were nominated. The Foreign Procurement project was nominated by every analyst involved in the discussion; initial conflict between stakeholders during the preliminary investigation gave indications to problems in future collaboration, and this provided an extreme instance (Oates, 2006) that offered opportunity of rich data. The second case was not clear and easy to decide on from the beginning, the automation of the Information Technology department was nominated to be undergone smoothly also the Legal Affairs departments showed initial collaboration. The case selection was decided after further investigation conducted with analysts involved and the Information Technology Department was chosen. These two cases were chosen with the intention of gaining rich insight (Oates, 2006) and better understanding from the implementation of the EStaC approach.

5.8. Sources of Information and Data Collection

For each project, a triangulation of sources was used to gather the information. The main source was interviews, mainly unstructured one on one or in the form of focus groups, and structured in the form of a questionnaire, in addition to observation and documentation. The overall workflow of data collection first started with group discussions, output was used to induce more focused interviews. Direct observation was heavily utilised at the start of the project, as the case progressed more dependence on documentation proceeded. Direct observation was heavily utilised again by the final stages of the project. These data collection sources are discussed in the following sections:

5.8.1. Focus Groups

Focus group sessions were arranged in the study at two different stages of implementation. They were conducted at the initial and final stage of the study. The reason focus groups are used is to capture cultural issues within a context (Kitzinger, 1999) in a small time frame (Gibbs, 1997). Power intimidation issues were considered in response to Kitzinger (1999), a specific group session was divided according to my reflection of how comfortable they would be in negotiation (Appendix D). However in professional implementation, this might be unavoidable.

At the initial stage, focus groups were used in Phase Two and Phase Three of the EStaC approach. It was necessary to focus the discussions and to keep the stakeholders engaged in the direction of the research. That is why the group sessions were facilitated by me, to focus the debate. My role was to ask open question (Gibbs, 1997) related to their collaboration in the project. Initial collaboration constructs collected in Chapter Two were used as motivation words. This type of guided group session is called guided brainstorming; it provides more creative solutions opposed to unguided sessions (Santanen, Briggs and Vreede, 2004).

Several tools were used as part of EStaC to guide and analyse the process, which include SSM rich pictures and CLD's; both were discussed in Chapter Three. A further expansion of the use of CLD is given in the coming sections.

At a later stage, focus groups were conducted as part of the user assessment strategy discussed in Chapter Eight, as focus groups are used to assess programmes after implementation (Gibbs, 1997) as part of post analysis workshop, in order to depict deficiencies and initiate further research.

A common problem faced was meeting cancellations and rescheduling; stakeholders would agree to a meeting date and then cancel due to work pressure. Getting users to set a date that is convenient for them for group sessions was also a challenge, having some users not attending the scheduled date has made the data collection process behind time schedule which might also be considered a limitation to the approach application. By assessing the risk of exceeding the time limit of my research program, I decided to proceed with group sessions with smaller numbers attending and then gaining feedback from stakeholders that did not attend. Another approach which was employed during the EStaC assessment work shop is to conduct several sessions according to the convenience of the participant schedules.

5.8.2. Causal Loop Diagrams (CLD)

Practitioners have expanded the use of CLDs (discussed in Chapter Three) over diverse problems in many fields, due to its unique feature of capturing the root cause of problems, leading to a more qualitative understanding of the problem. They have been used in combination with focus group discussions and results show that they were complementary to ethnographic research in capturing participant perceptions (Lefevre, et al., 2004). They also visualise the different opinions and interests of the participants (Purnomo et al., 2003) creating creative solutions to problems (Santanen, Brigge and De Vreede, 2004).

Although there are attempts of stating rules to validate the structure of CLDs (Burns and Musa, 2006), more and more, qualitative researchers face difficulties in handling the complexities of validating their findings, including model building. Trochim (2006) argues that qualitative validity depends on the philosophical perspective of the researcher, relating to epistemological and ontological assumptions. He further relates his thinking to Guba and Lincoln alternative criteria for judging qualitative research shown in Table 5.1. These alternative criteria are not specifically used in this study; however procedures that lead to them are embedded within the research strategy.

Traditional Criteria for Judging Quantitative Research	**Alternative Criteria for Judging Qualitative Research**
internal validity	credibility
external validity	transferability
reliability	dependability
objectivity	conformability

Table 5.1. Alternative Criteria for Judging Qualitative Research (Source: Torchim (2006)

Causal model building is a qualitative process that involves the researchers to employ means to collect and validate the data they acquire (Yin, 1994). A pragmatic choice of strategies is usually adapted to help manage and enforce structure to the process, where qualitative social science techniques are found beneficial to build confidence in the developed model as well as the formation process itself (Pala, Vennix, and KLeijnen, 1999; Luna, and Anderson, 2003). In such studies, new ways need to be involved to help the management of data collection and analysis. Researchers have used CLDs successfully to facilitate teams in virtual environment (Thomas and Bostrom, 2007). CLDs are used in this study particularly as a focus group facilitation and analysis technique in conjunction with SSM.

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Many causal models developed fail to be traced back to the fieldwork from which it was captured (Alter and Ginzberg, 1978; Luna-Reyes, 2004), this failure and the need for enforcing validity calls for investigating new means to ground models developed to perceptions of reality (Gottesdiener, 2003; Luna-Reyes, 2004). I believe that in qualitative research the smooth formation of causal models from unstructured data representations of the systems depends, in part, on the strategies which the researcher employed while the project was developed. This is especially important during the data collection phase, because it deals with stakeholders' perspectives and relationships at different levels of detail (Kotoyana and Sommerville, 1998).

In order to enforce validity, an insight must be gained into the causal model building methods (Jones, 2005). Social, cultural and political issues that influence interactions between stakeholders need to be examined (Hengest and De Vreede, 2004). The evaluation must be conducted using qualitative tools distributed over time because the social action of individual collaborations unfolds through time, affected by accumulated values (Black et. al 2002). In order to demolish the time factor, Design Patterns are introduced to collect several vignettes of the cause-and effect process in what is called a Collaboration Design Pattern (discussed in Chapter Three and Section 5.8.4).

5.8.3. Observation

Observation (Yin, 1997) was used to elicit collaboration patterns from the case studies. Direct unobstructed observation was heavily utilised at various stage of research, specifically in the initial and final stages; I acted as part of the requirement collection team and closely observed in close proximity the requirement collection process as analysts met with stakeholders. This observation initiated from the need to capture the context of collaboration from first hand experience.

My participation did not affect the unfolding of collaboration between the stakeholders; as I was an inactive observer. The reason behind that is the need to capture the data as it naturally unfolds in an unobstructed environment.

Beliefs, knowledge and previous experience in field were incorporated during the CLD formation within the focus groups. The reason behind that decision was based on research conducted by Yin (1997); where the researchers' beliefs and experience should blend with the analysis of the case study as a measure of quality.

Initial investigation with identified key stakeholders, guided the selection of meeting and tasks to be observed. This focusing was necessary to ensure rich data anticipated by key informants. Multiple observations were not considered because I was the sole researcher in the project.

As with other data sources, Design Patterns (discussed in Chapter Three and Section 5.8.4) were used as documentation tools and analysis extraction templates from observation, details are given in Section 5.8.4.

5.8.4. Design Patterns

Design Patterns (discussed in Chapter Three) were used as documentation tools of both rapid ethnographic findings and analysis. Collaboration patterns were mined mainly from observations (Khazanchi and Zigurs, 2007). Other means were also used such as focus group discussions, interviews and from documentations. This type of pattern encapsulation is called inductive pattern mining (Baggetun, Rusman and Poggi, 2004).

Patterns in this research provided a mean of cross observation that enforces validity to the model.

The pattern template (Appendix B) was adapted from patterns specifically developed to capture descriptions of cooperative arrangements in social settings (Martin et al., 2001), with an addition of the two fields (successor pattern and predecessor) which are originally in the Alexandrian patterns represented by the first and last paragraphs (Appendix A). The reason this addition was made was to link the patterns in a causal relation just as they were originally developed for, and associate it to the developed CLD's.

Rapid ethnography was considered to accelerate the analysis and decrease the time needed for pattern and theme building. The three key concepts provided by Millen (2000) were adopted, which were:

- Focus on the field research before entering, which is achieved by considering important activities that included specific requirement collection sessions and accessing key informants. Specific selection of projects that might involve interesting interaction was considered before engaging in the field.

- Use collaborative data analysis methods in group sessions using SSM concepts.
- Use multiple interactive observation techniques such as structured interviews, focus groups, brain storming and contextual inquiry.

Innovative ways need to be developed to deal with the demanding nature of the problem; therefore to speedup the analysis of the data collected, I used design Patterns in a way that other researchers in the field of ethnography call *collaborative data analysis* (Millen, 2000). According to Millen (2000), there are two ways that can be used to make qualitative research faster, computer-assisted analysis (such as NVIVO and FolioViews) and collaborative data analysis (such as cognitive mapping-causal modelling, influence diagrams and concept mapping-, pictorial story telling and scenario analysis); as suggested by Millen (2000) CLDs were used as a collaborative data analysis.

Design patterns uses in this research as discussed previously in this section are diverse; the first is their use as templates for documenting rapid ethnographic findings and the second is their use as a link that grounds the model to reality as perceived. This later aspect demolishes bias; as patterns proved to be useful tools for comparing between cases and insuring data consistency, as several instances of collaboration patterns were recorded across the case studies. Studies show this aspect of cross examination was useful for managing virtual projects (Khazanchi and Zigurs, 2007); this makes patterns an analysis tool as well.

Patterns also contribute to the model building process of the Causal Loop Diagrams (CLD). While the integration of systemic tools into system evaluation methodologies increases, there still remains a gap of how to link the conceptual data to its contextual environment in a comprehendible manner. As part of the approach description, Design Patterns were used as an embedded sub-phase in the EStaC approach, in order to ground conceptual perceptions of the models developed to the fieldwork. Design Patterns when used ensured rigour through the EStaC phases, as well as helping to rapidly increase the time spent in both the data collection and data analysis process. Further research into analysing the potential of mapping Design Patterns to CLDs to promote model validity is called for in Chapter Nine.

5.8.5. Interviews

In the literature foundation stage of the study, initial collaboration constructs identified were followed by a set of structured interviews with experienced software analysts' and project managers involved in major projects in Kuwait, the interviews were conducted over the telephone. The interviewers were faxed a one page document that explained the problem of *stakeholder collaboration* in software requirement collection. The document had the Initial Collaboration Constructs, followed by a brief explanation of each element. There were four outcomes I wanted to achieve from these interviews:

- What is their feelings regarding stakeholder collaboration in requirement collection?
- Do they relate to the Initial Collaboration Constructs?
- They were required to prioritise the set from most significant to least significant.
- Can they come up with other constructs they think are significant?

There was an emphasis on the importance of their opinion on how much they thought that these constructs shape stakeholder collaboration. Results show mutual recognition of the importance of these constructs. However, different results on the prioritisation of these constructs were obtained. Some analysts emphasised the importance of communication, however as discussed in (Chapter Two) it was removed from the set as it is embedded within the approach as a necessary condition to collaboration. My reflection to their responses is that different stakeholders under different context may regard what is important to collaboration differently. And the methodology under development encapsulates such elements. The phone interviews are presented in (Appendix C).

Unstructured interviews were employed throughout the stages of the case study. In the initial investigation stage of the study, unstructured interviews with key informants helped focus the research in terms of who to contact, where and how. Although unstructured interviews are difficult to organise, nevertheless they guided later interviews to aspects unrealised before because it enables interviewees to talk in different areas. Care was taken in making the interviewees focus on the topic of investigation. This was specifically realised in this research when these interviews included more than one participant. As multiple participant interviews conducted, it was noticed that the interviewees when story telling collaboration problems encountered in their work place, would sometimes get engrossed in the details, making them uncontrollable as they relate to details outside the research scope.

The organisation under investigation did not permit tape recording, therefore it was disregarded. This limitation is evident in the literature where other researchers faced this restriction due to confidential work processes and technologies related to the US military (Nissen, 2005). I believe that this might have been an advantage to this research more than a disadvantage; it gave the interviewers the freedom to talk freely without any constraint. Extra care was taken during note taking to gain optimum benefit from the data collected; tape recording would have enhanced the accuracy of the data (Yin 1997). To make sure the data collected was accurate, all interviews were followed by post analysis reports and Collaboration Design Pattern documented using the Templates.

Design Patterns (discussed in Chapter Three) were used as documentation tools and analysis extraction templates from interviews. As mentioned earlier, they served as comprehendible tools for comparing instances of patterns encapsulated from the interviews between case studies. This act demolishes bias as Yin (1997) reports are usually encountered in interviews.

Post analysis reports were documented and circulated to key stakeholders to clarify misinterpretations and establish authentic causalities. All reports included detailed descriptions and were reviewed by key interviewees. A structured template was used to transcript the interview that took the form in Figure 5.2 that documents task output, start/end date and comments regarding the case study. These were analysed, highlighting weakness and advantages of what the approach can diagnose. The reports provided extensive detail and descriptions; it includes direct quotes from the case study actors which are reported in narrative style. It is considered as an organised framework for thinking about my experiences.

Date **No.**
Time (start-end)
Attendance (name-position-representative)
Purpose of Meeting
Context
Meeting Structure
Recording Tools
Meeting Discussion
Notes
Conclusion

Figure 5.2. Meeting Report Template

Analysts and IT people both from KMOD and the software developer had tight schedules, I gained valuable data from them through coffee breaks and in between commuting between sites to meet with stakeholders. Approval was given to use the data gained from them to be included in the research. What I consider good qualitative information was collected from informal discussions more detailed and enlightening than formal interviews and was considered main data collected. Participators approval was asked for and extracted information was validated within the questionnaire. Some data was given in confidence and was not used within the analysis. Knowledge gained from this was used to trigger discussion between stakeholders in areas not discussed such as personal conflict and its effect on collaboration between stakeholders.

The sample population for the interviews included representatives of stakeholders in the project, directed by the key informant. Further analysis using pisoSIA indicated other relevant stakeholders which were also interviewed. Preliminary interview reports are shown in Appendix C.

5.8.6. Questionnaires

Throughout the study questionnaires were applied differently in different stages of the study development as follow.

During the pilot study, questionnaires were also used to validate context specific collaboration constructs (Shown in Appendix C). This gave confidence to the initial collaboration constructs identified. In accordance with participants' reactions to the questionnaire conducted during the pilot study, a careful consideration of the actual questionnaire development was taken to ensure a clear understanding of the questions. The problem synthesised in the pilot questionnaire is that it was written in a technical language that used terminologies unfamiliar to the average user. Also, one questionnaire was used for all stakeholder groups with certain sections to be filled by specific groups. This caused confusion and no significant data was extracted from the questionnaire. A decision was made to conduct the questionnaires personally to ensure the participants' authenticity and to demolish misunderstanding of questions. Also, stress was made on closed questions with room to state comments and opinion at the end. A point was also made to use as few questions as possible for the actual study.

At a later stage a questionnaire was used to validate the stakeholder collaboration model developed by CLD in both case studies (shown in Appendices D & E). Logic sentences that describe the CLD behaviour were written, and feedback was gained from participant stakeholders involved in the development of the models during the focus group session. This act serves as a post analysis to validate the data collected. The results were later used to validate collected data from previous analysis of other data sources.

An additional questionnaire not originally designed in the case study design report was introduced, to gain user acceptance feedback regarding EStaC from the participating analysts in the project (shown in Appendix B). The questionnaire was used after a workshop introducing EStaC to potential users involved in the KMOD project. The aim was to assess EStaC according to specific outcomes developed through the use of Goal Question Metrics (GQM). Feedback results of the user acceptance are analysed in Chapter Eight. Five scale intensity indicators were used similar to questionnaire in the related field (Luna-Rayes, 2004).

5.8.7. Documentation

In addition, documentation (Yin, 1997) was used to obtain detailed information regarding organisational structure, workflow and progress reports from both KMOD and the software developer analysts. It was employed specifically during the initial and middle stages of the case study. Initially, documentation helped in understanding the scope of the KMOD system and identifying initial stakeholders. It also gave indications of recurring communication problems between stakeholders identified through the analysis of weekly progress reports developed from both KMOD and the software developer. Highlighting was used to focus on these problems, which were later documented as Collaboration Design Patterns.

Also, literature review was an ongoing process throughout the study. Analysis of the literature guided the process of ensuring consistency of the case results with other research in the area. There was one contradicting reflection, literature argues that having the facilitator as an outsider to the organisation beneficial during stakeholder meetings (Van Mullekom and Vessix, 2000). In this study, although there was no specific role of a facilitator, the stakeholders that acted spontaneously in that role were within KMOD, I found that their act aided the collaboration as it promoted proper transfer of knowledge between the users and the system analysts.

5.8.8. Personal Log

A personal log was kept throughout the study. Notes and personal reflections were documented in relation to how the approach was progressing. It included notes related to the thinking that led to the final outcome of this study. Reflection on attitudes of stakeholders and its relation to collaboration were documented.

5.9. Data Analysis and Interpretation of Data

There are several known modes of analysis for case studies, such as analytical or pattern-matching. Analytical analysis makes use of matrix of categories, tabulating event frequencies, time series analysis, complex tabulation (GAO, 1990). The type of analysis I utilised is called explanation building, where data is used to fill gaps and structure the hypothesis (Tellis, 1997b). Pattern-matching compares an empirical pattern with a predicted pattern (Tellis, 1997b), it matches findings to hypothesis. Because of the explanatory characteristics of this research there was no hypothesis to begin with, a proposition evolved (presented in Section 5.6) from the initial phase of the study (which is a hypothesis with an uncertain probability associated with it). This proposition suggests that a hypothesis can evolve from the application of the proposition. I used pattern templates to match constructs (perceived by the stakeholders) to actual patterns in the field. Causal affect was also used within the analysis as Tellis (1997b) recommended the use of other analysis strategies, as well as the option of considering a technique for a specific instance. Therefore CLDs provided interlinking and explanation, Design Pattern templates provided categorised and themed explanations, thus both may be considered analysis tools.

Organisation of the material collected was very important considering the complexities of data collected for the problem under study. The personal log held detailed meeting schedules and personal reflection in parallel with the other sources of data collection, as discussed previously.

In order to enforce quality in the analysis of the case study, I made sure that the following was satisfied in compliance to Yin (1994) procedures:

- A dependence relation between analysis and evidence (established through the aid of design pattern).
- All interpretation included (systemic analysis of procedures integrated enforced that feature; CLD and SSM).
- Issues and topics of investigation addressed in advance (Section 5.5).
- Employment of my knowledge and previous experience in field blended with the analysis.

Causality was established by adhering to the criteria specified by GAO in (1990):

- Coherence of the evidence
- Consistency with the pattern ascribed to it

- Inconsistency with other explanations

Two characteristics are realised at the analysis level: the evaluators' intervention in performing the steps, and the analytical skills of the evaluator (Lee, 2003). This realisation of uniqueness of implementation and result analysis makes a case study the best evaluation practice for this study. It also provides better understanding of the developed EStaC approach.

5.10. Validation of Procedures

Triangulation is a key feature which ensures the validity of data collected and develops alternative interpretations of findings consistent or inconsistent with the researchers' hunches (GAO, 1990; Yin, 1994; Tellis, 1997a).

The following guidelines were followed to review the case study report and were used to assess its quality (GAO, 1990):

Design

- Clarity of issues
- Relation of the evaluation question to the case study application selected
- Basis for case study selection
- Time span of the study

Data Collection

- Appropriate data collection methods
- Evaluator training
- Information sources

Analysis and database formation

- Explicitness of procedures and techniques
- Interpretation differences
- Relationship of the findings to those of similar studies

A predefined template was used to document meetings shown in Figure 5.2.

The validity of the EStaC approach is related to its credibility. Credibility is achieved through internal validity of the approach. Strategies are embedded within the developed approach to enforce rigor (Morse et al. 2002) that indicates internal validity.

5.11. Validation of Results

EStaC results are theoretically validated using abductive inference. That became popular through the writings of the famous philosopher Charles Peirce. Abduction is used widely in medicine, biology, mathematics as well as many other fields. A famouse example of an abductive conclusion is:

> This jar contains white beans
> This is a white bean
> Then this white bean must have come from this jar

The above claim may not be convincing as induction and deduction, but it may be the best way of explaining a phenomenon, in a certain context, when many variables are difficult to obtain or control.

Abduction is viewed by some scholars as an initial phase that can be investigated further using deduction, however in complex situations a replication is impossible and since the results from the approach are consistent, coherent and logically convincing then the approach is valid until a case comes that can convince us otherwise as used in psychiatry where abduction is employed in analysis of patients' records (Richters and Hinshaw, 1999), or as used by doctors when diagnosing diseases (Bogason, 2006). As cited in Frankfurt (1958), Pierce believes that this is the only way of uncovering new and creative ideas. According to Hoffmann (1997) there is logic to Peirce's abduction, he argues that perception is logically abductive and calls it *contextualized logic*; by which he means that certain hierarchical orders of context can be reconstructed as a series of abductive inferences and that it can be

> *explained as the application of given habits on new situations. In this way the creation of new modes of perception is possible*
>
> *Hoffmann (1997)*

The developed EStaC approach defines evaluation constructs of stakeholder collaboration from the perceptions of stakeholders and these perceptions according to Hoffman are logically abductive.

An argument is valid according to abduction if the two criteria of *security* and *productiveness* are proved (Hoffmann, 1997). In EStaC, further validation of the stakeholder collaboration constructs is achieved by grounding them through the encapsulation of collaboration patterns in the fieldwork using rapid ethnographic templates of design patterns; I believe that this ensures security; it is also known by Yin (1994) as logic linking of the data to the propositions. As for the second criteria in the argument, productiveness is achieved through the lessons learned from EStaC application shown in the next two chapters, and the benefits of EStaC discussed in Section 4.5.

Also it was important that analysis drawn from EStaC (Chapters Six & Seven) provided results that were:

- Logical
- Coherent
- Structurally coupled
- Consistent
- Necessary and sufficient

A user assessment of EStaC is given in Chapter Eight; the aim was to compare the assertions captured to the perceived.

5.12. Testing Approach Implementation Procedures through a Pilot Study

As part of the procedural standards of the research methodology adopted in this study, a pilot study was launched to investigate the feasibility of applying EStaC in KMOD environment. The following issues were investigated as they are vital to proceed on the chosen site:

- Access to site
- Access to documentation
- Initial investigation for identifying key resources

- Response of stakeholders, how willing they are to give information
- Partial analysis of output result of initial phases of the approach

The following sections provide the case study background collected by the initial investigation of the pilot study followed by an analysis of the pilot study application and its inference to the EStaC approach.

5.12.1. Case Study Background

The public sector in the state of Kuwait has expanded its use of technology over the last few years. This expansion was the result of the state's decision to promote the new trend of electronic office management in preparation of an e-government (Zaied, Khairalla and Al-Rashed, 2007). One of its key objectives is to ensure better quality of outputs and services. This has been called for by Kuwait government for the past decade, however, delayed in the public sector by many factors.

Kuwait's Ministry of Defence (KMOD) is one of the main ministries in the State of Kuwait, its role being to provide high calibre services for the armed forces. While the strategy is that these can be better provided by the implementation of such technology, there is always a risk that such technologies will fail due to a combination of technical, social or political problems. A relatively high percentage of these problems is propagated via the initial phase of requirement collection which involves high stakeholder interaction.

EStaC approach was piloted in the KMOD environment. A preliminary investigation was conducted in December 2005; to investigate potential collaboration of the sector with the research topic. In April 2006 I returned to KMOD and acted as an observer, and results from phases 1, 2 and 3 were evaluated. These phases involve boundary definition, collaboration definition and conceptualisation of collaboration complexity. The aim of the pilot study was to evaluate the feasibility of accessing the site, data collection tools (observation and interviews), and access to documentations and meeting minutes. Documentation was given to me in printed format as well as digital format. Access to the official web site is also gained. Follow up of the meetings was done over the telephone.

The software house that developed the project is called National Computer Services (NCS), outsourcing Al-Raya (Developer Company) from Egypt to design and built the software. Al-Raya had experience working in Kuwaiti Environment, but no previous experience with KMOD environment and employees (this caused collaboration problems as presented in Chapter Six).

5.12.2. Reflection on Pilot Study

The systems analysis team was divided into three groups to work simultaneously in different departments. Each group consisted of two analysts, one to ask the questions and the other to document. I was appointed to group two; I attended all their meetings and took notes in relevance to their collaboration without obstructing their actions. All meetings took place at the stakeholders work space. The team had to revisit the next day some stakeholder groups because some were not ready, some needed to approve some aspects with their higher management and others did not have all their work artifacts with them such as samples of templates and official letter formats. The team also revisited stakeholders within their work environment to make observation notes of the workflow. The observation was done with continued involvement of the stakeholders as they described their work as it is done now.

The access to the site was tested and the data collected from key stakeholders was tested through a partial implementation of the first three phases of the EStaC approach. Also the pilot study confirmed the appropriateness of the strategies developed to collect data for the EStaC approach. Data collection tools documented in the case study design report were tested and calibrated during the pilot study. Weakness in the question format of the structured questionnaire was identified and altered for the actual study. A decision was taken that the questions in the questionnaire for each case study would be different and are inferred by the results of data analysed due to the context specific nature of the approach.

The decision to leave the EStaC approach qualitative (see rationale presented in Section 4.2) is supported by further discussions with experienced system analysts and project managers encountered during the period of the pilot study. A report of the pilot is given in Appendix F. Some results of the pilot study were used in a later stage in the actual case study, presented in Chapters Six and Seven.

In summary, the pilot launch of EStaC approach showed potential to understand the collaboration process as perceived by the stakeholders involved in the requirement collection process. This was done in two ways: Firstly, enforcing a structure that the project manager or facilitator can use to organise and comprehend the problem. Secondly, by raising a state of awareness within stakeholders to make them conscious of the constructs that are affecting their collaboration in producing requirement documentation.
The question now was:

Does the EStaC approach satisfy the criteria developed in a real environment?

A detailed implementation of these strategies is presented in the form of two case studies in the next two chapters, using data extracted from two projects within KMOD Automation System.

5.13. Conclusions

The EStaC approach (when applied according to procedures and standards) is able to comply with the following issues:-

- Handled the complex nature of stakeholder collaboration within requirement collection in a visual and comprehendible manner.
- Manage to uncover hidden issues –social, political, etc. - other means failed to with a mean to validating them and relate them to the fieldwork.
- Manage to distinctively identify these stakeholders. Give them priority and analyse conflict areas that might hinder collaboration.

These issues are considered success criteria for the case study because they evolve from the main research question. The following sections were essential in the strategy developed as part of the research methodology that included implementation of the case studies; as shown in the next two chapters.

It was important to first apply the research methodology on a pilot case study. This action enforces quality to the procedures and makes room for improvement in data collection tools, analysis and evaluation. Preliminary investigation through the pilot study enabled me to reflect on my position within the organisation under study. It also enabled me to perform the following acts:

- Establish connections
- Build an overview of software projects under development (to choose best proper case)
- Reflect upon the basic collaboration constructs developed
- Refine the EStaC approach under development

The use of pattern templates made data collection more organised and helped reduce the time spent on analysis by previously categorising the data needed to be collected within the template. It did not induce preempting as the categorising of the data is not the result required from the case study; rather the constructs and the inter-relation of constructs are the focus of the research.

Data collection tools were developed and documented in the case study design report which set the rules followed which ensured reliability to the case study and forced external validity.

Multiple sources were used as described in the case study design report attached in the appendix. All interviews and group discussions would be followed by a report to be validated by parties involved which included thick descriptions and reviewed by key interviewees. A pattern language was developed where causality is linked to the field as a chain of evidence. Thus three levels of validations are followed to verify the context specific stakeholder collaboration criteria mix. Firstly, preliminary criteria encapsulation was conducted. Secondly, pattern template encapsulation of context specific criteria instances was performed. Thirdly, structured interview in the form of a questionnaire was utilised for final validation of the criteria and their inter-relations that construct the model. This study is a journey that uncovered qualitative data that was used to develop a qualitative approach of evaluation.

Now that the strategies for implementing the EStaC approach have been presented; they show that they satisfy the objectives of the research. A detailed implementation of these strategies is presented in the form of two case studies in the next two chapters by the aid of data extracted from two projects within the KMOD Automation System.

Chapter 6

6. Application of *EStaC* Approach: Case Study I

This chapter contains a case study, which tests the application of the new approach to the Ministry of Defence in the State of Kuwait (KMOD). Each phase of the approach described in the previous chapter is applied in turn. Two projects were chosen from the corpus of projects within the KMOD Automation System. The two projects were nominated by a team of system analysts from both KMOD and NCS. The Foreign Procurement (FP) Project was chosen as explained in the previous chapter, being an example of a typical ministry department with expected problems in collaboration between stakeholders.

6.1. Phase I – Boundary Definition

The limits of investigation are defined by the following steps:

6.1.1 Understand the System

An initial understanding of issues in the department; including goals, roles, structures, influence and procedures was gained through preliminary investigation of documents and early interviews with officials and employers in the FP project.

The FP project is concerned with procuring and maintaining the availability of all the armed forces in the Kuwaiti Army (Land, Air, and Navy forces) and the demands of the independent committees and units demands. It works in sync with two types of committees:

- Committee concerned with projects under the annual budget
- Committee concerned with projects under the support budget

The FP Department has three main goals for the system they want to develop:

- Ease the mechanism of business procedures of the sub-departments and divisions in the Foreign Procurement department and enable the transfer of information between them using the security level assigned for each user of the system.
- Integrate the Foreign Procurement system with other systems in the ministry including, Financial, Legal Affairs, and General Record systems.
- Construct a proper infrastructure for the Foreign Procurement department to implement the system.

I used the VSM recursion concept to sketch the level of recursion in the FP department. There are four major levels of recursion shown in Figure 6.1.

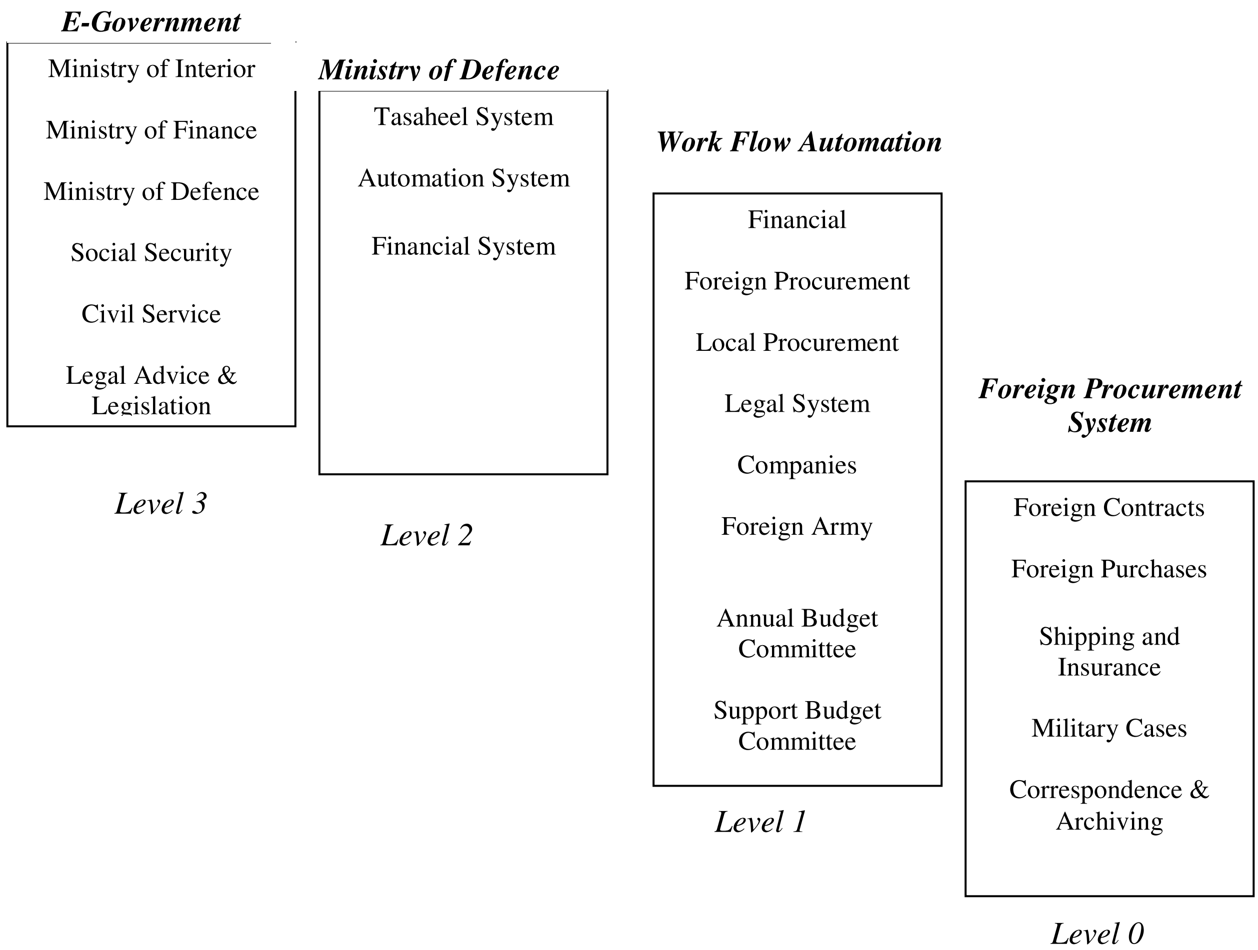


Figure 6.1 . The VMS Recursion of the FP System

The top level (Level Three) is Kuwait as a government and its direction into implementing an E-government infrastructure. The civil service for employment and the Legal Advice and Legislation for legal affair resolutions are important sectors that FP indirectly deals with and need consideration. A realization of these parties at this early stage will enhance the understanding of the system, the influences and procedures that need to be covered.

KMOD is at a lower level two; KMOD has several ongoing software systems such as Tasaheel and the Financial Systems. The Automation System is to be integrated with ongoing systems. There is a threat here of overlapping requirements. Collaboration is essential in negotiating what requirements the ongoing systems cover and what requirements need to be covered by the new system. The Financial Department for example has some dispute regarding access rights to some screens, this is a major problem that needs special concern; a tremendous amount of money could be lost or embezzled with small mistakes. The FP department is given a considerable budget with no authority needed to be given back from the Financial department. This is a serious matter that needs attention from the analysis team.

Level one, shows the details of the Automation System, it consists of several projects to be integrated as a working flow system, one of which is the Foreign Procurement (FP) project –the system in focus-. The FP system works in sync with two types of committees on the same recursion level: committee concerned in projects under the annual budget, and committees concerned in projects under the support budget. Also, on the same level of recursion FP interacts with outside companies to qualify specialised orders in foreign procurement, follow up on their activities, and to implement the systems needed to filter and distinguish those companies. The FP system is also highly integrated with other systems in the ministry such as, financial, legal affairs, and general record systems. Through this integration, information between those sub-systems must be transferred easier and faster. This indicates that collaboration between stakeholders at this level is essential for achieving proper information transfer in the whole system. To do that requirement collection sessions must be conducted with relevant stakeholders involved from all the interrelated sectors, I find that missing in the implementation of this project as requirement collection sessions are conducted individually for each project –this is a warning sign that needs to be propagated to final analysis-.

Level zero shows a finer granularity of the FP project that is the focus of this case study, sub-departments communicate to achieve the overall goals of the department, and are visualized: Correspondence and Archiving Mail System, Foreign Contracts System, Foreign Purchases System, Shipping and Insurance System and Military Cases System. FP through the Foreign Purchase Department is responsible for purchasing and supplying all spare parts and maintenance parts from foreign markets. Through the Shipping and Insurance Department, all shipments of spare parts and maintenance are executed for the military forces. Finally through the Military Cases sub-department, FP is handling all the military cases signed with the American and British governments in the military field. Consideration needs to be taken in the same level of recursion where the system lays. Also different sub departments in FP – system in focus - operate in house developed stand alone systems and wishes to replace these systems and their associated services in the new automated system. Each of these sub-divisions is an autonomous unit with its own procedures and can be modelled on its own and the approach can be applied to it.

The FP project needs to be diagnosed by considering all the levels of recursion that affect it. This type of analysis gives a holistic view of the problems; all factors that affect it that needs to be resolved to ensure the viability of stakeholder collaboration, will be considered. Figure 6.2 shows another representation of the levels of recursion for the FP system.

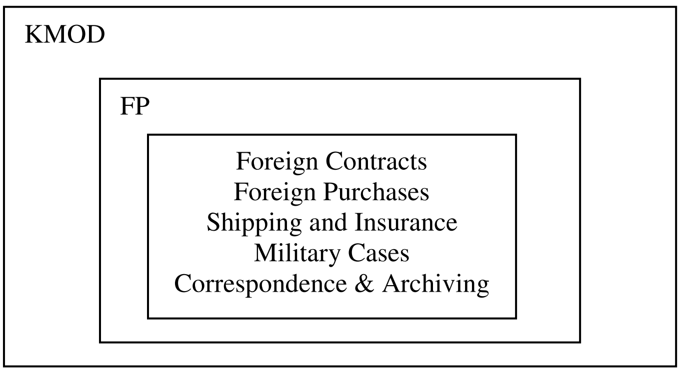


Figure 6.2. Another View of the Recursion Levels of the FP System

The complexity of boundary definition is handled comprehensibly through the distinctive concept of recursion which is highly appreciated to focus on specific details without losing the holistic perspective. Figure 6.2 emphasises the FP Automation System as an embedded system. For us to understand it we need to consider other systems at the same level with which it needs to integrate. We also need to consider levels above and below it that are affected or will affect it. This realisation definitely promotes collaboration through raising the awareness factor, which is found important in this case study as will be shown in phase II. Recursion drawing not only visualises the boundary of the system it also gives an initial and instant understanding of what needs attention to ensure collaboration viability.

At this point the identity of the system embedded in its goals has been recognized. The recursion levels gives us a holistic view of the boundary of the system and an initial idea of the structure and what roles to expect. The following sections will give detailed information regarding these aspects.

6.1.2 Structure the System Boundaries

The requirement collection for the FP System involves the collaboration of several sub-systems serving different sub-departments and divisions as well as outside agencies as will be seen in the human boundary definition. VSM provides a structure to visualise the boundaries of the FP system as shown in Figure 6.3.

Fig. 6.3

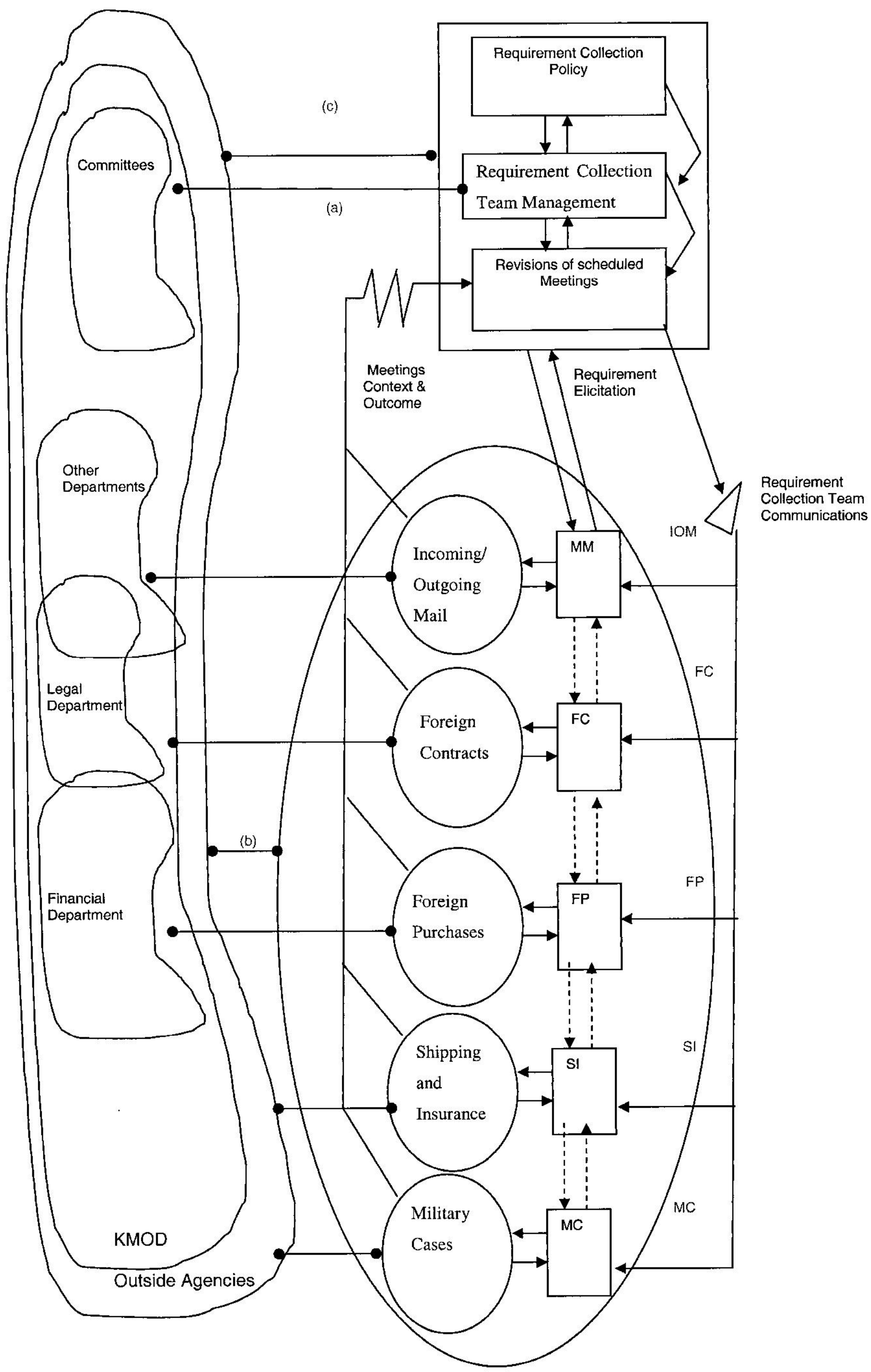


Figure 6.3. VSM Structure at Recursion Level 1 of the FP System

System1:- Operation of Primary Activities

FP is currently organised into sub-departments, which constitute the System 1 and are completely autonomous; and each produces unique services for the department which include:

- Incoming/Outgoing Mail System.
- Foreign Contracts System.
- Foreign Purchases System
- Shipping and Insurance System
- Military Cases System

The integration of these five sub-systems defines the FP system. Collaboration of stakeholders for these individual systems must be achieved by conducting requirement collection sessions between them with representatives from each. This was obvious and conducted accordingly in this project.

System 2:- Regulation, Stability & Conflict Resolution

Internal regulation of each system 1 is important. There must be a stakeholder that is responsible for insuring internal collaboration within the requirement collection sessions of each System 1. This stakeholder must be knowledgeable of all the issues in the department that involve process and procedure of work for the requirement collection to be conducted for each System 1. This position will need to be identified from the stakeholders in the next step.

System 3:- Synergy & Optimisation

Organization and communication is important for achieving optimum collaboration between stakeholders within the requirement collection sessions. Each division in the sub-department has a head of division which reports to the controller of the sub-department. General management meetings are conducted weekly on the level of divisions as well as on the level of sub-department. However these meeting were not employed enough to raise awareness of the automation project that is being developed. When it came to the meetings with the IT staff and analysis team, users were not empowered and could not give definite requirements. It should be noted that the power of collaboration is optimised when the delegates agree to the requirements without having to go back to their supervisors.

***System 4**:- **Adaptation & Forward planning**-*

The IT department is in communication with the Procedural Development but no actions were taken if procedures in the current system under development were to be reengineered in the future.

System 5:- Authority, Identity & Policy

Periodic meetings between controllers in the IT department and daily meeting between the software house analysis team and the Software Analysis sub-department in KMOD ensures a sufficient level of understanding and sharing of the policy procedures for conducting requirement collection. Specific procedures were developed by the project manager and which it was adhered to in the FP project. This procedure included the following:

- The FP department director was given a copy of the part in the old requirement documentation that related to their department.
- A deadline was specified for the FP department to read their requirement documentation, discuss it with employees within the department.
- Feedback was expected from the FP department with a representative to meet with IT and SW house employees.
- A date was sent to schedule a meeting between the department representatives, IT and SW house employees.
- Several group meetings were conducted to negotiate the final requirement for each department as well as observation.
- A signature was for final requirements.

As suggested by VSM discussed in chapter three, when diagnosing a system in focus we should look at one recursion above and one below the system in focus. The VSM diagram of the Automation System (recursion Level Two) and VSM diagram of recursion level zero are presented with stakeholders mapped each in turn in the coming steps of EStaC.

6.1.3 Define Human Boundaries

Five sub-departments work under the FP department as shown if Figure 6.4, each responsible for procedures and executing tasks assigned to them, depending on the roles and responsibilities and the business procedures cycle.

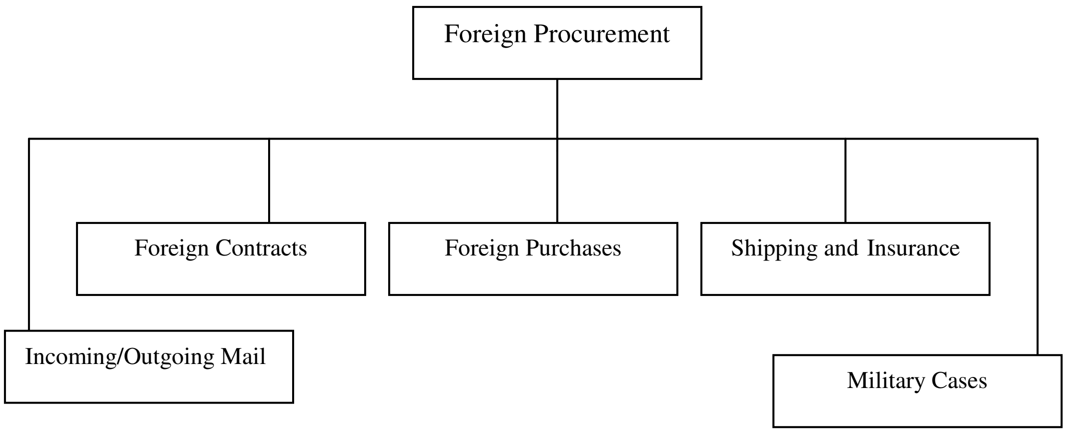


Figure 6.4. Hierarchy Structure of FP department

Table 6.1 shows the stakeholders involved which represent the human boundaries of the system according to the hierarchy structure FP system. They are divided into four categories: the system engagers, facilitators, outside agencies and decision makers. In each category a number of users are identified according to the characteristics presented in the pisoSIA description in chapter three.

At this level of analysis, the human boundary of the system has been specified. Roles have been identified and distributed into categories. People who may have an influence on the success of collaboration are identified in the matrix. A stakeholder that poses all three attributes should be given higher priority. Such stakeholders are definitive and have a higher claim that should be given immediate attention such as controllers in the engagers' sub-category. As the project progresses, some stakeholders could be removed and others maybe added. This awareness is needed throughout the requirement collection phase.

The project manager needs to be aware of those who will affect the progress of the project. Table 6.1. shows stakeholders identified through the use of the pisoSIA matrix (guidelines in Appendix A).

	Stakeholders	Stakeholder Attributes			Stakeholder Influence
		Power	Legitimacy	Urgency	
	Secretary		X	X	Dependent
	Shipping & Insurance Personal		X	X	Dependent
	Foreign Contracts Personal		X	X	Dependent
Engagers	Foreign Purchases Personal		X	X	Dependent
	Correspondence Personal		X	X	Dependent
	Military Cases Personal		X	X	Dependent
	Shipping & Insurance	X	X	X	Definitive
	Controller	X	X	X	Definitive
	Foreign Contracts Controller	X	X	X	Definitive
	Foreign Purchases Controller	X	X	X	Definitive
	Correspondence Controller	X	X	X	Definitive
	Military Cases Controller	X	X	X	Definitive
	Manager	X	X	X	Definitive
	Head of Division				
	Project Manager	X	X	X	Definitive
	SWH Analyst		X	X	Dependent
	KMOD SA Controller	X	X	X	Definitive
Facilitator	KMOD SA		X	X	Dependent
	Technical Office P		X	X	Dependent
	Communication Officer		X	X	Dependent
	IT Undersecretary	X	X	X	Definitive
	Ministry of Finance		X	X	Dependent
	Legal Advice and Legislation		X	X	Dependent
	Military Office (Embassy)		X	X	Dependent
Outside Agencies	Companies		X	X	Dependent
	Foreign Armies		X	X	Dependent
	Educational Facilities		X	X	Dependent
	Accountancy Bureau		X	X	Dependent
	Central IT Body		X		Discretionary
	F.P. Undersecretary	X	X	X	Definitive
	F.P. Manager	X	X	X	Definitive
	MOD Undersecretary	X	X	X	Definitive
Decision Makers	Planning Sector		X	X	Dependent
	IT Undersecretary	X	X	X	Definitive
	Procedural Development		X		Discretionary
	Annual Budget Committee	X	X	X	Definitive
	Support Budget Committee	X	X	X	Definitive

Table 6.1. Stakeholder Identification and Analysis Matrix of the FP Structure**.**

6.1.4 Visualise the System Boundaries

Stakeholders identified from the pisoSIA matrix are mapped into the FP structure defined by the VSM. This step visually defines the system boundaries; the evaluator must ensure that all Systems One through Five of the VSM exists in the VSM structure and has stakeholders associated to perform them (as discussed in Chapter Three). The evaluator at a later phase needs to check that these stakeholders are not over exhausted with multitasking.

Heads of Divisions must be aware of the FP system goals and the KMOD vision to resolve conflict between stakeholders within facilitation sessions. Session facilitators can share the responsibility of ensuring collaboration stability between stakeholders during the requirement sessions, which is missing in KMOD projects in general no role "*facilitator*" is given to a specific person, but somehow there is always this person from the KMOD IT staff that fills this role instinctively as will be seen in later section of this chapter as collaboration patterns evolve. It would be beneficial as an intervention point to develop a *facilitator* role and assign it to a proper member of staff with the qualified characteristics. Collaboration will definitely be smoother during the sessions.

Communication officers in KMOD are responsible for ensuring that all stakeholders are informed of upcoming requirement collection sessions. They are also responsible for informing all relevant stakeholders of changes in any scheduling. They optimise collaboration by optimising communication.

Fig. 6.5

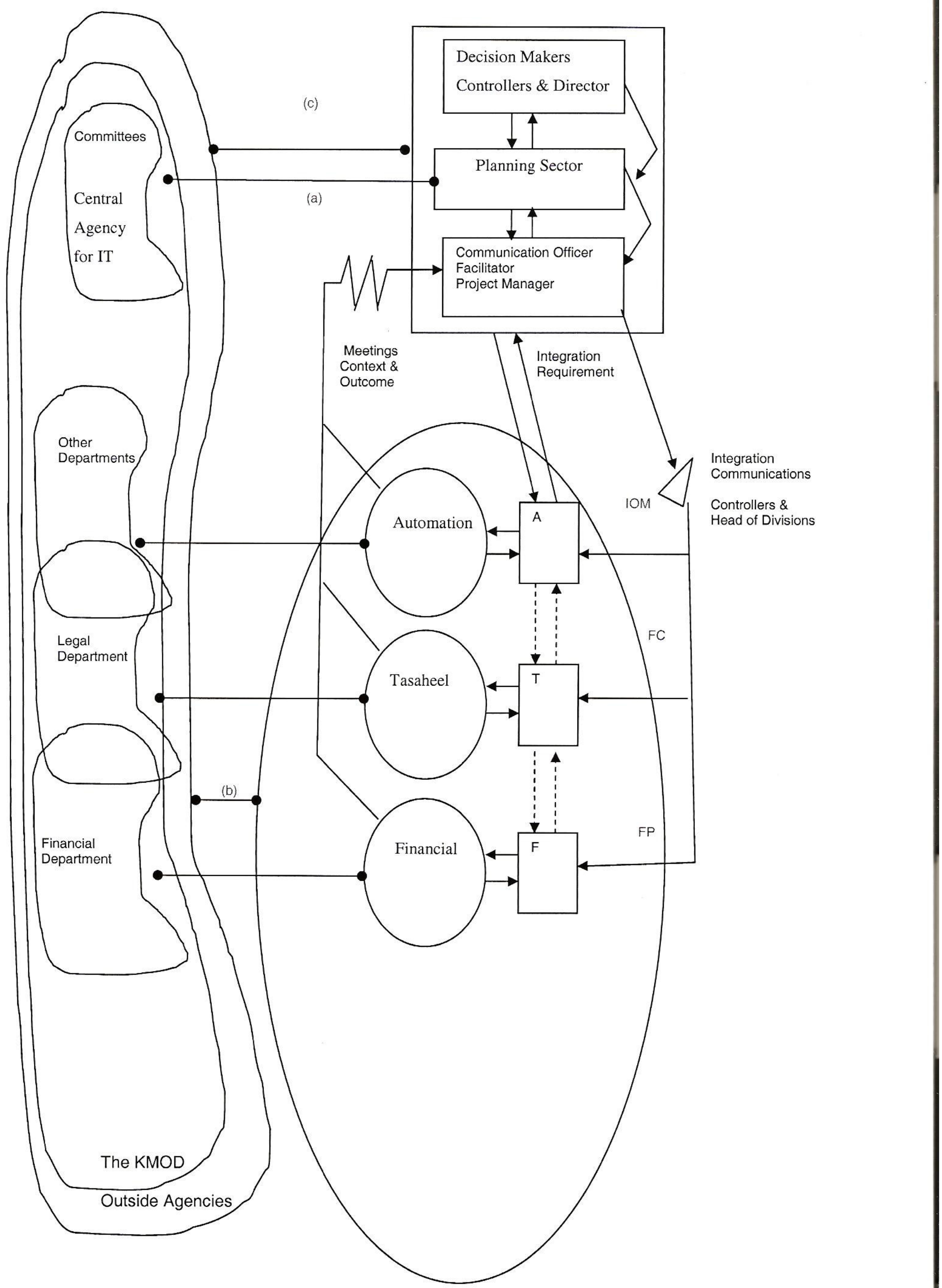


Figure 6.5. Human Boundaries Mapped to FP VSM (Recursion Level Two)

In the FP project the communication officer was changed twice during the requirement collection phase. This change has affected collaboration negatively as it was not organised properly and relevant stakeholders were not informed. This is a warning signal that needs to be passed to final analysis; relevant stakeholders should be informed of any changes of communication officers.

Project Managers should be able to develop contingency plans that aim for internal optimisation in stakeholder collaboration by analysing future changes in the organisation. In the FP project many changes in the hierarchy of the department affected by the political status of the country have altered the level of collaboration in which the stakeholders were involved. Collecting requirements and knowing that expected changes will affect these requirements lowered the level of collaboration.

System 4 function is not evident during the procedures of the FP requirement collection. The communication was overlooked during the integration of two sectors before the start of this project, there being the Technical Office and Procedural Development. Managers need to examine the environment in which they exist and to plan accordingly.

All communication channels shown in Figure 6.5 must also exist and have stakeholders to perform them. A deficiency in collaboration is immediately diagnosed and identified by completing the structure. Early warning signals are passed on to Phase Five to be documented as part of the intervention points in the planning strategy.

Figure 6.5 shows one level above the system in focus, being Level Two. The human boundaries are visualised in this diagram. VSM analysis can be applied to this diagram to diagnose collaboration problems at a higher level of investigation. One level below the system in focus (which is Level Zero), can also be drawn. In the FP case, there will be five Level Zero diagrams.

6.2. Phase 2: Collaboration Definition

It was very important to understand the social, political and cultural issues that are going to affect the group as seen in the previous analysis. In a system thinking structure a focus group session of the stakeholders (not all the stakeholders attended) was conducted. The purpose was to extract important factors affecting the collaboration of the group. I clearly define to them their roles as stakeholders in a software development process so that they could improve collaboration and decrease communication problems.

6.2.1. Define the Collaboration Constructs

First, I started with a checklist that had the constructs seen below.

Knowledge Sharing: what mutual perception they share related to work?
Interests: what makes them engrossed in participation?
Roles: do they know what they are supposed to do or what they only do?
Trust: are they given assurance and certainty to any threats?
Empowerment: do they have the power to change a process?
Dialogue: are they expressing their opinions freely?

As a facilitator I explained to them what I meant by these constructs. This was done to stimulate the discussion (I found that after I explained the factors participants were more willing to participate and give their own perception).

SSM rich pictures (discussed in Chapter Three) were used to visualise the complexity related to the collaboration process between stakeholders while they were discussing the collaboration factors. I mapped pisoSIA® stakeholder categories as identified in Figure 6.6. I tried showing all related interrelationships that might be needed during the software development process, making emphases upon interests and influence. Originally this step was to be performed mutually by the stakeholders and the facilitator. I found however from early engagement in the pilot project that it is more convenient for the facilitator to engage in developing the rich pictures because while the group was engrossed in discussion, I simultaneously translate what they were saying into pictures without disturbing the focus of their discussion. I then added unrepresented groups (outside agencies and decision makers) to the picture after the session was over; the pictures were shown to participating stakeholders at the end of the session for validation of interpretation.

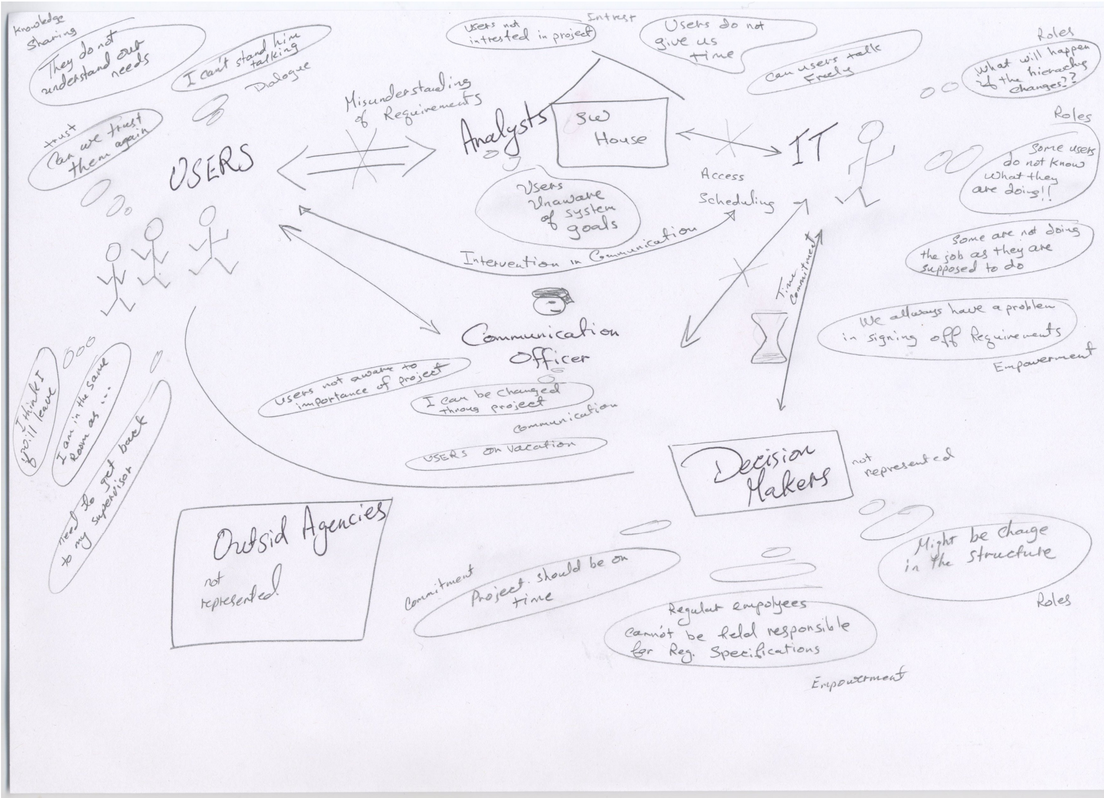


Figure 6.6. The SSM Rich Picture for the FP Project

As the facilitator in this project I found using rich pictures in the group session beneficial in making the problems in collaboration between stakeholders stand out for the FP project. However, as participants talked more and more I found it difficult for me to continue adding to the drawing. It became too crowded and I thought that it may lose its essence if too much information was added.

The SSM pictures highlight three major conflicts in the FP project designated by the big cross on the links between the pictures. The following section is a simple analysis that designates these issues.

There are obvious problems between the system analysts and users, requirements are repeatedly misunderstood and software developed never performs what needs to be performed. This needs to be resolved by investing in dialogue.

Roles within the FP department are clearly specified; however staff members are not given authority to sign off the specification of their own process tasks. Empowerment is definitely missing in FP; I believe that this is because there are varieties in performing certain tasks that the current manager does not agree with, even though this is how the staff are doing their job.

Another conflict in collaboration arises between the IT staff and the FP communication officer. I noticed that this conflict happened during the FP project. At the beginning of the FP requirement collection phase the communication officer designated was fully committed and all relevant stakeholders were negotiated and schedules were set. At a later stage of requirement collection the communication officer was changed due to associated social problems in the department. This change affected collaboration as some stakeholders were not notified and were brought to requirement collection sessions without preparation as can be seen as patterns in Appendix B.

6.2.2. Filter & Prioritise the Collaboration Constructs

At this sub phase, I wrote down every construct that the group mentioned during their discussion of their potential collaboration. I ticked beside the construct or artifact every time a participator in the group talked about a story or incident in relevance to it. The following was obtained in Table 6.2:

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interests	✓
Roles	✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Dialogue	✓
Awareness	✓ ✓ ✓ ✓ ✓
Communication	✓ ✓ ✓ ✓ ✓ ✓
Commitment	✓ ✓ ✓ ✓ ✓ ✓ ✓

Table 6.2. Collected Collaboration Constructs of the FP System

At the end of all focus group meetings, I filtered the constructs and artifacts by picking the ones that were ticked three times or more (by the rule of three that design patterns follow, these constructs are considered patterns) as shown in Table 6.3.

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Awareness	✓ ✓ ✓ ✓ ✓
Communication	✓ ✓ ✓ ✓ ✓ ✓
Commitment	✓ ✓ ✓ ✓ ✓ ✓ ✓

Table 6.3. Filtered Collaboration Constructs of the FP System

Some of the patterns were collected during the group session. I went back to previously collected data from interviews and meetings and identified patterns of collaboration between stakeholders. I then associated each pattern to a context either from previous data or by conducting new meetings. This step is a validation of findings. Collaboration patterns were validated after I found corresponding patterns from the case study by linking these constructs to actual stories. Templates (Appendix B) were used to document the incidents [vignettes] and are attached in the. An example is given in Figure 6.7.

6.2.3. Define the Collaboration Patterns

A prioritisation of these constructs was obtained from focus groups with stakeholders involved as follows (starting from the highest priority): Knowledge Sharing, Awareness, Trust, Communication, Empowerment, and Commitment. This prioritisation is context specific to the organization under study. Other context specific factors were also recognised, such as user readiness and user reassurance, before meeting the analysis team. The number of systems analysts meeting with the users also had an affect on their collaboration. An analysis team of more than two made the users intimidated and less willing to engage. Planning and sticking to the schedule was also important to the collaboration process. An important factor affecting collaboration between stakeholders was the facilitator representative. In the FP project the role was not specifically defined, but one of the KMOD IT members filled this role instinctively (encapsulated patterns in Appendix B). It was found that the communication gap was less between system engagers and systems analysts and the collaboration was most effective, when the facilitator was from within the organisation. This observation is opposed to what the literature calls for (van Mullekom and Vennix, 2006).

Name
Requirement Consensus

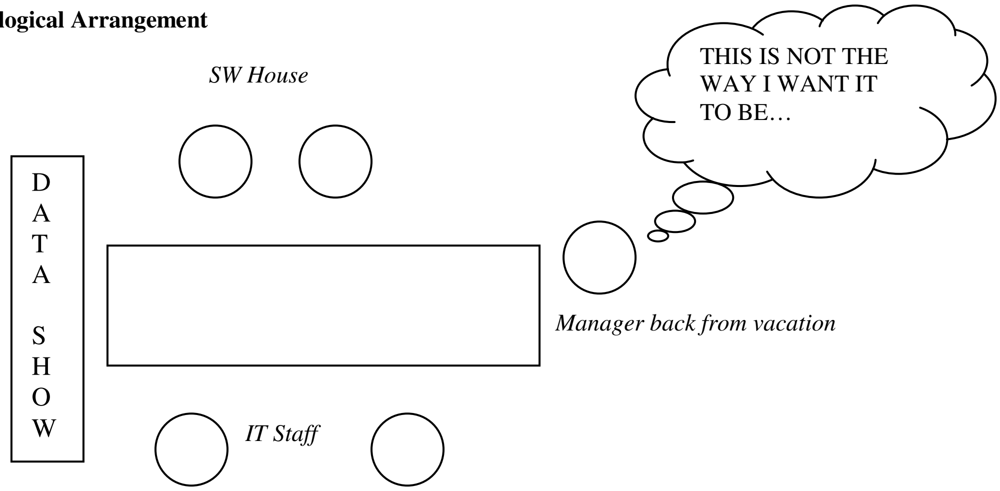
Vignette Number: 2
CASE: Foreign Procurement

Predecessor
Increase Collaboration

Collaborative Arrangement
The final phase of the requirement documentation, the manager missed out on the early phases. The IT staff & SW house are briefing him. Data show used, early version prototype used.

Representation of activity
The early version prototype used made collaboration worse, non working features made the manager upset. Collaboration was improved by intervention of IT staff explaining what will happen in the real software.

Ecological Arrangement



Collaboration Technique
The collaboration was achieved by a personal face to face discussion of how the software will appear. Better collaboration would have happened if a final version of the prototype was used.

Population of Use
IT staff

Successor
Increase Collaboration

Figure 6.7. An Example of an Encapsulated Collaboration Pattern

Figure 6.7 shows the template used for encapsulating the collaboration patterns. Some patterns were encapsulated during the focus group sessions. Other patterns were extracted latter on from previous interviews; I went back to previously collected data and identified patterns, which were associated to a context. Mainly most of the patterns were encapsulated from direct observation or discussions with stakeholders during observation. The pattern template was used as a structured way to document the incidents [vignettes]. They were used as data recording sheets (other use of patterns in this study is shown in Chapter Five); these findings were validated from the source. Corresponding patterns from the case study were linked to the constructs defined previously by the participants telling actual stories.

6.3. Phase III Collaboration Complexity

A holistic view of the FP stakeholders' collaboration is developed at this point. VSM, SSM, and pisoSIA are used in combination to Systems Dynamics CLD to capture specific detail of the context specific criteria of collaboration. Social as well as political issues will affect the collaboration process of requirement specification. A model is developed for the requirement collection process, showing how collaboration is dynamically developed. The model encompasses the major relationships that exist between stakeholders in the specific context of the FP project.

6.3.1. Draw Inter-relationships of Collaboration Patterns

A basic collaboration model is presented in Figure 6.8, showing collaboration as a causal loop diagram (CLD) that leads to requirement consensus during the requirement collection phase of the FP project.

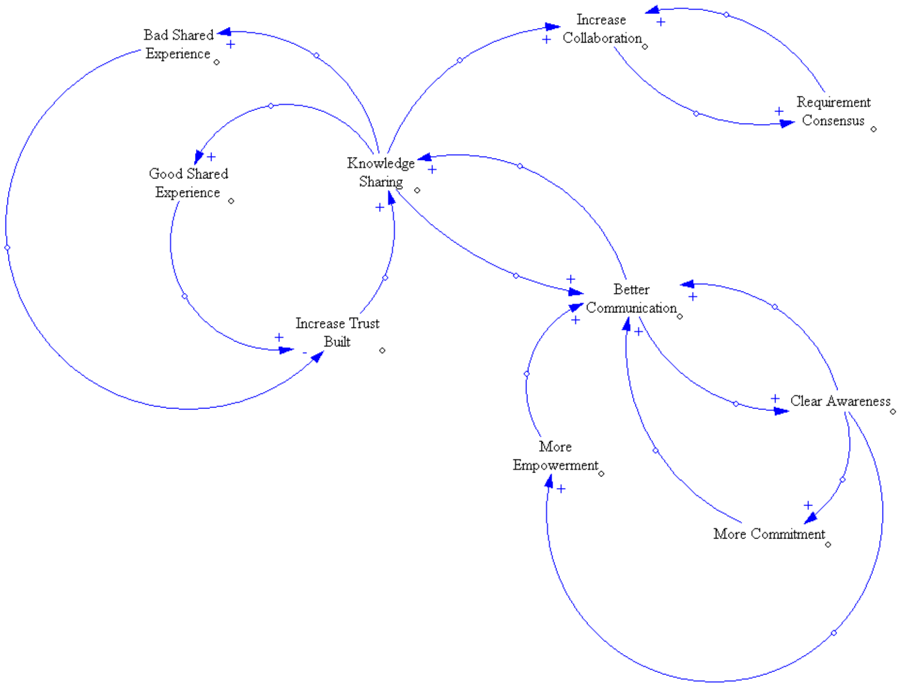


Figure 6.8. The Collaboration Model Overview of FP Requirement Collection

This FP Collaboration model is validated by stakeholder perception. The patterns encapsulated before act as a link between the CLD and the actual case study. They give reliability and confidence to the results of the CLD. Consensus regarding the CLD developed was gained from participant stakeholders during the group sessions of Phase II, and more confidence is given to the CLD by developing a questionnaire that has the CLD associated with written expressions that describe the diagram. This questionnaire was given to stakeholders to evaluate the model. It was written as logical statements that describe a qualitative pattern of behaviour that leads to collaboration. The questionnaire was presented to stakeholders in groups and comments acted as feedback where changes were made accordingly and affected the final CLD given in Figure 6.8. Consistent stories from participant stakeholders suggest good correspondence of the FP model with their experience.

I noticed that trust was built up gradually as the meetings progressed throughout the requirement collection phase. It showed when at certain points through prototype presentations stakeholders agreed on certain aspects that were not clear and said that they had trust that this will be clear after the system is launched. He had the awareness that the users need to adapt to the software gradually, and was aware and willing to accept that the system might have certain deficiencies that the IT department would correct.

6.3.2. Analyse Collaboration at Different Granularities

Analysis in this phase is conducted in both a parallel and sequential manner, using VSM and CLD interactively to evaluate findings affecting the collaboration process passed on from the previous phases of the FP project.

Initial analysis of the collaboration model in Figure 6.8 emphasises the importance of knowledge sharing to increase collaboration in the FP project. It is the basic construct in the model that directly affects collaboration. Communication and trust both feed into knowledge sharing with positive loops.

Collaboration could be analysed at different granularities in this phase, for example at the better communication level, for example going back to patterns encapsulated it is evident that bad communication in scheduling the requirement collection session was a factor that altered collaboration. Also, during requirement collection sessions artifacts were not considered carefully in aiding collaboration. Dialect was also a factor that was not considered, the accent of the users was negatively affecting transferring knowledge between the analysts and the users.

Communication channels in Figure 6.5. shown by bidirectional arrows, need to be active. Missing information within these channels is an indication of deficiencies that need to rectify it by sending warning signals that need to be passed on to following phases. One such missing communication channel is the looking into the environment channel that propagates potential threats and changes back to the operational units, which are the requirement collection sessions for each sub-division. There is a need to look into how these missing channels might affect the current requirement collection process in the FP project. Analysis show that project managers should appoint resources to identify potential disturbances in the ministry and country. Causal affects are important in such complicated situations. The FP model could be used to analyse each requirement collection session individually. Requirement collection sessions for each sub-division can be analysed to evaluate collaboration resulting in different interpretations and impressions between stakeholders represented.

Phase 4: Collaboration Evaluation

6.4.1. Identify Collaboration Viability

According to VSM analysis, I checked the FP project against the list of viable collaboration signs documented in the previous chapter and associated the analysis results in Table 6.4.

Signs of Viability	Analysis Results
Make sure that having stakeholders in multiple roles will not affect the system behavior. Human resources must be deployed efficiently over the VSM structure.	*Multiple roles were assigned and resources need to be relocated in the FP project*
Missing communication channels between stakeholders will affect the viability of collaboration between them.	*Many communication links missing in the project*
Primary operations in VSM System One must be atomic, higher level interference must be minimum and not interfering with the ability given to the lower level to handle variety.	*All primary operations are atomic*
Everyday activities in System Two must be met efficiently and deployed with resources.	*Efficient System Two*
Synergy and optimal performance must be achieved, System Three ensures such synergy.	*Lacking in the FP project as scheduling and communication are inefficient*
Looking at the future ensures planning for disturbances that might affect collaboration. System four is in charge of these activities.	*Lacking in the FP project*
System Five, ensures that policies are implemented according to goals identified achieves closure.	*Goals of FP automation need to be more clearly identified*

Table 6.4. FP Collaboration Viability Checklist

This checklist ensures viability of collaboration in the FP system through consideration of the following:-

1. Management should be able to handle unexpected perturb during requirement collection.
2. Flow of information in the communication channels (bidirectional arrows) are available at the right time and in the right place.

6.4.2. Analyse Short and Long Term Behavior

Major feedback loops for collaboration shown in Figure 6.8 are determined in the FP model in order to identify the factors that improve collaboration. We need to find answers to the next question "*what contributes to each factor presented in the model?*"

CLD behavioural analysis of the FP model shows that there are six major positive reinforcing loops of collaboration. These loops are desirable and ways of boosting should be considered. The project manager has to critically investigate short-term decisions on stakeholders' long-term collaboration performance. A good project manager needs to determine the major feedback loops that affect stakeholder collaboration and investigate ways of intervention to promote positive feedback. The major reinforcing feedback loops are shown in Figure 6.9, numbered 1 to 7.

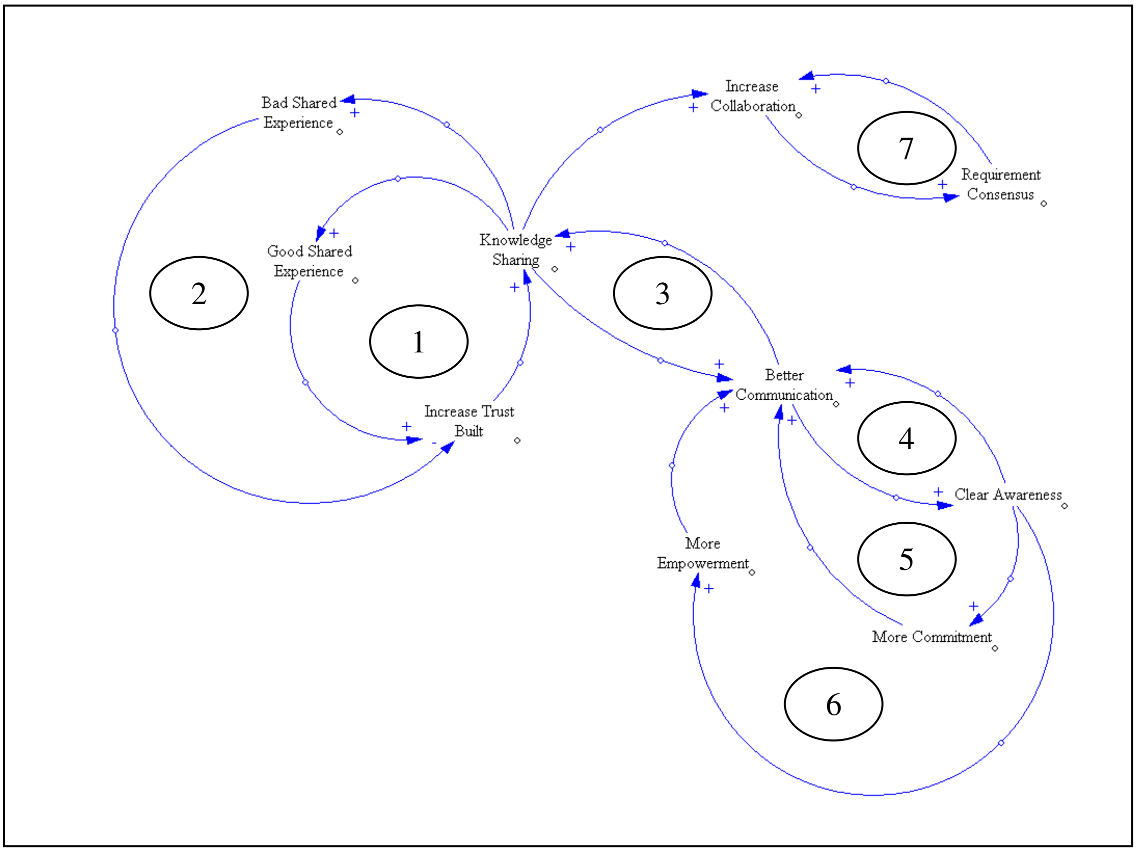


Figure 6.9. Reinforcing Loops of the FP Model

Each reinforcing loop shown in Figure 6.9 is a point for analysis. The project manager needs to consider long term affects on the system. For example awareness is found partially missing in the FP project, users are not aware of the target vision, and goals are not specifically explained to potential users in the FP system. One pattern that hindered collaboration related to this issue was evident when the manager kept asking for requirements that are either covered by other current systems in the ministry or are not relevant to the objectives of the automation project. This pattern of behaviour and how it affects collaboration during requirement collection was overlooked and this specific approach was able to encapsulate and intensify its long term affect.

The other loops marked in Figure 6.9 also need to be analysed, to get an overall evaluation of the interrelated factors that affect collaboration. Results are visualised in the next sub-phase as the patterns are mapped onto the VSM structure.

6.4.3. Map Collaboration Patterns

In this part of the approach actions are recognised that can be specific to certain values that the FP needs to embed into its culture. Figure 6.10 shows the patterns mapped onto the FP VSM, promoting discussion between the project manager and higher management to means of implementation.

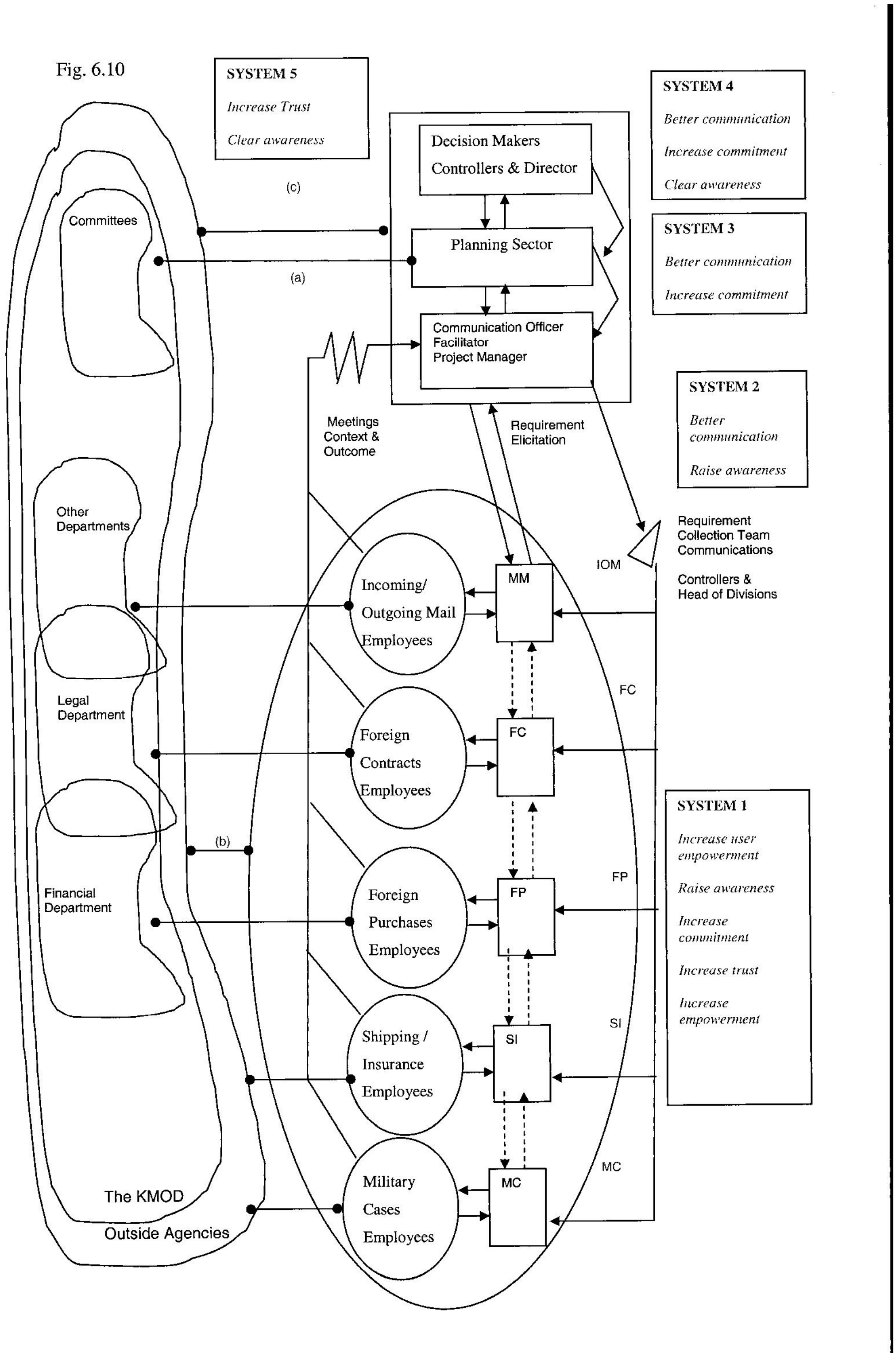


Figure 6.10. The Collaboration Patterns Mapped to the FP Model (Recursion Level Zero)

Analysing Figure 6.10, an evaluator can think of many ways to promote collaboration. These options should be negotiated by decision makers in the orginisation in order to decide which would suit them better. Examples of these considerations are:

- As discussed in the previous chapter human relation courses can be employed such as empowerment courses in the case of low empowerment, or informal ways of changing the attitudes of employees can be utilised to boost their collaboration through social events with collaboration goals.
- Short and multiple seminars is another option that can be conducted to promote the use of electronic procedures.
- Emphasising the work of the developer company with previous clients could also be employed to increase trust which will affect knowledge sharing.
- Visits to previous customers allowing them to perform seminars in the department with open discussion to share their experience and discuss the overall process of change and how they managed to accept it.

These are options to be considered, others may be considered according to management procedures.

6.5. Phase V: Collaboration Planning

This is a strategic planning phase developed from what has been uncovered and learnt in the previous phases.

6.5.1. Perturb Findings

Early warning signals are passed on from Phase Four to Phase Five, to be documented as part of the intervention points in the planning strategy. The most obvious warning signals are the missing communication channels in the FP project which are propagated immediately to final analysis. Other deficiencies diagnosed are considered in the next sub-phase, taking into account results obtained in Table 6.4.

6.5.2. Final Analysis

VSM analysis emphasises the lack of resources assigned to communication links in the FP project. There are missing processes throughout the requirement collection phase that ensure proper delivery of information related to scheduling stakeholders meetings. This is evident in the lack of awareness in stakeholders during the meetings.

"*Communication Officer*" is a role supposed to be filled by a member of personnel in the department that is being analysed. He must have both personal and professional communication skills including scheduling, reasoning, courtesy, negotiation and social attractiveness. His job is to facilitate meetings between parties. In this particular case the communication officer was changed several times, and this caused a lack of synergy in the meetings. Some users were called for meetings without prior notice and some were not aware of the system scope and demanded requirements outside the system boundaries. Communication channels need to be re-considered; more emphasis should be given to planning and scheduling. This continuous changing of roles between stakeholders was a major factor that negatively affected the flow of information between the channels. There is a pattern of communication officers changing throughout the FP requirement collection phase which has affected collaboration negatively by affecting the commitment factor. There is no specific person committed to the role of communication officer and there is no relation of commitment between stakeholders in FP with that changing figure.

A focus on what really matters to stakeholders must be identified by focusing on what is relevant to stakeholder collaboration at each level of recursion. Stakeholders need to have enough requisite variety (discussed in Chapter Three), to distinguish the possible states of collaboration. Considering the complexity of natural settings, these states are infinite, and affected by infinite variables. Stakeholders need to attenuate these states by factoring out what is desirable and then amplify it by finding manifestations that can describe it and thus be able to promote it. One such example is the getting better communication through faciliataton. There exist many manifestations that can define communication. The VSM is used to identify physically missing communication links, but what about the infinite factors that can contribute to better communication in the FP project? How can we limit these factors? According to cybernetics the project manager must find means to select the relevant factors that promote collaboration and then in turn amplify it to best use. Group sessions can be used for this matter to collect comments from stakeholders. Results from FP stakeholders show two emerging artifacts that manifest communication. These are the medium used during the sessions, and the dialect. Sessions that had prototypes and data shows used in them showed high participation from stakeholders while sessions where no such mediums are used showed less participation. Now a project manager needs to utilise these two artifacts to promote collaboration.

Patterns encapsulated show evident examples of the tense atmosphere in the country; news of changes in ministry hierarchy is known to affect the structure of the ministry which will definitely have changes reflected in the requirements. In the FP project entire processes may be removed, the project manager should have the means that enable him/her to decide on appropriate action on what ever course of action that might occur.

System Two is relatively effective in FP. The head of each division is responsible for extracting requirements from potential users; requirements were being extracted from collaborating stakeholders and conflict was relatively avoided during the meetings for each System One sessions. Missing communication links have however affected the availability of information to System Two, in turn affecting the availability of information to operational units.

Knowledge sharing which involves the transfer of perception from one individual to the other is not evident enough in the FP project. The difference in dialect between the analysts and the users was an obstacle in communication which negatively affected collaboration.

User empowerment was not evident during the sessions with users of Systems One & Two. In order to achieve stability in collaboration, they should have enough empowerment to optimise agreement to the requirements without having to go back to their supervisors.

Facilitation tools as a manifestation of better communication need to be considered, their effectiveness, and what needs to be changed to optimise requirement collection. This is the job of the facilitator, and clearly undefined in the FP project; no one had been actually appointed to commit to that role. A committed facilitator will audit tools used in each meeting and will improvise creative ways to make the requirement collection easier and the transfer of knowledge between the system users faster. Throughout the project the only tools used were the requirement documentation and the prototype, on a laptop or presented through a data show. An auditing system is definitely missing. If the project manager is over tasked, a staff must be appointed to that important task.

Evaluation of the FP department culture calls for improving trust and empowerment as they will definitely lead to an enhancement to the collaboration in the requirement process. Higher management in this department are military personal. Some users did not want to engage before meeting the analysis team. This emphasises the importance of trust and its positive affect on collaboration. Trust development in the system is associated with the trust in the analysis team and SW Developer Company. This emphasises the importance of trust and its positive affect on collaboration.

Clearly they are not performing the System Four activities properly: they are in touch with their environment, but are not planning at the sector level to adapt to future threats and opportunities. This was evident in the process when the requirement collection was preceded, even with the threat of having the business processes re-organised during the re-election of the National Assembly and the delegation of the new government. It was a matter of good luck that the same minister was appointed to KMOD, otherwise the hierarchy of the organisation would have bean changed and requirements for changed departments would have been re-collected.

This system needs attention from higher management. There is a planning committee on the level of the ministry. Its interaction with the IT Undersecretary needs to be stimulated and it needs better communication with System Three to account for current threats.

On the level of meetings for requirement collection, the policy is indicated by the IT undersecretary (in the future the Central Agency for IT needs to contribute). Periodic meetings between controllers in the IT department and daily meetings between the software house analysis team and the Software Analysis sub-department in KMOD ensure a sufficient level of understanding and sharing the policy procedures. There is a sufficient amount of trust, knowledge sharing and empowerment within the department and the IT team that motivates a fair amount of collaboration.

There is a communication gap in the requirements collection process of the FP project. This communication gap is affecting the collaboration of stakeholders which was seen in the patterns collected.

User readiness for change and awareness; some users were asked to join the meeting with out prior notice from their direct manager. They were found less willing to engage in the meeting and wanted to schedule another meeting.

The above analysis indicates that collaboration between stakeholders in Recursion Level One is essential for achieving proper information transfer in the whole system. To do that, requirement collection sessions must be conducted with relevant stakeholders involved from all the interrelated sectors. I find that missing in the implementation of this project as requirement collection sessions are conducted individually for each project (this is a warning sign that needs to be propagated to final analysis).

At this level of application, a subjective evaluation of stakeholder collaboration is developed through descriptive analysis. The evaluator can relatively decide on what level of collaboration is achieved by comparing to collaboration viability signs. The final sub-phase of intervention point development provides closure to the approach by identifying straight forward points.

6.5.3. Develop Intervention Points

Intervention points and recommendations are developed at this point for a viable requirement collection process in the FP project. Considering specific details of pattern behaviour (Appendix B) in combination with CLD of Figure 7.9 indicates what needs to be addressed in order to promote collaboration. This is combined with consideration results of pisoSIA matrix of Table 7.2 and the collaboration viability checklist of Table 7.5. Results from the previous sub phase of the approach are propagated and intervention points are uncovered associated with examples from the patterns encapsulated which are in the (Appendix B on the CD) as well as meeting reports in the (Appendix C).

The following are intervention points identified in the requirement collection process:

- Immediate action must be taken to investigate missing communication links in the FP VSM (example: *Better Communication* pattern vignette *2*).
- Manifestations of artifacts need to be collected in order to identify the ones that directly increase user collaboration within FP (example: *Knowledge Sharing* pattern vignette *3*).
- Awareness alerts must be heavily appointed to FP stakeholders (example: *Clear Awareness* pattern vignette *1*). Goals and vision of the new system must be explained in more detail. Flyers and department news flashes could be employed. Seminars explaining how the new system would affect the daily process of the users in the FP department could be conducted. Actual users of new automated systems in other ministries could be called to recall their experience and how they managed change.
- Develop a strategy that promotes stakeholders to accept change in FP (example: *Good Shared Experience* pattern vignette *1*).
- Build a trusting environment emphasising security measures of the new system (example: *Good Shared Experience* pattern vignette *2*). Trust must be built gradually through relationships and shared experiences. The developer company can invite stakeholders to engage in the construction of a shared vision and understanding of the potential system. New participatory approaches in requirement collection must be looked at.

- Decide on an agreed number of system analyst meeting with the users (example: *pilot study progress report*)
- Plan and stick to the schedule by developing effective scheduling contingency plans (example: *Better Communication* pattern vignette *2*).
- Improve System Four activities which is planning by employing resources that look into the environment and detect specific future factors that affect the collaboration of stakeholders and reporting back to the project manager to take the appropriate action (example: *Meeting P1_2_2006*).

These intervention points provide alerts to diagnosed problems in collaboration through the FP stakeholders; focusing on specific problem areas in this case study and enabling project managers to plan for contingency actions to act on during requirement collection. In the long run such implementation will promote a collaborative culture in FP that accepts change with less conflict.

6.6. Assessment & Evaluation of EStaC Approach Implementation

A questionnaire is used to evaluate the approach according to its objectives. The best way to develop the questionnaire was through the use of Goal Question Metrics (GQM) (Basili, Caldiera and Rombach, no date), where questions are developed in correspondence to goals specified. The questionnaire is aimed to be completed by potential users of the approach (SW Project Managers, System Analysts and Facilitators). In this case they are required to complete the questionnaire comparing their current experience in the FP project with what information is gained from the developed approach and how useful it would have been if the intervention points had been made use of through out the requirement collection phase of the FP project. Its usefulness in future SW projects for evaluation of stakeholder collaboration is also questioned. Their reflection of the intervention points produced from the approach is useful and can be used in determining how they think collaboration can be promoted. This evaluation is a subjective evaluation relative to the partitions perception, no exact measurement is used and that is due to the soft and complicated nature of the problem.

6.7. Conclusions

In this chapter the FP system is chosen as an example of a typical department in a public sector undergoing software development. The EStaC approach is applied to it in five phases to evaluate the collaboration of stakeholders involved in the FP project. The results of the approach are compared with a questionnaire developed to evaluate how well the approach achieved its objectives in handling the problem under focus and how close the results are according to system analysts and project managers involved in the FP project. Results (shown in Chapter Eight) give considerable confidence in EStaC as it managed to match participant perceptions.

The following limitations of the EStaC approach were synthesised during application of the FP project. The same limitations were reflected during the IT project (in the next chapter) and will be returned to briefly in the next chapter conclusion.

The first limitation of this approach is that it is expensive to apply in terms of effort and time. Both the evaluator and the stakeholders must be willing to put some time and effort into the processes of the approach. The approach consists of rigorous qualitative analysis to be conducted, which may not seem preferable economically in the same term. The organisation must believe in the valuable results that can be obtained by this type of approach, easily overlooked when using quantitative approaches.

It is sometimes difficult to set a limit on when to stop the evaluation, once you get engrossed the evaluator must have the experience and inner knowledge that guides them when to terminate the evaluation. Sticking to defined goals preset by the project management which ensures proper evaluation.

An important aspect of the EStaC approach is that collaboration definition is generated by the stakeholders' viewpoint. This viewpoint might generate contradictory definition to what is available in the literature. For example, although there is no general theory but there is a correlation in the literature between trust and knowledge sharing, because of the nature of the approach and the involvement of multiple perspectives of stakeholders' conceptions are constructed influenced by past experience, a different correlation might be resulted. At the moment there are no guidelines for the evaluator to follow to ensure a construction of a collaboration model that complies with the literature. Further research needs to be undertaken to attach the approach with means for the evaluator to intervene. This intervention may however alter the concept the approach is based; being context specific constructivism.

The EStaC approach could benefit in the future from research in the realm of enforcing structure and balance on the design pattern languages developed. This is further discussed in Chapter Nine.

Results of EStaC heavily depend on the evaluator's experience in using systemic tools and understanding cybernetic principle of system design and diagnosis. An ability to detect warning signals as soon as there are indications, is crucial. This is essential for planning collaboration when associated with the proper distribution of resources and proper flow of information.

The phases in the EStaC approach are presented distinctively for presentation purpose. In real application a more holistic implementation is applied, and phases are intertwined.

Chapter 7

7. Application of the *EStaC* Approach: Case Study II

This chapter contains a second case study, which again tests the application of the EStaC approach to the Ministry of Defence, but with a very different project. Again each phase of EStaC as described in Chapter Four is applied in turn. As discussed in Chapter Five, the two projects were chosen from the corpus of projects within the KMOD Automation System. The Information Technology (IT) Project is the second project selected from within the environment of KMOD as an example of a typical ministry department with expected high collaboration between stakeholders. How and why it was chosen was described in detail in Chapter Five. Originally the IT project was selected as a pilot study. In this chapter elaboration of application is given as the phases are applied.

7.1. Phase I – Boundary Definition

The system boundaries are defined by the following steps:

7.1.1 Understand the System

Preliminary investigation of documents and early interviews with IT officials gave an initial understanding. IT indicates that the IT department provides IT services to all KMOD departments and employees. Such services are divided into the following:

- Operations
- Technical Support
- Networks
- Document Processing
- System Development
- Qualification and Assessment
- IT Training

Although the IT department deals with all the other departments in the ministry through providing the IT services, it has special relations with the following:

- Financial Department System
- Local Procurement System
- Administration and Personnel Department
- Training and Development Department

The IT Department has the following main goals for the system they want to develop:

- Ease the mechanism of sending and receiving calls from all departments regarding fixing problems and requesting new services.
- Integrate the Information Technology system with other systems in the ministry that are directly related, Financial, Local Procurement System , Administration and Personnel Department, and Training and Development Department

Figure 7.1 and 7.2 emphasise the IT Automation System as embedded systems where there are four major levels of recursion shown (recusion discussed in Chapter Three). The top level which we will call Level Three is Kuwait E-government infrastructure, where our main interaction sites are the Ministry of Finance, Social Security, Civil Service and the Central Agency for IT. It is most important to be in synch with the Central Agency for IT because it directly deals with all the resolutions of the IT departments of all the public sector in the country, to which the KMOD IT System belongs.

The Information Technology (IT) Project was the system in focus. It works in sync with other projects on the same recursion level: Financial, Local Procurement, Administration & Personal, Legal System, Training & Development, and IT Solution Companies from the outside environment. As in the FP case study requirement collection sessions were conducted individually for each project, I find that there was missing sessions that involve stakeholders from all the interrelated departments. This was an early diagnosis that was confirmed later through further analysis using the approach.

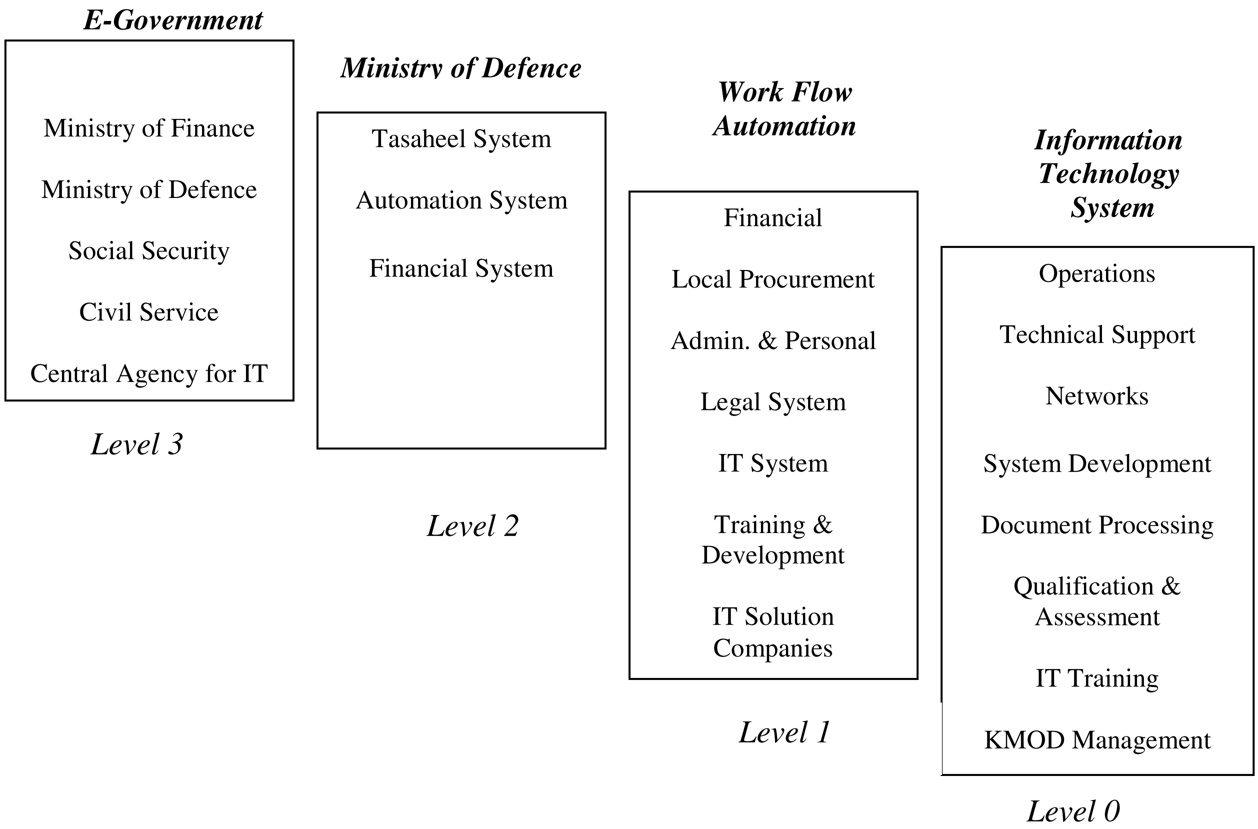


Figure 7.1 . The VMS Recursion of the IT System

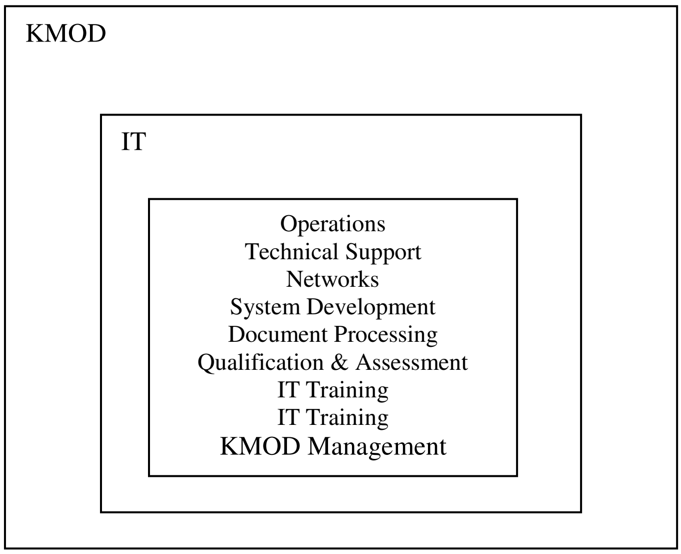


Figure 7.2. Another View of the Recursion Levels of the IT System

Level Zero shows a finer granularity of the IT Project which is the system in focus of this case study. The IT Department has several systems working simultaneously which are: Operations, Technical Support, Networks, System Development, Document Processing, Qualification & Assessment, and IT Training. Each system delivers complete unique services to the IT System which when integrated fulfils the department goals. Therefore all of these systems are considered System One in Phase One of the approach. At the time of application the IT also has a responsibility of managing and completing the KMOD Automation System, so the activities involved could also be a System One. The System One activities are connected and could be in conflict. Further analysis is considered in later phases of the approach, we need to make sure that the KMOD management is not in the way of other activities in System One causing problems of oscillation.

Again a holistic analysis was conducted; the IT project needs to be diagnosed by considering all the levels of recursion that affect it. Systems in the same level in which it needs to integrate with and levels above and below it that are affected or will affect it are considered. From a cybernetic viewpoint, resources are allocated to the IT department at recursion level one. These resources are then reallocated by the IT management to either sub-department at recursion Level Zero. Sub-departments compete for these resources and threat the proper flow of information in the system. Careful consideration of how the resources are allocated ensures the existence of the right information at the right place and therefore enforcing the viability of collaboration between the stakeholders within the requirement phase.

7.1.2 Structure the System Boundaries

Figure 7.3 shows a visualisation of the requirement collection for the IT System. It involves the collaboration of several stakeholders serving different divisions as well as outside agencies in the environment; where specific appointment of the stakeholders shown are identified in the human boundary definition in the next step of this phase. The management of KMOD is also shown as a System One, where special care needs to be considered to avoid conflict.

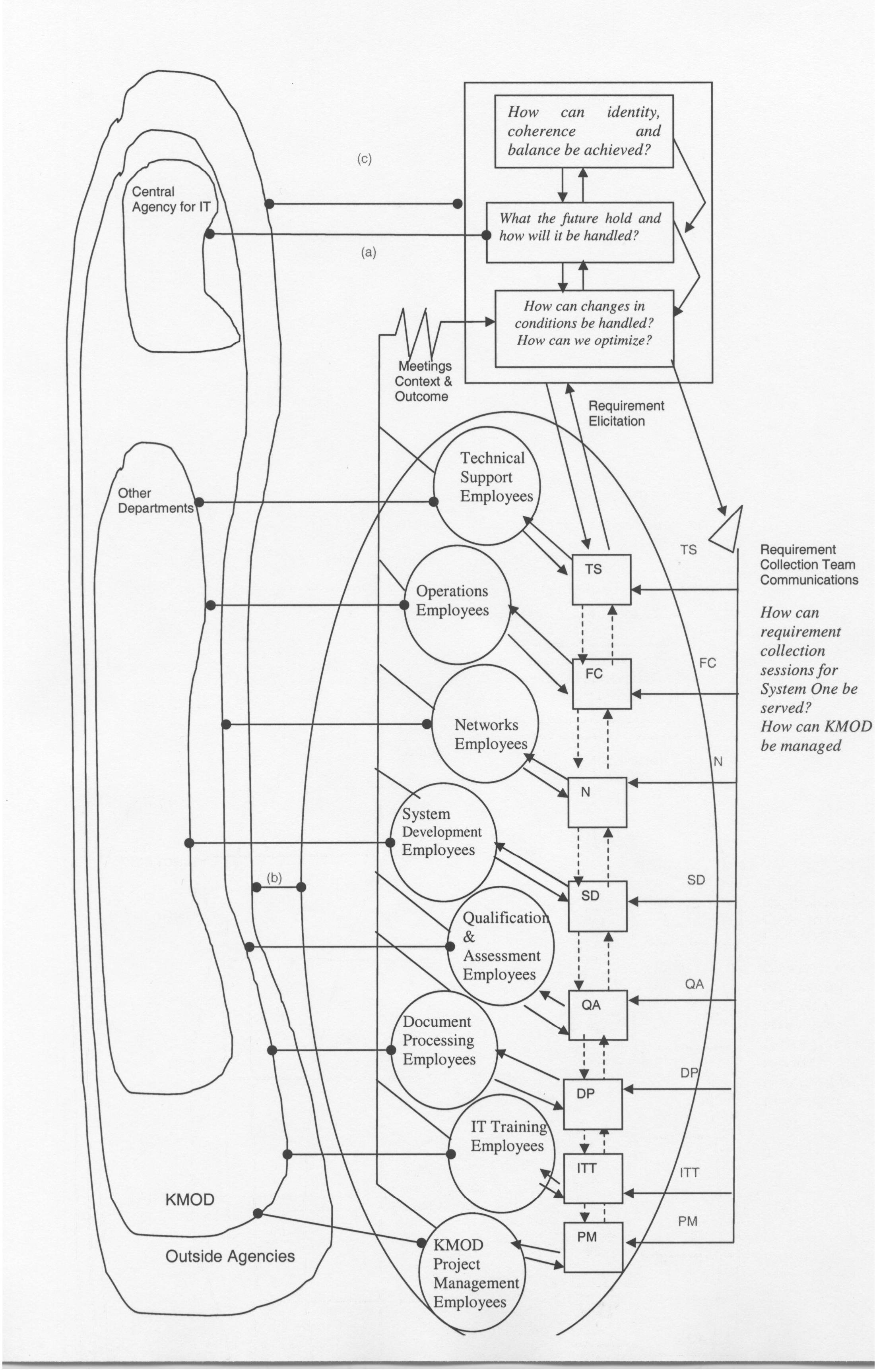


Figure 7.3. VMS Structure at Recursion Level 0 of the IT System

Table 7.1 shows what needs to be considered in order to define a proper structure for the IT System stakeholder collaboration process according to the VSM.

System	Queries to be considered	Affiliation
One	***What are the unique activities***	o Technical Support o Networks o System Development o Document Processing o Qualification & Assessment o IT Training o KMOD Management
Two	***How can System One activities be served?***	This can be done by: o Promote collaboration constructs o Consider spatial arrangement o Consider facilitation tools
Three	***What are the circumstances of requirement collection now? How can changing conditions be handled?***	o Prioritise stakeholder meetings o Shift resources (consider tradeoffs) o Consider synergy in meetings (consider whether the time saved in requirement collection is worth the increased risk of the project failure)
Three*	***How can I audit the collaboration process?***	o Readiness to collaborate (reconsider collaboration definition) o Sessions scheduling satisfactory o Transportation arrangement o Facilitation tools o Review requirements o Authorisation access to sites
Four	***What does the future hold? And how will it affect the current status?***	o Establish reasonable idea of future happenings (short or medium term by association with the procedural development dept.) o Decide what could be done o Look for conflict between decision made and identity and goals in System Five o Check feasibility with System Three o Consider possible changes to System One
Five	***What can be done to maintain identity, coherence and balance?***	o Consider goals o Consider politics o Consider rules

Table 7.1. VMS Structuring of the IT System

In the coming steps of EStaC, the VSM diagram of the Automation System recursion Level Two and VSM diagram of recursion Level Zero are presented with stakeholders mapped each in turn are stakeholders carefully considered.

7.1.3 Define Human Boundaries

Seven sub-departments work under the IT department as shown in Figure 7.4, each responsible for procedures and executing tasks assigned to them, depending on the roles and responsibilities and the business procedures cycle.

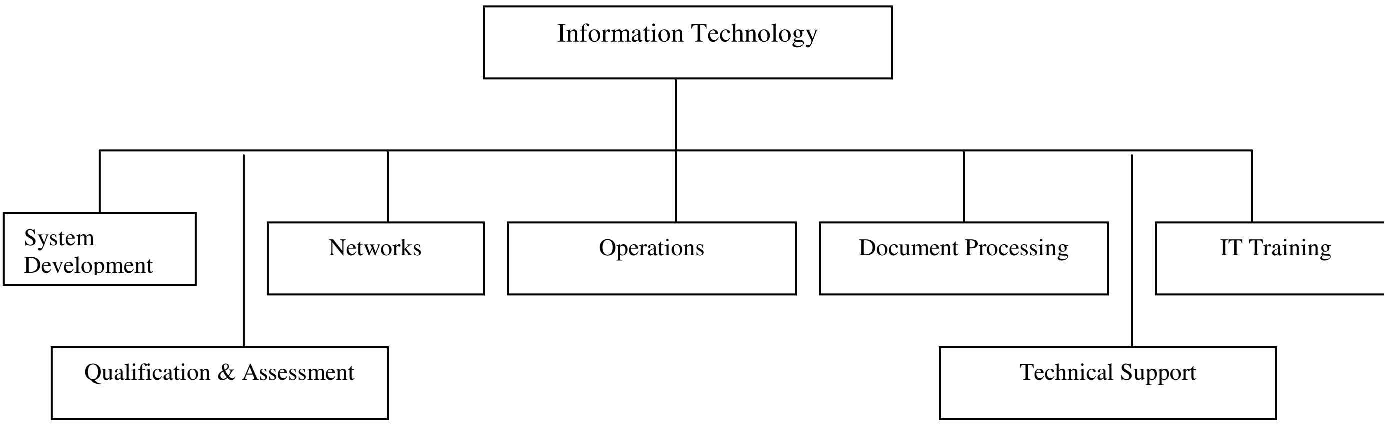


Figure 7.4. Hierarchy Structure of IT department

Table 7.2 shows the stakeholders involved identified through the use of the pisoSIA matrix (Guidelines in Appendix A). These represent the human boundaries of the system according to the structure of the IT system.

According to pisoSIA, a stakeholder that clicks all three attributes should be given higher priority so that project manager needs to be aware of those who will affect the progress of the project.

	Stakeholders	Stakeholder Attributes			Stakeholder influence
		Power	Legitimacy	Urgency	
System Engagers	IT Secretary		X	X	Dependent
	Technical Support Personnel		X	X	Dependent
	System Development		X	X	Dependent
	Personnel		X	X	Dependent
	Operations Personnel		X	X	Dependent
	Networks Personnel		X	X	Dependent
	Qualification & Assess.		X	X	Dependent
	Personnel		X	X	Dependent
	IT Training Personnel		X	X	Dependent
	Document Processing				
	Personnel		X	X	Dependent
	Technical Support Head of				
	Division		X	X	Dependent
	System Development Head of		X	X	Dependent
	Division			X	Dependent
	Operations Head of Division				
	Networks Head of Division		X	X	Dependent
	Qualification & Assess. Head		X	X	Dependent
	of Division				
	IT Training Head of Division	X	X	X	Definitive
	Document Processing Head of	X	X	X	Definitive
	Division	X	X	X	Definitive
	Technical Support Controller	X	X	X	Definitive
	System Development	X	X	X	Definitive
	Controller	X	X	X	Definitive
	Operations Controller	X	X	X	Definitive
	Networks Controller	X	X	X	Definitive
	Document Processing				
	Controller				
	Qualification & Assess.				
	Controller				
	IT Training Controller				
	IT Manager				
Facilitator	Project Manager	X	X	X	Definitive
	SWH Analyst		X	X	Dependent
	KMOD SA Controller	X	X	X	Definitive
	KMOD SA		X	X	Dependent
	Technical Office Personal		X	X	Dependent
	Communication Officer		X	X	Dependent
Outside Agencies	Ministry of Finance		X	X	Dependent
	Legal Advice and Legislation		X	X	Dependent
	Developer Companies		X	X	Dependent
	Educational Facilities		X	X	Dependent
	Accountancy Bureau		X	X	Dependent
	Central Agency for IT	X	X		Discretionary
Decision Makers	IT Undersecretary	X	X	X	Definitive
	IT Manager	X	X	X	Definitive
	MOD Undersecretary	X	X	X	Definitive
	Planning Sector		X	X	Dependent
	IT Undersecretary	X	X	X	Definitive
	Procedural Development		X		Discretionary
	Central Agency for IT	X	X	X	Definitive

Table 7.2. Stakeholder Identification and Analysis Matrix of the IT System

The Central Agency for IT is categorised as both outside agency and decision maker at this particular time of investigation. The decision was reached because the authorisation of this association was not fully configured; as it was initiated after the start of the project. I believe it should act as a decision maker in future projects.

7.1.4 Visualise the System Boundaries

Stakeholders identified from the pisoSIA matrix are mapped into the IT structure defined by the VSM (discussed in Chapter Three). This step visually defines the system boundaries. This step can be analysed at different granularities (depending on the evaluators' intuition). Taking in mind that EStaC is holistic and various phases are integrated and conducted simultaneously, Phase 3.2 (in Section 7.3.2), enables us to look at different granularities of the system under focus. Thus we can visualise at this step stakeholders at different levels of system focus. Figure7.5 shows the stakeholders of recursion Level Two and Figure 7.6 shows the stakeholders of recursion Level Zero. The reason these two levels are considered and given in Section 7.3.2.

Fig. 7.5

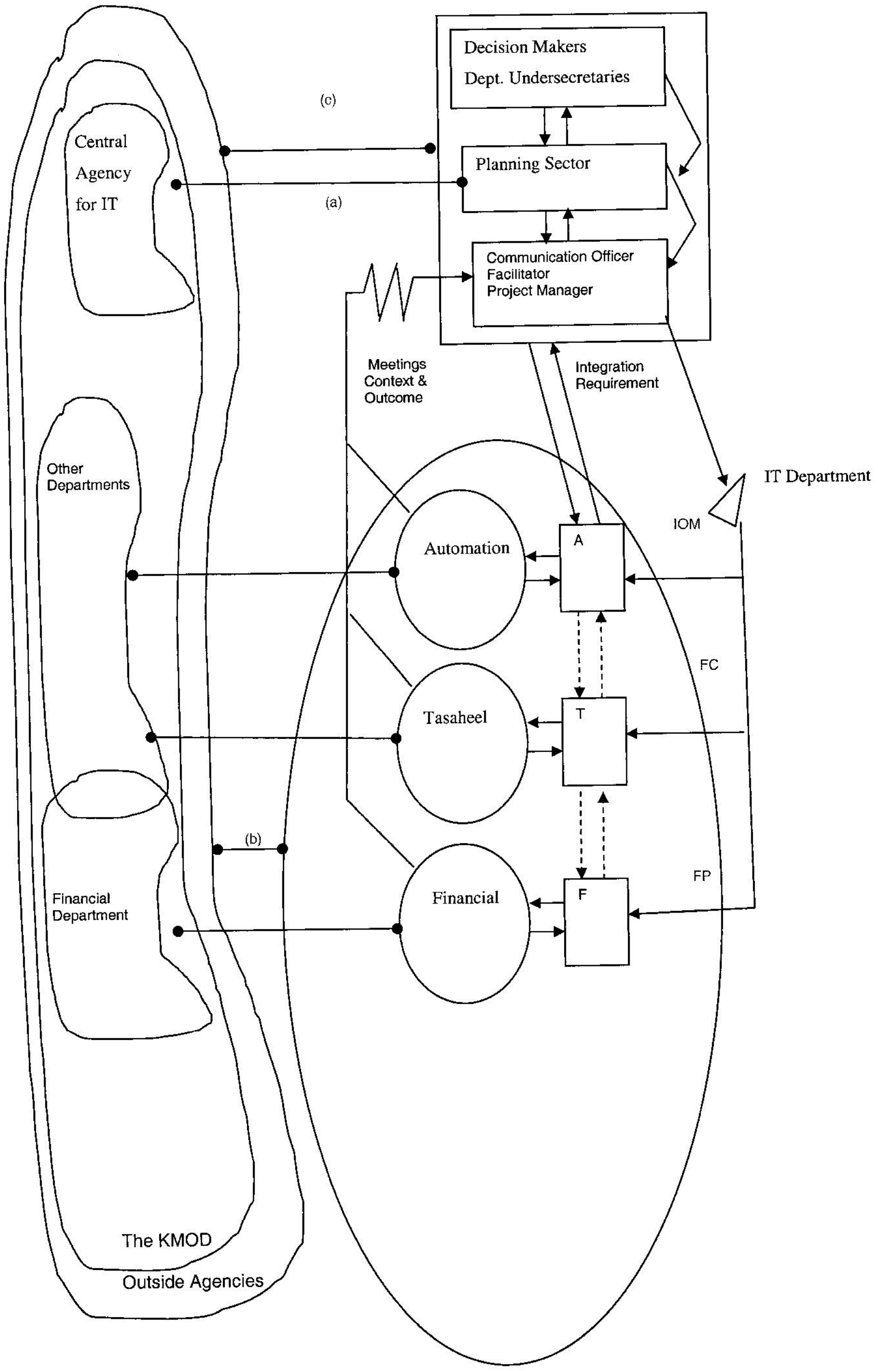


Figure 7.5. Human Boundaries Mapped to IT VSM (Recursion Level Two)

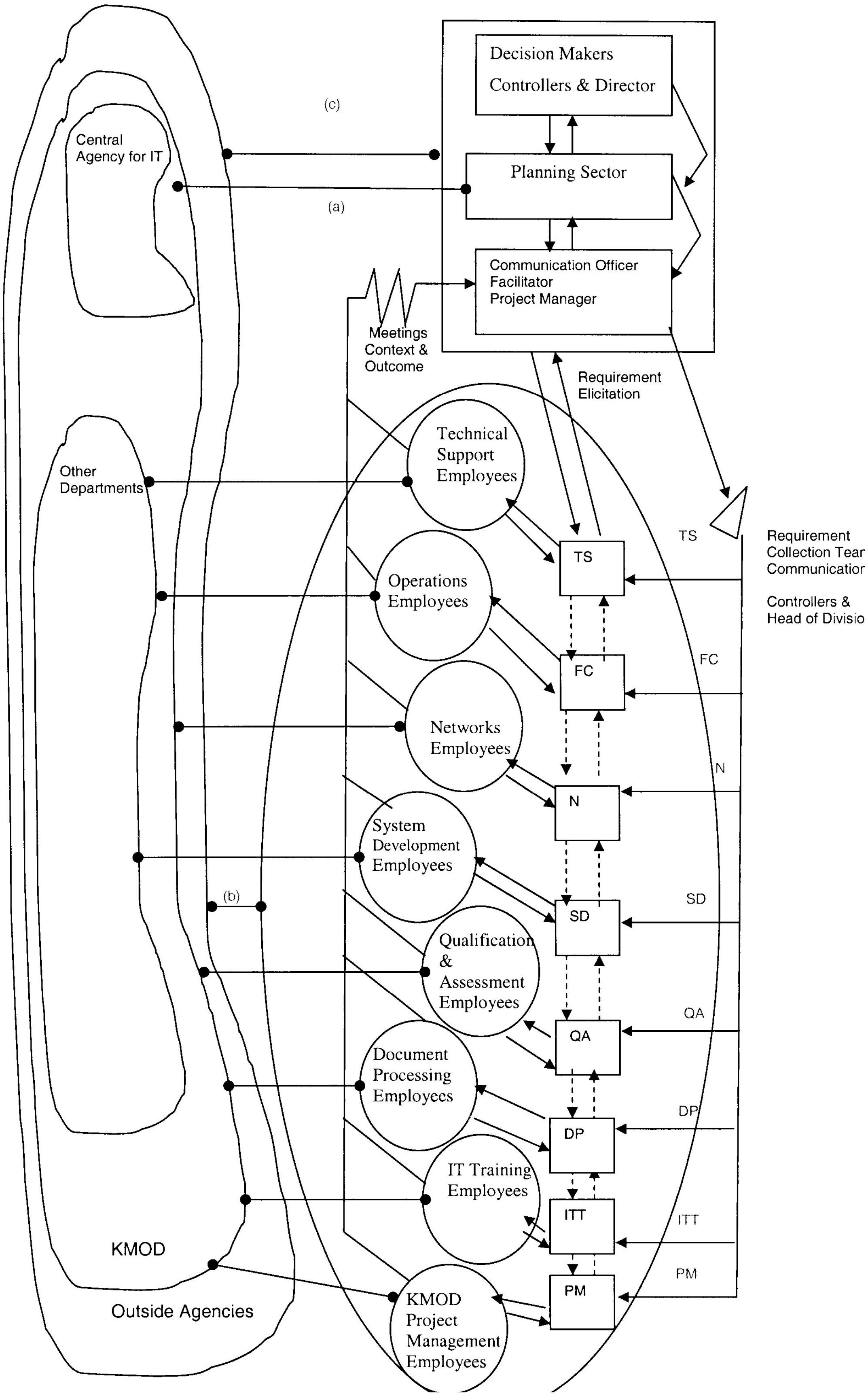


Figure 7.6. Human Boundaries Mapped to IT VSM (Recursion Level Zero)

7.2. Phase 2: Collaboration Definition

A focus group session of the stakeholders was conducted to extract important factors affecting the collaboration of the group. Two sessions were conducted separately as the stakeholders were not all free at the same time and the results were cross checked and modifications were made accordingly.

7.2.1. Define the Collaboration Constructs

In the stakeholder session, the same procedures which were performed previously within the first case study were employed. A checklist with the initial constructs [knowledge sharing, interests, roles, trust, empowerment and dialogue] was explained to them.

Knowledge Sharing: what mutual perception they share related to work?
Interests: what makes them engrossed in participation?
Roles: do they know what they are supposed to do or what they only do?
Trust: are they given assurance and certainty to any threats?
Empowerment: do they have the power to change a process?
Dialogue: are they expressing their opinions freely?

Again, the SSM concept of rich pictures shown in Figure 7.7 was used by me in association with the group discussion to visualise the collaboration process between stakeholders in their discussion of the collaboration constructs. Stakeholder categories identified using pisoSIA® were mapped, showing all related interrelationships that might be needed during the software development process making emphases on interests, potential conflict, and communication. Pictures were validated by the participating stakeholders at the end of the session. The following section analyses the issues highlighted by the use of the SSM rich pictures.

From the rich pictures in Figure 7.7, there was a clear communication problem in the project, however according to participants it was not significant and was omitted by the approach at this stage (communication gap diagnosis is inherent within the approach and is addressed in a later stage of implementation).

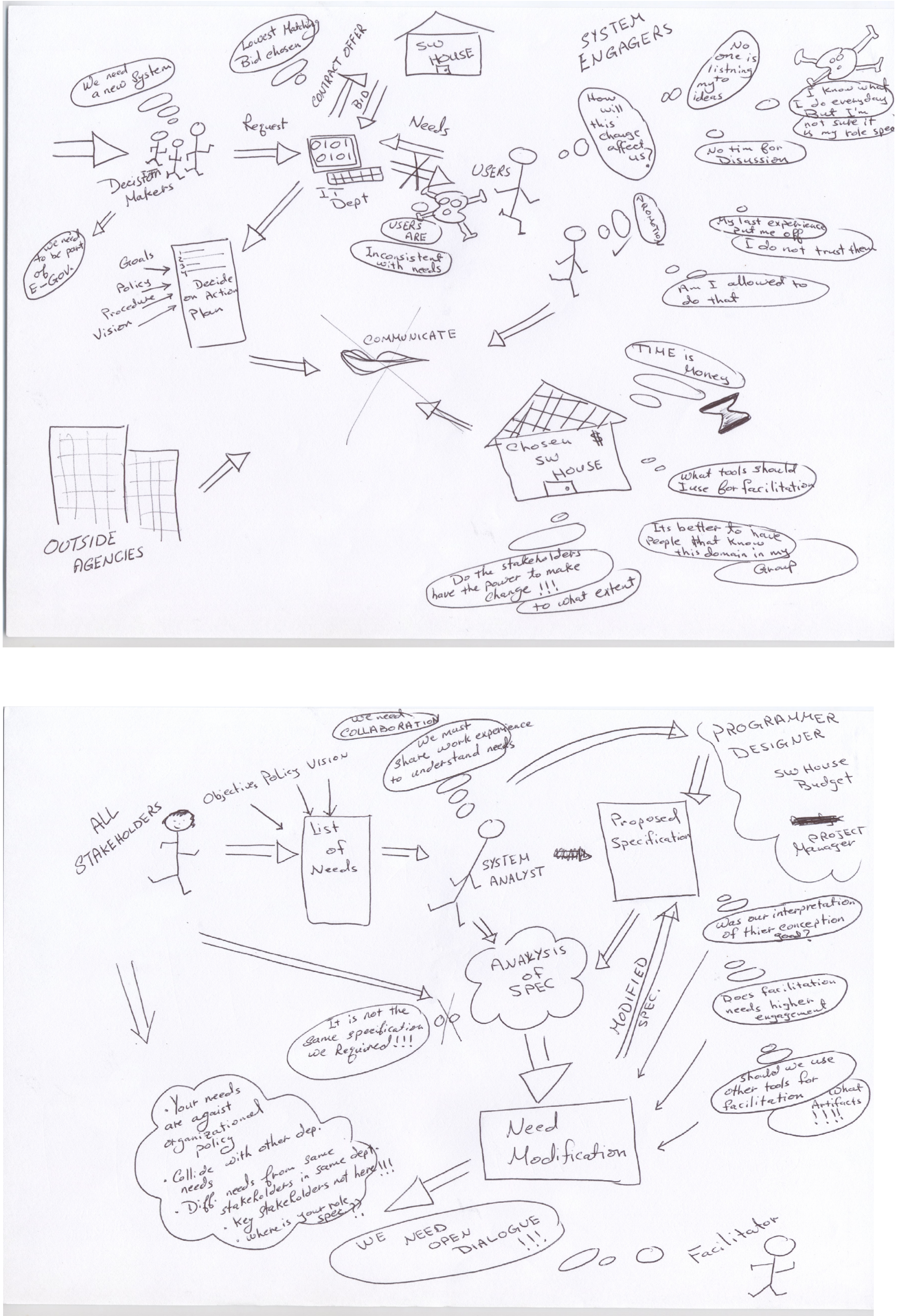


Figure 7.7. The SSM Rich Pictures for the IT Project

According to participating stakeholders correct transfer of requirements is achieved if roles in the developed project are understood.

7.2.2. Filter & Prioritise the Collaboration Constructs

At this sub phase, I recorded every construct that the group mentioned during their discussion of their potential collaboration. I ticked the construct or artifact every time a participator in the group talked about a story or incident in relevance to it. The following was obtained in Table 7.3:

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interests	✓ ✓ ✓
Roles	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Dialogue	✓ ✓ ✓ ✓ ✓ ✓
Awareness	✓ ✓
Commitment	✓

Table 7.3. Collected Collaboration Constructs for the IT System

I filtered the constructs by picking the ones that were ticked three times or more (by the rule of three that design patterns follow, these constructs are considered patterns) as shown in Table 7.4.

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interest	✓ ✓ ✓
Roles	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Dialogue	✓ ✓ ✓ ✓ ✓ ✓

Table 7.4. Filtered Collaboration Constructs for the IT System

The Constructs were rated from the highest priority to the lowest priority as follow: Knowledge Sharing, Trust, Roles, Empowerment, Interest and Dialogue.

7.2.3. Define the Collaboration Patterns

Patterns of collaboration were then associated to a context either from previous data collected through observation or by conducting new interviews. Templates were used to document the incidents [vignettes] and are attached in Appendix B. The same template used for encapsulating the collaboration patterns in Chapter Six was used.

7.3. Phase III Collaboration Complexity

From the group session of Phase II, a model was developed for the requirement collection process showing how collaboration was dynamically developed in the IT System. For ease of analysis it was partitioned into two CLD models shown in Figures 7.8 and 7.9. The models encompass the major relationships that exist between stakeholders in the specific context of the IT project. More elaboration is given in the next sub-phases.

7.3.1. Draw Inter-Relationships of Collaboration Patterns

Figures 7.8 and 7.9 consecutively show the requirement collection process, and the unfolding of collaboration, as a causal loop diagram (CLD) (that leads to requirement consensus and completeness of requirement specifications). The CLDs were collected from stakeholders involved in the IT project during the focus group sessions. The sessions involved negotiation between the stakeholders, which resulted the development of the CLD models.

Since most of the involved participants come from an IT background, they stressed including the analysis of requirements as a process to be part of the model.

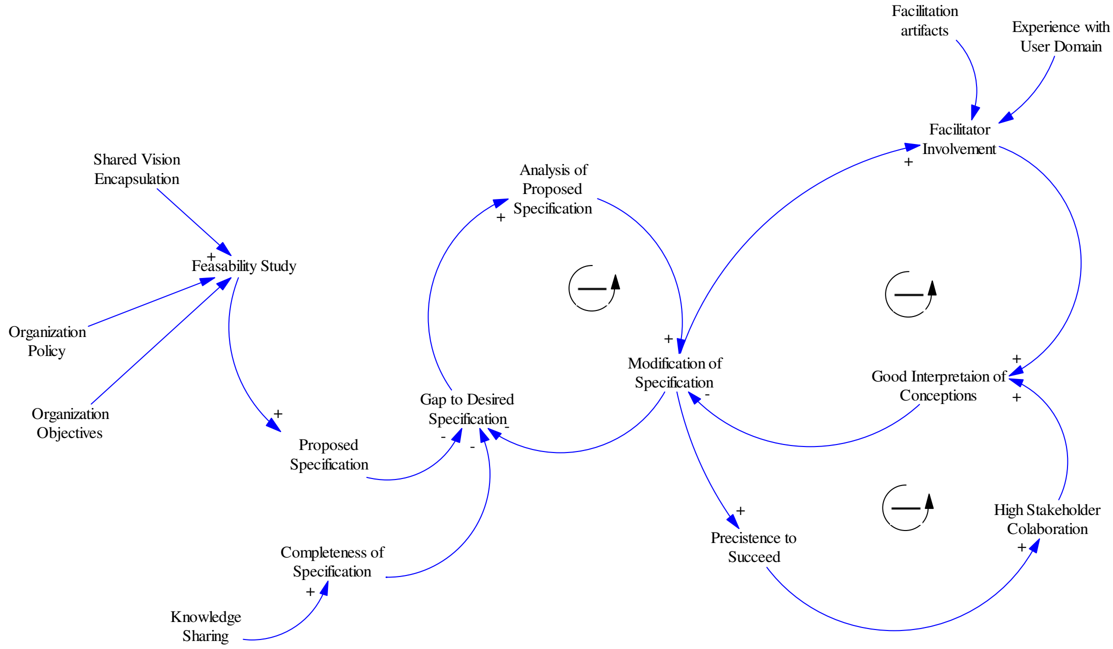


Figure 7.8. Requirement Collection from IT Stakeholders Perception

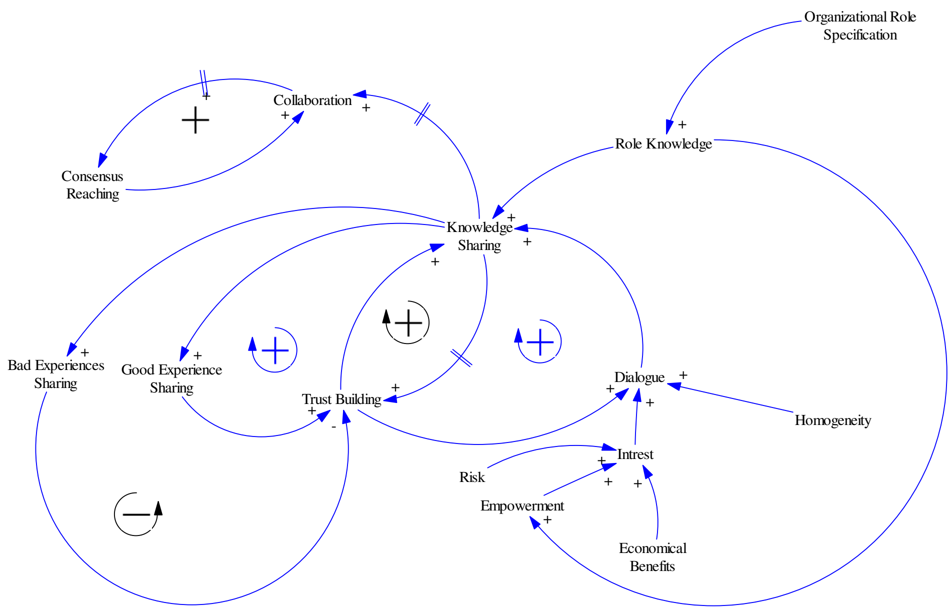


Figure 7.9. Collaboration Model of Requirement Collection Perceived by IT Stakeholders

The two models in Figures 7.8 and 7.9 can be combined to one model as in Figure 7.9 in Section 7.4.2.; however it is significant as discussed for ease of analysis to keep them separate.

7.3.2. Analyse Collaboration at Different Granularities

Collaboration could be analysed at different granularities in this phase; VSM analysis can be applied to diagnose collaboration problems at different levels. The system in focus is the IT Department in Level One recursion as shown in Figure 7.1. Specific attention should be given to one level below the system in focus, and one level above. Level Two provides a higher level of recursion; this level enables the evaluator to consider the Automation System in relevance to the other current systems in the ministry as shown in Figure 7.5. KMOD Management can be considered at this level of recursion as the internal regulator for the system as it provides services for the Automation System; however at recursion Level Zero (shown in Figure 7.6) it is considered as a main operational activity which needs services from System Two.

Taking in mind this concept of granulated analysis, findings from the previous sub-phase was integrated with the coming phase of CLD analysis in 7.4.2 in order to map the Collaboration Patterns to the VSM accordingly. More detail is given in section 7.4.3.

7.4. Phase 4: Collaboration Evaluation

7.4.1. Identify Collaboration Viability

Table 7.5 shows the IT project collaboration viability check analysis.

Signs of Viability	Analysis Results
Make sure that having stakeholders in multiple roles will not affect the system behaviour. Human resources must be deployed efficiently over the VSM structure.	*Multiple roles were assigned and resources need to be relocated in the IT project*
Missing communication channels between stakeholders will affect the viability of collaboration between them.	*Many communication links missing in the project*
Primary operations in VSM System One must be atomic, higher level interference must be minimum and not interfering with the ability given to the lower level to handle variety.	*All primary operations are atomic*
Everyday activities in System Two must be met efficiently and deployed with resources.	*System Two needs to be more effective*
Synergy and optimal performance must be achieved, System Three ensures such synergy.	*Lacking in the IT project as scheduling and communication are inefficient*
Looking at the future ensures planning for disturbances that might affect collaboration. System four is in charge of these activities.	*Lacking in the IT project*
System Five, ensures that policies are implemented according to goals identified achieves closure.	*Goals of IT automation are clearly identified*

Table 7.5. IT Collaboration Viability Checklist

7.4.2. Analyse Short and Long Term Behaviour

Major feedback loops for collaboration shown in Figure 7.8 and 7.9 are identified in the IT models, making emphasis on loops that have highly prioritised collaboration constructs. CLD behavioural analysis of the IT model shows that there are four major positive reinforcing loops of collaboration which are shown in Figure 7.10 by + sign. These are desirable and ways of boosting them should be considered. The project manager has to critically investigate short-term decisions on stakeholders' long-term collaboration performance. A good project manager needs to determine the major feedback loops that affect stakeholder collaboration and investigate ways of intervention to promote positive feedback.

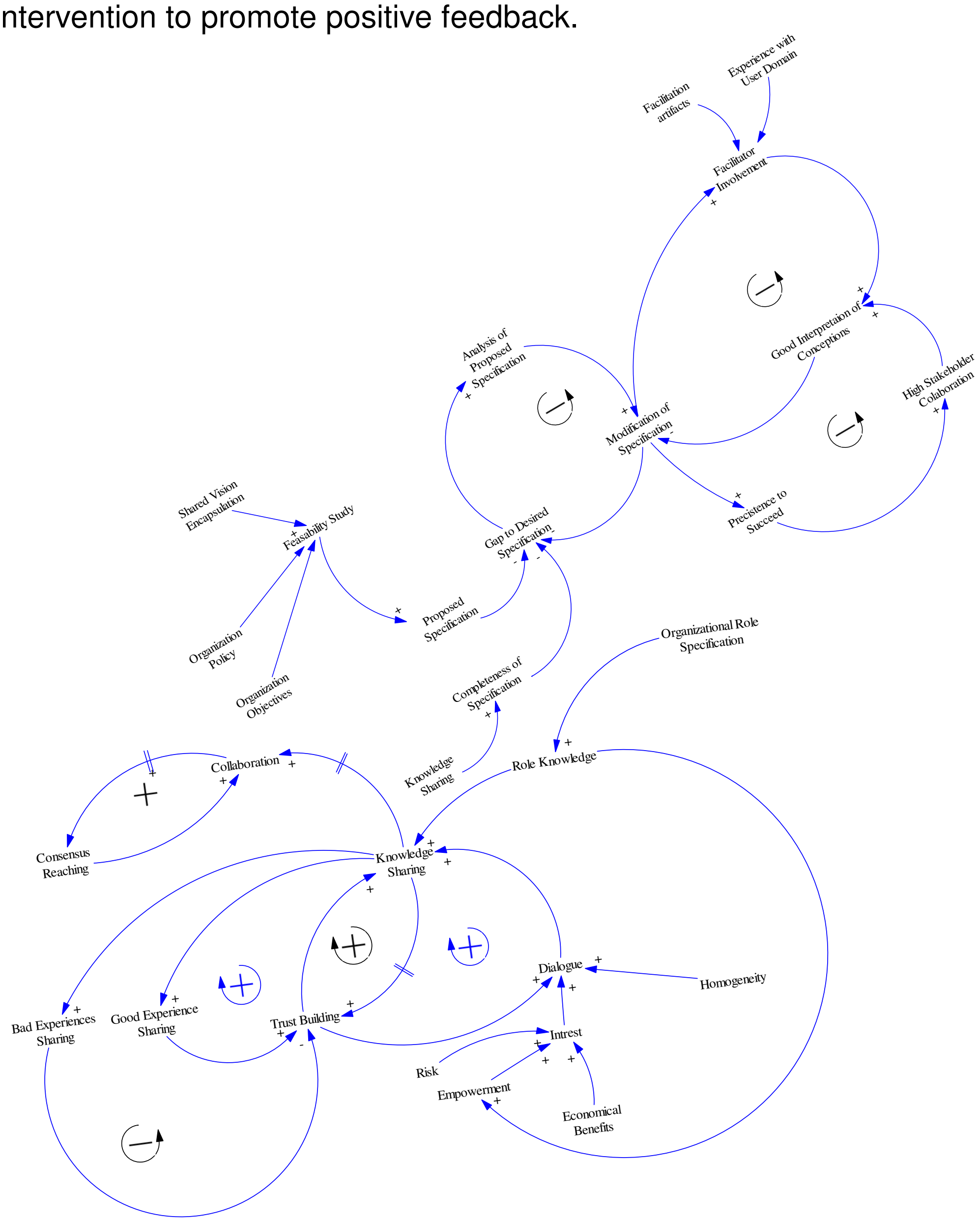


Figure 7.10. Reinforcing Loops of the IT Model

Reinforcing positive loops in the IT System in Figure 7.9 need to be considered for long term affects on the system. For example some relationships between variables in the CLD need more time to occur, such as the building of trust through the dynamic interaction of knowledge sharing. In real life it will happen over a considerable time period that could go on for months and months until good shared experiences are achieved. The same could be expressed as collaboration that will eventually lead to consensus in the requirement collection process.

The model shows that in the long term, the creation of a collaboration culture is self-preserving and that as long as each stakeholder knows his role in the project, the positive loops show that collaboration will be generated. It should be realised that one of the variables affecting knowledge sharing positively is dialogue, thus variables feeding into it need to consider for knowledge sharing, specifically if it can be triggered as a short term affect on it. There are four negative or balancing loops, which are bad shared experiences, less modifying specifications through persistence to succeed, less modifying specifications through facilitator involvement, and decreased gap of specifications through analysis. In this analysis, the objective is to encourage both positive and negative loops increasing consensus through collaboration.

Results are visualised in the next sub-phase as the collaboration patterns are mapped onto the VSM structure and affective constructs are intensified.

7.4.3. Map Collaboration Patterns

Figure 7.11 show the collaboration patterns emphasised in the CLD mapped onto the VSM of Figure 7.3. In this sub-phase the VSM acts in a design mode for promoting collaboration within stakeholders rather than a diagnostic mode. Each pattern is shown associated in the corresponding stakeholder position. For example, stakeholders known as system engagers need to increase user empowerment, promote dialogue in their sessions, investigate what interest they have in the project, increase trust between them and the analysis team, and increase their Knowledge sharing.

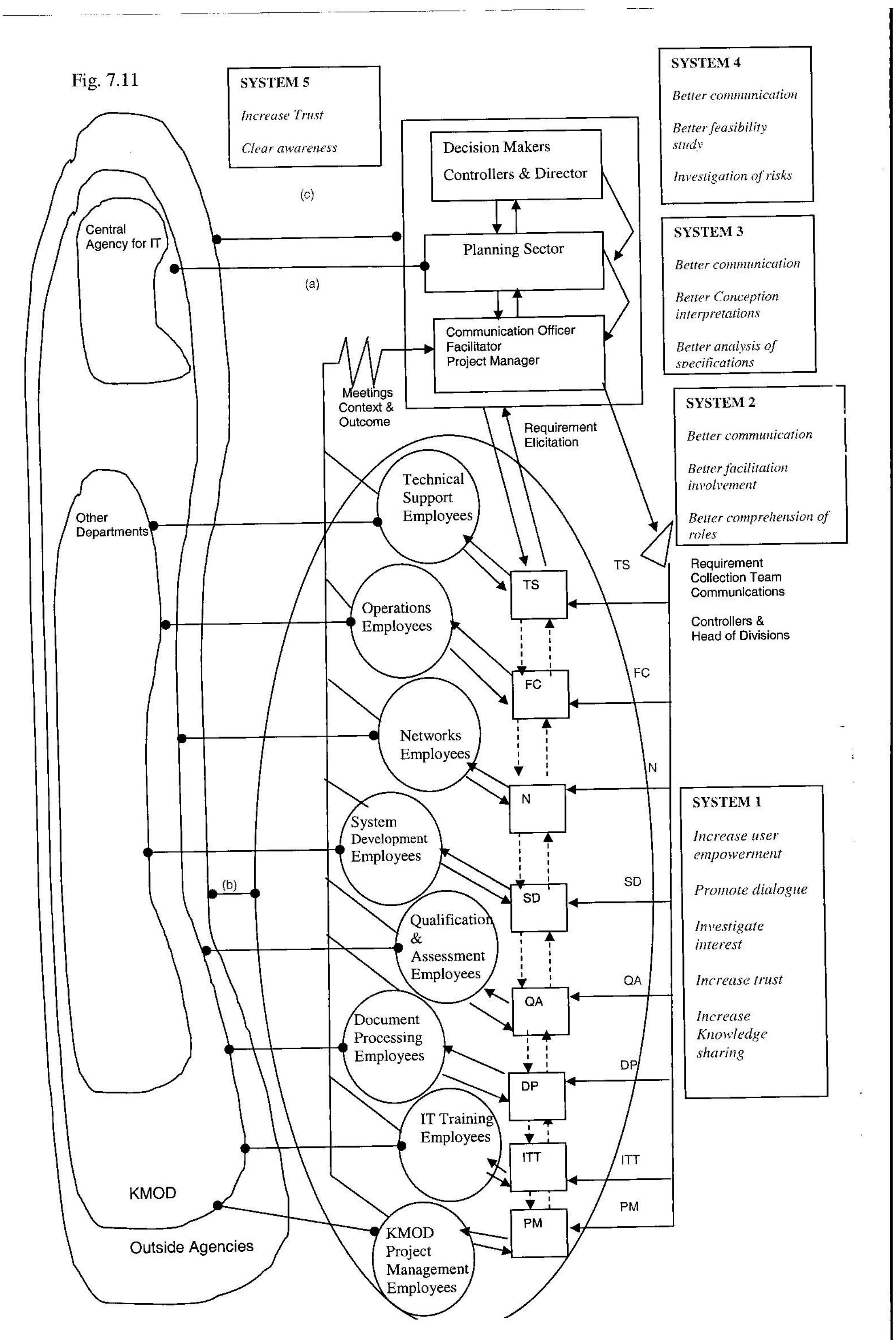


Figure 7.11. The IT Collaboration Patterns Mapped to the VSM Model

The System Two through Five are shown in Figure 7.11 with the associated constructs needed for collaboration. The evaluator needs to take notice of which level of recursion is under investigation in order to associate the proper stakeholders to the constructs.

From the cybernetic viewpoint of recursion, the problem could be investigated as discussed in section 7.3.2 at different granularities. According to the system in focus the IT Project, there are eight systems embedded in it at a lower level of recursion. They are concerned with the main operational units the IT department provides, which are: Operations, Technical Support, Networks, Document Processing, System Development, Qualification and Assessment, IT Training and KMOD Management. Each of these is a semi-autonomous unit with its own production procedures. The approach can be applied to each of them in turn. The IT System itself is embedded in a larger VSM the KMOD that involves contextual collaboration constructs as well.

7.5. Phase V: Collaboration Planning

7.5.1. Perturb Findings

A highlighted warning signal passed on from early analysis (Section 7.2.1) is the missing *"communication channels*" in the IT project and this is propagated immediately to final analysis. Other collaboration problems are diagnosed in the next sub-phase taking into account results obtained in Table 7.5.

7.5.2. Final Analysis

Resources in the project are under estimated and over exhausted. This is evidently seen in missing communication links throughout the project. It is worth noticing that this is a recurrent problem as it was a major problem in the FP case study as well. The project manager must find the resources that fill this gap either through increasing human resources or introducing new process, or artifacts that could be used to fill this gap.

Stakeholders of operational units in System One (shown as circles in Figure 7.10) need to be fueled with certain social capital to enable them to proceed collaboratively during the requirement sessions, such as empowerment, trust and knowledge sharing.

The role of facilitator was missing in the IT project, as is the role of communication officer as well. This lack of facilitation is recognised by me as an evaluator and is perceived to have a negative affect on the outcome of the project. Emphasis is shown in promoting the role of a facilitator gaining feedback from previous domain experience and the use of artifacts.

System Two calls for better services to be given prior, during and after the requirement collection sessions. Missing communication links, missing facilitation involvement and lack of role envision, call for better collaboration intervention.

An auditing system is definitely missing; this is found from preliminary interviews with IT personnel (Appendix C). A member must be appointed to audit every session of requirement collection from different aspects. Examples include spatial representation, scheduling, user participation, user readiness, and facilitation tools. Planning with insight into future disturbances needs to be incorporated into the strategic planning of the requirement phase. There seems to be no evidence of risk assessment related to sessions of requirement collection.

Integrated results obtained from the previous analysis are considered at this point. Intervention points are development from this analysis and is presented in the next section.

7.5.3. Develop Intervention Points

Intervention points and recommendations are developed at this point for a viable requirement collection process in the IT project. Results from the previous sub-phases of the approach are propagated and analysed. Considering specific details of pattern behaviour (Appendix B in combination with CLD of Figure 7.9) indicates what needs to be addressed in order to promote collaboration. This is combined with consideration results of pisoSIA matrix of Table 7.2 and the collaboration viability checklist of Table 7.5. in relation to patterns collected (in Appendix B) and meetings with analysts (in Appendix C). The following intervention points are uncovered:

- Develop definite distinctions in role specifications of the stakeholders in the project, there seems to be a blurring between them that is causing planning and implementation problems (example: *Role Knowledge Increases Empowerment* pattern vignette *1*).
- Employment of effective and sufficient staff in project. It is clear that the people involved are exhausted and overworked. Multitasking is heavily evident in all resources negatively effecting collaboration (example: meeting *P1_2_2006*).
- Immediate action must be taken to investigate missing communication links in the IT scheduling and planning within its departments (example: meeting *P1_2_2006*). There needs to be reconsideration of the activities currently adapted associated with requirement collection planning with relevant stakeholders involved in the project. Giving emphasis upon the information bottlenecks that are affecting the quality of communication.
- A strategy must be investigated to ensure proper development of an alert scheme and debriefing of meetings involving all stakeholders in the IT project (example: *Clear Awareness* pattern vignette *3*).
- Involve all stakeholder representatives, with emphasis upon interdepartmental involvement in requirement collection sessions (example: *Interests Leads to Dialogue* pattern vignette *3*).
- Involve a facilitator as part of the requirement collection session using proper facilitation skills and tools. Involve the facilitator in enabling the stakeholders to comprehend their exact roles in the project and investing in better communication skills (example: *Facilitator Involvement Effects Interpretation* pattern vignette *2*).
- Invest in pragmatic activities related to the definition of requirements for the prototype (example: *Increase Collaboration* pattern vignette *1*). Develop possible incentives that help stakeholders create effective collaboration.
- Develop a sense of empowerment by investigating the diversity of interests and promoting dialogue between relevant stakeholders at different power positions. Vision of organisational role specifications could be used to promote shared goals inspired by that vision. If invested properly, better awareness of roles will

be appreciated in increasing the shared knowledge through the user empowerment factor (example: *Role Knowledge Increases Empowerment* pattern vignette *1*).

- Develop a strategy to share good experiences with potential users. Use this strategy to build trust in order to achieve better interpretation of conceptions through increased knowledge sharing (example: *Good Shared Experience* pattern vignette *1*).
- Improve investigation of risk assessments associated with social and political issues, by looking into future disturbances that needs to be investigated relating to requirement collection. Develop contingency plans that take into account hidden issues (example: *Requirement Consensus* pattern vignette *1*).
- Develop a strategy for auditing requirement specifications, to optimise the requirement collection process of reaching consensus. Develop a more learning strategy that identifies constraints of the project and ways of adaptation (example: *Increase Collaboration* pattern vignette *3*).

Collaboration within the IT System stakeholders can be promoted through careful intervention. Intervention points developed give the means to deal with expected issues that hinder collaboration. The involvement of well aware users such as IT users did not ensure the success of requirement collection process. The approach identified such deficiencies in collaboration, even though this project was nominated by involved analysts, as a case with potential good collaboration (as presented in Chapter Five). Results of experienced perceptions comply with issues that needed intervention analysed by the approach. This specific case study gives definite implication to the importance of social issues and that the requirement collection process of software development is definitely a social problem. According to the analysis developed by the approach, two issues clearly affected smooth collaboration: missing viability signs and the complexity of non-linearity.

7.6. Conclusions

In this chapter the IT System is chosen as an example of a typical department in a public sector undergoing software development that had potential high collaboration among the stakeholders involved in the requirement collection process. The five phases of the approach was applied to evaluate the collaboration of stakeholders involved in the IT System.

A distinctive realisation from the previous analysis is that although collaboration is highly expected in this specific project, warning signals affecting collaboration negatively were realised at an early stage of analysis that propagated to the intervention points as output.

The phases in EStaC are presented in a more integrated implementation than the previous case study presented in Chapter Six. This application shows some results of phases intertwined and not in the exact order presented by the approach (as pointed out in both Chapters Four and Six); as the order is only for presentation purpose.

It is important to identify the limitations of the approach in order to get the full potential it offers. Although this approach covers more dimensions and criteria then the current practices, it also has its own limitations and need for improvement. In addition to the limitations in the conclusion section of Chapter Six, a consideration of group facilitation tools should be investigated.

EStaC as a generic approach is recognised: Results from EStaC can not be generalised at the moment. But over time a repository of collaboration patterns may be collected. This repository, if organised by the right structure, can produce a collaboration pattern language specific to the organisation. This needs to be investigated in further research.

The next chapter presents the user assessment of EStaC approach. This was developed to assess how well the EStaC approach achieved its objectives in handling the problem under focus, and how close the results are according to the perspectives of system analysts and project managers involved in both the IT and FP projects. The results which have been critically analysed are promising and are presented in detail in the next chapter.

Chapter 8

8. User Assessment of EStaC Approach

8.1. Introduction

This chapter presents a crucial aspect of evaluation of the EStaC approach. It seeks to determine whether or not the second objective stated in the case study design in Chapter Five is being achieved, which states

Critically evaluate the output of the EStaC approach against the perceived assertions of the participant stakeholders.

The objective is to explore the potential user assessment of the EStaC approach according to the following aspects:

- How close their perceived experiences in both the FP and the IT projects match the presented analysis in both Chapters Six and Seven consecutively.
- How useful it would have been if the intervention points have been made use of in the planning and throughout the requirement collection phase.
- Practitioners' acceptance of its usefulness in future SW projects for evaluating stakeholder collaboration.

This is similar to evaluation techniques conducted in areas of stakeholder collaboration research (Luna-Rayes, 2004; Flurhling, et. al, 2007), where perceived participant satisfaction is collected via questionnaires that followed workshops.

This chapter introduces the background and setting of the assessment. It then considers issues that were involved in the assessment process. This is followed by discussion and analysis of the participants' feedback. The chapter ends with a conclusion of the results of the assessment sessions.

8.2. Background and Setting

As part of the assessment of the study in the conceptual research framework (Figure 1.2), an initial intent as presented in Chapter Five, was to conduct a workshop (in the form of focus group) introducing the EStaC approach to system analysts involved in the project. A description of the EStaC approach was presented followed by an implementation of both the FP and IT case studies. Feedback was collected from the participants by the aid of a questionnaire at the end, giving time for discussions and comments collection.

As it happened, there was considerable difficulty in scheduling the date for the workshop. After several months of delay, I decided to handle that problem by conducting several sessions, some were personal one-to-one sessions followed by questionnaire.

These sessions were conducted after explaining the time limits involved in my research to higher management in the IT department of KMOD, I got approval for conducting my evaluation on the 23rd and 24th of January 2008. Analysts involved in both systems gave me their attention, but I had to fit in between their busy schedules. Which I managed to do by conducting individual sessions, groups of two, and groups of three.

8.3. Assessment Process

The assessment process was conducted over a period of two days with main participants. However not all feedback was collected at the time of the sessions.

8.3.1. Participants

The assessment sessions were focused on potential users of the *EStaC* approach, SW Project Managers, System Analysts and Facilitators involved in the KMOD System; mainly FP and IT projects. The aim was to compare their perceived experience in both the FP and the IT projects with the analysis developed by EStaC.

8.3.2. Assessment Outcomes

Following the procedures presented in Chapter Five, a questionnaire was used to assess EStaC according to specific outcomes. Outcomes were developed through the use of Goal Question Metrics technique (GQM) adapted from the Gold Practice Website (Goal-Question-Metric Approach, 2005), where questions are developed in correspondence to goals specified (Basili, Caldiera and Rombach, no date). Respondents assessed each statement in the resultant questionnaire on a scale (1 to 5); from totally disagree to totally agree. A copy of the questionnaire is provided in Appendix B.

The first outcome of assessment is to determine whether the application of EStaC fulfilled the main criteria for understanding stakeholder collaboration developed in Chapter Two, as follows:

- Depict context specific social, cultural and political issues
- Provide mechanism to comprehend complexity
- Identify relevant stakeholders
- Incorporate Non-linearity and feedback
- Incorporate different perspectives of stakeholder collaboration
- Be holistic
- Emphasise the quality of data collected

Another outcome is to compare the perceived experience of the participants with results obtained in Chapters Six and Seven of the implementation in the case studies.

From the objectives in the introduction, an outcome is also required to capture practitioners' acceptance of EStaC usefulness in future SW projects for evaluation of stakeholder collaboration. The participants' reflection of how the intervention points may have been used in promoting collaboration throughout the project was questioned.

8.3.3. Assessment Sessions

I included in the assessment sessions members of KMOD IT employees who were active participants in the project as shown in Table 8.1. It is important to state that they were involved at different stages of the requirement collection process. This called for care considering each participant's individuality in the project and therefore a qualitative perspective was adopted for results analysis.

As already mentioned in Section 8.2, the participants' busy schedules forced me to conduct several sessions for EStaC assessment shown in Table 8.1.

Day	Time	Participant
1	10:15am - 11:45am	Amer Al-Taibani
	12:00pm – 1:10pm	Loula Al-Sager Adel Al-Bader Ahmed Quragati
	1:15pm – 4:00pm	Ahmed Dokishi
2	9:15am – 11:30am	Fatma Al-Salman Boudor Al-Hirz
	11:45am – 12:30pm	Ahmed Dokishi
	12:45pm – 2:00pm	Walla'a Al-Sobaiee Loula Al-Sager

Table 8.1. Session Assessment Scheduling

The objectives of the assessment were explained clearly to the participants before the start of each session. I made it clear that their sincere view will be appreciated and that any negative feedback is an asset to the assessment; as it will feedback into improving EStaC.

According to the participants work time schedule I included as many participants in the same session as possible, as presented in Table 8.1. A description of the approach was presented followed by the results of an implementation of both the FP and IT case studies. As I progressed through the session, I used an approach attitude allowing participants to engage in a flow of conversation to stories they experienced within their involvement in the project, which revealed their appreciation of EStaC. It was interesting for me to find that this conversation provided validity to findings developed by EStaC as they related to stories of personal engagement.

The feedback was analysed individually and is presented in the next section (giving careful consideration to each participant's context in the project). Such consideration included years of experience, role, and time and duration of involvement. A quantitative evaluation of the questionnaire would not give any value to the assessment, and a viewpoint driven analysis therefore is used.

8.3.4. Assessment Sessions Analysis

Based on the perspectives of system analysts and project managers involved, the assessment of EStaC shows promising results. The remainder of this section analyses the sessions and questionnaire results.

Table 8.2 highlights some of my reflection collected over the sessions. All the participants' discussions show that the approach application using the FP and IT case studies, managed to capture their knowledge of reality for the projects.

The rest of this section focuses on the main issues revealed by the questionnaire. I would like to note that five out of the eight participants gave feedback through the questionnaires; the other three had busy schedules and were not able to fill the questionnaire however reflection is collected from their discussions during the sessions. I referred back to some participants after analysing their questionnaires to clarify specific issues.

Questionnaire feedback indicates participants mainly either agreed or totally agreed with the EStaC analysis results derived from all the different sub-processes. One participant had no opinion regarding the collaboration deficiencies captured by EStaC based on her experience. Therefore, the analysis at this point supports the claim that EStaC encapsulates perceptions of stakeholders involved in the project.

Participant	My Reflection
Amer Al-Taibani	Very interested and asked for a copy of the case study... He believes that the basic issues and problems were considered... While discussing the case studies, he agrees with all the results from a system analyst perspective working on two sides, customer and developer...
Loula Al-Sager Adel Al-Bader Ahmed Quragati	Loula was not co-operative at the beginning and was not willing to participate... After I started describing the approach she got interested and started asking questions... She gave me her feedback the next day after discussing the questions again with me.. She was particularly asking the meaning behind each question and took her time in answering... Adel had difficulty understanding the purpose of the approach... he kept relating to the database repository of the system.. It took from me a considerable amount of explaining for him to consider the social implication of the problem which he concluding appreciated... I think this goes back to his technical background... He is a controller in the technical office that was pushed into conducting analysis work due to resource shortage... Promised to give feedback in a later date... Still feedback not obtained... Ahmed Quragati understood the problem the approach evaluates immediately... He relates to the issues that the approach touches which he emphasized as the culture of the organisation... Ahmed stress on the issue of religion and faith and their relation to the success of collaboration especially to an eastern culture... Ahmed was not involved in the original development of the collaboration model... It is interesting how the model would have perceived if he was part of the model construction... Feedback from Ahmed was to be given by email...
Ahmed Dokishi	Ahmed Dokishi is a very enthusiastic person who believes in achieving good results through proper planning... He highly believes in academic work in preparation for solving real world problems... He had a total overview of the problem even though he was involved late in the project... He was assigned to the project in May 2007; three months before launches when higher management detected problems in requirements... He believes that the trust between the KMOD IT higher management and the SW house exceeded the trust between the KMOD higher management and their staff... His remark could lead to a finer grained analysis of the approach to investigate collaboration within the IT department itself, which the approach supports through the levels of recursion... The initiator to discussions of the workshop lead to an interview that lasted three hours with him, which continued the next day… Approach discussed relating issues emphasised to his perceived reality and experience... Questions were discussed and feedback was to be given through email...
Fatma Al-Salman Boudor Al-Hirz	Both thought that the VSM was eye catching and give early and fast diagnosis, which they referred to as the cell... They both related to the problems that the approach diagnoses as part of their perception... The most important intervention the approach realises according to both of them is the exhaustion of the resources... They assure me that they are performing multiple tasks affecting their throughput in the project... They both agree that the approach lays a good plan that need to be followed in an ideal situation of requirement collection...
Walla'a Al-Sobaiee	Finds the approach very interesting to apply... She thinks that it is too ideal but applicable...

Table 8.2. Session Assessment Comments

Results related to the usefulness of the intervention points were agreed upon by all the participants. The intervention points described exactly what needed to be handled for appropriate collaboration to evolve. The idea of having points identified in the early planning and throughout the requirement collection phase was appealing to the participants. They thought that this intervention process is particularly useful when dealing with complicated social settings that involve diverse types of stakeholders, such as those having different power and influence on the project development.

Results related to the usefulness of the EStaC approach as a whole was also agreed upon by all the participants. They all thought that the use of the approach both in the planning phase of requirement collection and throughout the requirement collection process would present useful outcomes for the development process.

Results related to using the EStaC approach in future software development projects are encouraging. All participants responded positively except one who gave a neutral response. I was particularly interested in this specific participant, and consider his feedback very crucial because it reflects the experience of both the developer and the client. Engineer Amer Al-Taibani (with 18 years of experience as a system analyst) held two roles in the KMOD system project. Since the beginning of the project in February 2006 he was a manager and senior analyst working for the developer NCS. Latterly he became a consultant in KMOD and by the time of the session January 2008 he is now two month into the project as a consultant and project manager working with KMOD. He has faced many problems and difficulties in the KMOD project and is a good representative of who captures the perception of the system analysts involved in the field. When questioned about his reluctance in using EStaC in future projects, he focused on how easy it is to use and how much training needed. This has implications for usability issues; however these are outside the scope of this study and should be addressed in future investigations. His comments of "*well covering most of the issues*" in reference to his feedback in the questionnaire revealed that EStaC is promising in getting a better understanding of the problem. Also, at the end of the session he asked for a copy EStaC and its implementation using the case studies, this showed me that there is sincere interest in it.

Loula Al-Sager felt that collaboration is not complex and is easy to achieve. When questioned about what she meant (after analysing her feedback), she revealed that she thinks when everyone puts the effort and intervention is utilised collaboration is easy to achieve. Her responses to the other questions shared an appreciation of EStaC and the results it unravels. Therefore, I felt that I had to probe what she actually meant by that answer. Her reply shows that, she considers achieving collaboration not a complicated task *if it is planned for appropriately, and proper tools are used.*

There is a definite overlap in the intervention points evolving from the application of EStaC to both the FP and IT case studies. This overlap shows the capability of EStaC in identifying inherent properties which is a collaboration deficiency pattern through out the KMOD project; however, application of EStaC to other cases in the project would need to be investigated to certain this claim. The EStaC results are context specific, yet, use of EStaC in other cases in the project and if a repetition of the results are obtained, then a pattern of collaboration deficiency is generalised on the organisation level.

Finally, the feedback process from the questionnaire comments section generated interesting comments and suggestions that EStaC would benefit from. These comments were collected from the questionnaires returned from the participants. Table 8.3 presents these individual comments with my reflection. Some of the comments will be considered for future work to enhance EStaC.

Participant Comment	My Reflection
Implication of each individual definition of collaboration constructs should be more emphasised by the approach.	Although SSM session allows such discussions, it was thought that more structured incorporation of these definitions should be brought to the model. I think that this would systematically evolve over time as a corpus of constructs is collected. Future research could be investigated in attaching predefined constructs as part of EStaC.
Organisational culture and individual culture should be fixed inputs to the model.	Imposing specific constructs destroys the uniqueness of EStaC. Diversity of people involved in the project will produce a unique blend each time the approach is used reflecting upon the context of time and space, which is the specific reason that this process has been left flexible as not to impose any presumptions to the participators. Over time, specific patterns of collaboration will distinctively be repeated and could be generalised.
Facilitator tools should be appointed to the model, It is important to associate the type of tools with the collaborative interaction.	I did not include any reference to specific types of tools; however I did mention that artefacts promoting facilitation should be considered in the intervention points. If a general agreement is brought forward an additional model could be produced that critically analyses each facilitation tool.
The approach should involve an IT specialist stakeholder to be involved from each department.	I believe that the culture of the organisation could be targeted to achieve such a request. EStaC can achieve that, if the stakeholders involved in the definition process call for such demands, or could be embedded in the collaboration pattern definition process. I agree that such involvement decreases the trust gap and will promote collaboration.

Table 8.3. EStaC User Assessment Feedback Comments

8.4. Conclusion

This chapter presented the results of the last part of a multi-part strategy to evaluate the analysis produced by EStaC developed from the KMOD data. This strategy was conducted on EStaC as follow:

- Theoretically comply with criteria developed in Section 2.4.
- Results obtained from practical implementation in Chapters Six and Seven are: logical, cohesive, structurally coupled, consistent and thus are abductively reasonable.
- Results in this chapter comply with user perception.

- Results in this chapter empirically comply with criteria developed in Section 2.4.

The work in this chapter was based on feedback of system analysts and project managers that served throughout the IT and FP projects. The focus was to collect data concerning their perceived experience of collaboration and its correspondence with the analysed data. Their reflection on how useful the data might be in application was also under question. Finally, an assumption of the likelihood of using EStaC in future projects was considered, and data collected relating to its potential use.

The results show high correspondence of the results produced by EStaC with both the participant's FP and IT experiences. The perceived experience of these participants matched the analysis developed from EStaC application. This contribution provides a measure of value of the approach.

The following chapter concludes the work presented in this thesis, focusing on future work derived from limitations reflected in this study.

Chapter 9

9. Summary and Conclusions

9.1. Introduction

This chapter presents a summary of the work carried out through the process of this thesis development. The aim of this final chapter is to encapsulate the different threads of the thesis in a conclusive summary. It seeks to satisfy that aim by starting with a summary of the work carried out in this research. It then presents a critical review of what has been developed, emphasising the novel characteristics of the work. Recommendations for future work are then discussed in the fourth section by considering two issues: First, the limitations of the study carried out. Second, other research studies in current position that could support future work. The chapter concludes with some final remarks.

9.2. Developed Work

This thesis has presented an approach for evaluating stakeholder collaboration within requirement collection of software, EStaC, which have been applied to the crucial phase of requirements collection. It supports the collaborative process that stakeholders need to engage in, to help develop the requirement specification.

The objective was to provide a synthesised approach from multiple methods and methodologies for capturing the stakeholders' perspectives of their collaboration process during software requirement collection, and to use this approach as the basis for evaluating their collaboration throughout their requirement collection process.

The thesis presented addresses the research question

> *Can a suitable approach be developed to evaluate the collaboration of stakeholders involved in the requirement collection of software development?*

The literature review in Chapter Two showed that collaboration is not exactly and absolutely defined, as there is no general theory for collaboration. However, I believed that its nature could be agreed upon in a specific context, and fourth generation evaluation principles used for evaluation. Therefore, an approach could be developed if the definition of what needed to be evaluated –collaboration- was encapsulated from the following perspectives:

- Context specific
- Multi-perspective

The nature of the problem needed to be incorporated in the development of the approach, thus, it was important that the approach be able to handle the following issues:

- Synthesise social, cultural and political issues
- Provide mechanism to comprehend complexity
- Identify relevant stakeholders
- Incorporate Non-linearity and feedback
- Incorporate different perspectives from identified stakeholder
- Be Holistic
- Emphasise the quality of data collected

It was important for the approach to satisfy these criteria to validate what can be called the success criteria of evaluating collaboration of stakeholders in the context of software requirement collection (discussed in Chapter Two), and thus answer the research question. The case studies were important to provide closure in presenting practical evaluation of EStaC.

The main ideas are founded on fundamentals from collaboration, systems and stakeholder theories. An approach that uses an integration of methods and methodologies was developed; the aim was capturing the stakeholders' perspectives of their collaboration process, during software requirement collection.

The approach then used their perspectives as the basis of defining what needs to be considered for evaluating their collaboration throughout their requirement collection process.

The first thing to be determined was what the factors and constructs are that make up collaboration. It was noted that there is no general theory of collaboration. Research in the area shows theories developed from specific context and could not be generalised. The literature review therefore showed that a gap existed.

Stafford Beer's VSM was used as a blueprint to map collaboration as a social concept based on constructs that shape and promote it. The constructs are encapsulated through a series of systems activities that started with brainstorming sessions making use of SSM rich pictures. The sessions engaged representatives identified through the specific use of pisoSIA as a stakeholder analysis method. The importance of social perspective of collaboration constructs was discussed and highlighted throughout the sessions. Design Patterns were then used to ground the perceived constructs to stories and experiences in the field, the goal was to draw on vignettes of realities. Causality was then established through group discussions that involved mental perceptions, leading to causal loop diagrams of the collaboration process.

From a cybernetic perspective, the social constructs of collaboration were diagnosed for deficiencies. Analysis of the causality of the interrelated collaboration constructs was integrated with VSM analysis. A key outcome of the EStaC approach is the intervention points developed from the integration of the analysis.

It was important that analysis drawn from EStaC provided results that complied with participant experiences as well as being abductively reasonable (as discussed in Chapter Eight). Results need to be:

- Logical
- Coherent
- Structurally coupled
- Consistent

- Necessary and sufficient (Eltemsahi, 2000)

Case studies were then used to show the practical validation of the approach. Results satisfy the evaluation criteria and thus, EStaC can be considered an original contribution to both stakeholder and software development realms.

In this thesis, the overall work carried out satisfied the five objectives presented below:

1. Research current philosophies and methodologies in stakeholder theory, collaboration theory and systems theory.
2. Develop criteria to evaluate stakeholder collaboration based on these philosophies and methodologies.
3. Critically evaluate and analyse the current methodologies of stakeholder collaboration in reference to criteria developed.
4. Develop a new collaboration evaluation approach that satisfies criteria developed.
5. Evaluate the new approach developed: from the aspect of satisfying systemic criteria supported by the use of a case study.

9.3. Novel Characteristics

This thesis has been particularly concerned with how stakeholder social constructs should influence the design of stakeholder collaboration evaluation and how the need to involve different perspectives from relevant stakeholders affects the overall evaluation. The ultimate objective of this study was to extend the requirement collection planning process to better understand the process of developing the requirement documentation.

The work in this thesis presents a novel contribution to requirement elicitation by introducing a specific approach for planning the collaborative involvement of stakeholders. The EStaC approach involves the strategy of evaluating stakeholders in terms of their collaborative behaviour in the early stages of planning for requirement collection. This evaluation can also be conducted by applying EStaC at different phases in the process. The EStaC approach contributes to the development of two modes of analysis, the design and diagnosis, both of which involve using the principles of the VSM.

The novelty and value of this work is specifically considered with the development of the EStaC approach for stakeholder collaboration evaluation within the requirement collection of software that focuses on the social act of interaction by applying systemic strategies and cybernetically driven principles.

9.4. Future Work

This work has revealed the important role that effective collaboration can play in supporting the overall process of software development. Thus, stakeholder collaboration should be supported and used to achieve an improved requirement collection process and to support the overall software development process.

EStaC opens various possibilities for future development and improvement. Realisation of the limitations raised in the thesis has raised several interesting areas for future research, which are discussed below.

9.4.1. Tool Support

EStaC approach uses analysis methods developed manually and structured using standard off the shelf products such as MS word and Vensim. Specialist tools could be utilised to help facilitate the structuring and analysis of the work carried out by the approach to diagnose problems, suggesting intervention points.

The VSM can be considered a flexible blueprint that can be modified and extended. Each phase in the approach can be developed to give automatic responses and mapped onto the VSM. Stakeholder identification could be automated to produce tabulated results, collaboration constructs could be associated with the stakeholders and a relational generation of causality could possibly be obtained.

The suggested table of checking collaboration viability signs can be used in developing options of good collaboration integrated with VSM analysis; this process allows the development of the intervention points.

Developing an automated archive repository for the collaboration patterns would also be helpful. This repository could be linked to all the projects in an organisation in order to ground collaboration constructs to real experiences. This process would allow efficient reusability.

The systemic structure developed by EStaC is simple, but it is not easy to trace by a novice evaluator with no systemic skills. Therefore, a tool can effectively facilitate the use of the EStaC approach by integrating and mapping the phases.

9.4.2. Patterns: Linking CLD to the Fieldwork

There is scope for taking part of the approach to contribute to the system dynamic realm. To my knowledge there is no structured tool that offers to link a causal loop diagram to collected data in a systematic way. If the CLD is big and complicated, the model may be confusing to understand, and hence, validation will be very complicated and difficult to follow.

Patterns have been used as rapid ethnographic documentation templates in this research to link causal loop diagrams to the fieldwork, providing a systematic mapping. In this approach, they worked as data collection, analysis and validation tools as well as being part of the approach description. This allowed the data collection, analysis and validation to be done during observation.

Design Patterns have been used to link rapid ethnographic findings to the fieldwork; they have also been used successfully by software designers. For example, they were used as templates to capture ethnographic instances in rapid ethnography by Lancaster University. I believe that their experience could be transferred to the field of model building, as I find their application useful in this research. The reason I say this is because in system dynamics the researcher has to find "*archetypes*" (Burchill and Kim, 1993) that describe the system (which are patterns of system structure or behaviour that recur). The pattern template can be used to store these archetypes in a systematic manner. A collection of related patterns are called a pattern language which I think is parallel in properties to archetype systems. The archetype systems are a set of generic structure interconnected and reinforced by feedback and delays. A "pattern language" shares "archetype systems" the characteristic property of being generic, recursive and interconnected.

System dynamics lacks a structured way to relate inter-relationships to the field work. This is especially important as a validation procedure for big and very complicated inter-related relationships. System dynamics could benefit from such a structured process which should be investigated further in future research. The significance of looking into a structured way of linking conceptual models to qualitative data is found in similar studies as in the attempt of linking rich scenario maps to causal influence diagrams to running simulation models (Howick Ackermann and Andersen, 2006); this adds qualitative value to model building by linking event thinking to formal structural thinking.

There is a need for a focused examination to investigate further the potential possibilities of this relation in a more academic scenario. If this could be presented in some way, a sense of structure and control could be introduced to model building which is currently lacking in the field of system dynamics.

A Design Pattern Language emphasises the importance of structure in a pattern language. This approach could benefit in the future from further research in the realm of enforcing structure and balance on design pattern languages, as soundly developed by other fields such as e-learning design patterns. An investigation of the effect of using CLD creation concepts in drawing the pattern language might uncover beneficial results.

9.4.3. Integrating Stakeholder Personality Analysis to the Approach

EStaC could benefit from research into facilitator choice and stakeholder representatives. Participants' commented in their feedback that guidance in the choice of facilitator and other stakeholder group representatives is lacking. I recognise that this is an area not considered within the scope of this thesis. The EStaC approach as developed currently has no guidelines on how to choose such representatives; future research is needed to gain focused understanding of characteristics of personalities and how they relate to their positions within the requirement collection process, in achieving affective viable collaboration.

Specific collaboration patterns encapsulated (Appendix B) indicates that there is a need to focus on developing stakeholder representatives' guidelines based on specific personality characteristics. These characteristics need to reflect collaborative constructs based on personality characteristics as well as cultural characteristics of the organisation. This could be accomplished through using similar work conducted on XP teams to associate the personality characteristics in a software development team (Young et al., 2005).

Another significant way of associating stakeholder groups is through the concept of personas (Blomquist and Arvola, 2002; Pruitt and Grudin, 2003; Wolstenholme, 2004), which was in the initial proposal of this research, but was removed after considering the time limitations. Personas of stakeholders could be developed and associated to the four groups in the pisoSIA matrix. Stakeholder groups could be investigated further trying to match them with personas that will support the promotion of the specific collaboration constructs identified by the approach.

9.4.4. Generalisation and Standardisation

A limitation that needs to be considered in this research is the transferability of collaboration assumptions to other requirement collection collaboration experiences under evaluation in the same project or in other projects. As mentioned earlier, EStaC is a subjective evaluation approach that is relative to the participants' perception and viewpoints; no exact measurement is used as no exact measurement can exist due to the soft and complicated nature of the problem. Results from the EStaC approach are influenced by the perceptions of the stakeholders involved. Therefore, it is difficult to identify specific collaboration assumptions that are generalised over the organisation.

However, I believe a relative generalisation could be achieved over a long time span. Since, if collaboration evaluation is conducted regularly, a sense of organisational collaboration culture could be captured. This could be developed by looking for recurrent patterns of collaboration, which could be relatively generalised over time (that produces a mechanism for conducting inductive testing, leading to deductive inference and therefore generalisation). However, total generalisations is beyond the scope of any research, according to reasoning of Solomons (2007), relating to Bhaskar's critical realism. Bhaskar reasons that any amount of testing could never capture true reality, because experience alone could not give an individual the ability to realise everything that is conceivable; indicating to an existence of a greater reality known as the "*intransitive dimension*". That is why Solomon turns to the law of requisite variety (addressed in Chapter Three) and uses it to test whether the developed variety of the work conducted produces useful variety to absorb the problem under investigation. Relating this sense to the work of this thesis, this direction to usefulness is achieved in Chapter Eight, feedback from participant's show that EStaC is found useful in the context of software requirement collection.

9.4.5. Quantification

Quantification of the EStaC approach could be investigated in future research, developing a corpus of definitions for soft factors (collaboration constructs) and relating them to mathematical equations. This corpus can be added to a later version of the EStaC approach, extending it to include a quantitative analysis that could be used to further investigate what-if scenarios using system dynamics software. However, this quantification process needs careful attention, a good understanding of measurement rules. Misinterpretation of the quantification process may lead to wrong results (Ossimitz, 2002). Poorly quantified qualitative data will result a model that is less significant than a qualitative model (Coyle 2001).

9.4.6. Usability

As this thesis involved an exploratory investigation, usability was not an issue considered. Further research needs to be conducted on usability issues of the EStaC approach. From my practical experience in implementing this approach, I faced some obstacles and the most frustrating was organising group meetings. Focus groups were difficult to organise in a live organisation; I had no direct authority over the stakeholders involved which made the participators less committed to attending. Several reschedulings resulted in a delay in implementation from my part. However I believe if it is originally part of the planning strategy of a software development project and conducted by evaluators in the IT staff, stakeholders will be more committed.

Although EStaC does not provide explicit guidelines for group facilitation, the use of the systems tools (such as rich pictures and CLD) and the steering of the group sessions depends entirely on the experience of the evaluator. From my experience in this study, they aided the facilitation process in the case study group sessions of Chapters Six & Seven, as well as being part of the EStaC phase. An addition of rules and guidelines for the group facilitation process would be beneficial, as it was a limitation indicated by the user assessment of EStaC in Chapter Eight. Such an addition could include motivation techniques and an adaptive use of cognitive stopping rules (Pitts and Browne, 2004).

Also there are no indications to when and at what level to end the evaluation process. This also depends on the evaluator’s experience, intuition and self-awareness. The use of EStaC requires experience in systems and cybernetic evaluation methods. The evaluator’s knowledge of requisite variety enables him/her to be in control of the process by adapting to situational context. However, guidelines in the form of a checklist could be developed; comparing results to predefined goals of collaboration. The checklist could be introduced at several levels of recursion and would provide a useful guide to when to end the process.

There is also a need for others to use the EStaC approach. In this research, the EStaC approach was only used by me. Further investigation needs to analyse the reflection of others that use the approach, the focus being to assess its usability in the real world. There is a need to identify how accessible they think the approach use is, how useful and how long it takes them to perform.

9.5. Final Remarks

The work in this study is based on the realisation that requirement collection is a social process of collaboration that is influenced by unlimited cultural and political constructs. The focus has been on how such collaboration is evaluated effectively.

Unlike other collaboration evaluation methods, where the criteria of evaluation are predefined, this work contributes towards methods that support the Fourth Generation of Evaluation, which allows the people under evaluation to engage in the criteria development process This contribution is multidisciplinary in nature based on combining cybernetic principles to manage social variable (collaboration constructs). This multidisciplinary nature has pragmatic influences upon many realms which leads to direct contribution to the area of social software engineering, stakeholder analysis and social collaboration.

This thesis has developed EStaC as a new approach for evaluating the collaboration of stakeholders within requirement collection of a software development environment. In order to do this, I first identified a gap in the literature which suggested that there was a need for a new approach. I gained confidence on the important of the issue through the engagement of fieldwork. This was refined by a critical review of current methodologies and approaches using criteria established for evaluation purpose. The EStaC approach was then evaluated to whether it is a useful addition to the field of requirement collection by using two case studies. Based on my analysis, and experience gained through this thesis work, I have learned that stakeholder collaboration during requirement collection has a direct effect on the success of the requirement collection process, and that it is the responsibility of the project manager to ensure the viability of such collaboration. To ensure collaboration, we have to deal with collaboration as a social system, which has components, and that in order to understand the system, an understanding of the components' relations is needed. Both understanding collaboration as a system and finding means to evaluate it is a challenging and complicated goal to achieve, therefore, applying systems methods within the approach developed was significant and highly appropriate.

The developed EStaC approach provides stakeholder collaboration evaluation based on the structure and visualisation of the collaborative nature evolving between them. This type of further understanding of the collaboration process (from its social nature) has been called for but not supported to be incorporated, by previous approaches in requirement engineering methods. Most, if not all, approaches of requirement collection have stakeholders as collaborators; therefore, the requirement collection process should support this new direction of evaluating their collaboration, and providing context specific intervention points that ensure viable collaboration.

This thesis has addressed this overlooked area by offering a generic approach to support a better understanding of a *collaborative requirement collection process*.

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APPENDICES

Appendix A	Models and Methods Help Material Used
Appendix B	Case Study Research and Design
Appendix C	Foundation Research
Appendix D	Case Study I Material
Appendix E	Case Study II Material
Appendix F	Publication

Appendix A

Models and Methods Help Material Used

A1. Piso Stakeholder Identification and Analysis (pisoSIA)

A1.1. pisoSIA Framework

A1.2. pisoSIA Course Material Instructions

A2. System Dynamics

A2.1. Causal Loop Diagram Guidelines

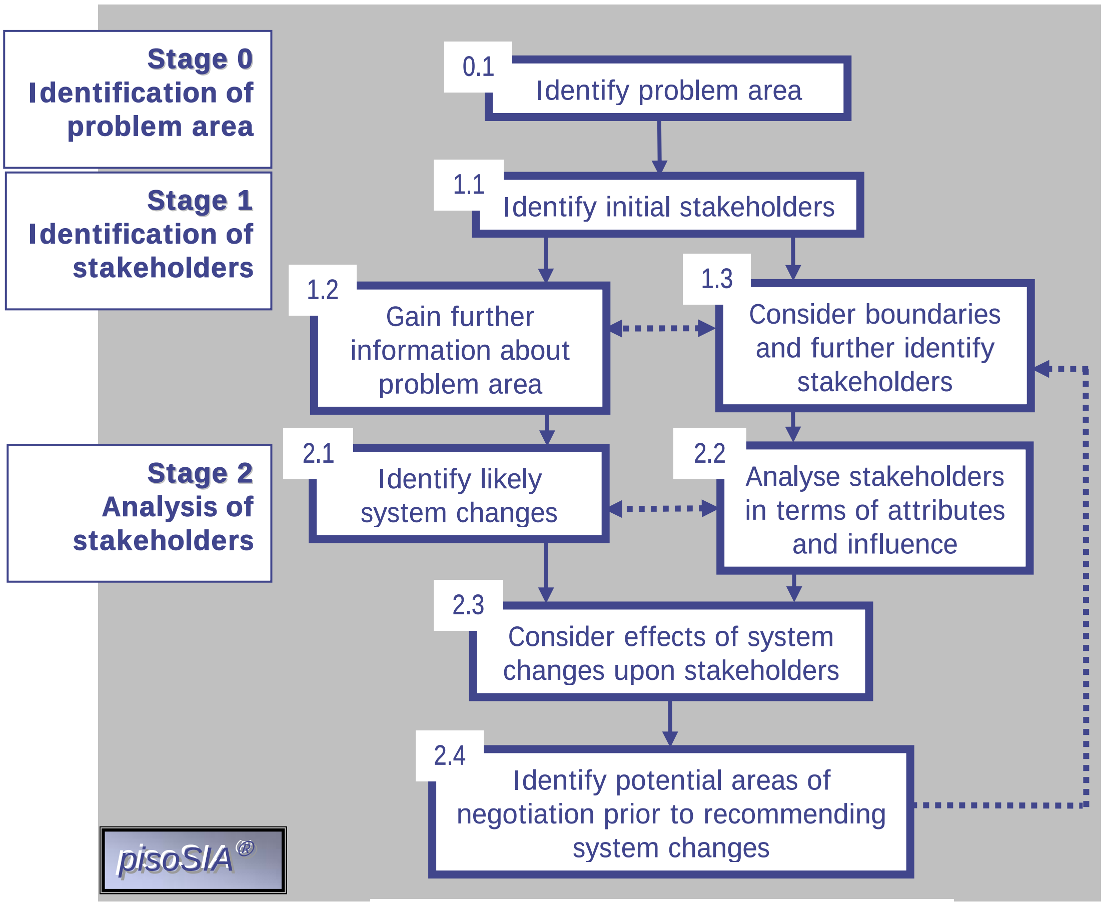
A3. Pattern Language

A3.1. Example of an Original Alexandrian Pattern

A3.2. Example of a Descriptive Pattern

A1.1. pisoSIA Framework. Source: Davison, J. (2006). *Stakeholder Identification an Analysis as an Enhancement to PISO® (Process Improvement for Strategic Objectives).* PhD Thesis. The University of Sunderland.

The pisoSIA framework



A1.2. pisoSIA Course Material Instructions. Source: Davison, J. (2006). *Stakeholder Identification an Analysis as an Enhancement to PISO® (Process Improvement for Strategic Objectives).* PhD Thesis. The University of Sunderland.

Guidance Notes for the Identification and Analysis of Project Stakeholders

[For Use With the PISO® (Process Improvement for Strategic Objectives) Method]

Jean Davison

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How to do a Stakeholder Identification and Analysis

This Stakeholder Identification and Analysis technique was developed to enhance the PISO (Process Improvement for Strategic Objectives) method. Appendix 1 shows the PISO framework and where stakeholder identification and analysis will occur within the method.

To produce a useful stakeholder identification and analysis the following areas should be covered.

- Identification of all potential stakeholders to the project or system redesign utilising the Stakeholder Boundary Guide on page 5.
- Consideration of the relative priority and interests of stakeholders within the project utilising the attributes of Power, Legitimacy and Urgency shown in the "Quick Assessment of Power, Legitimacy and Urgency" and the stakeholder influences section on pages 7 to 10.
- Consideration of the likely effects of the proposed system changes on the relevant stakeholders utilising resistance to change factors, as proposed by Mullins (1999) on page 11.

Identifying the stakeholders

Identify and list all potential stakeholders to the project, from your knowledge of the area being improved and by talking to 'known' stakeholders (those working within the area of improvement). During Stage 2, step 2.1 (Information Gathering) more stakeholders will emerge and should be added to the list. Additionally, once the first physical data flow diagram is produced further missed stakeholders could also appear. It is important to note that some stakeholders who are relevant to the project will not be apparent within the system. Please see the Stakeholder Boundary Guide (p.4) to help with identification.

The stakeholders are divided into three categories: *direct*, *interface* and *indirect*.

The ***Direct*** category consists of the **system engagers**; those directly affected by the project, who have the most impact on and interest in the project. They carry out a process, are served by a process or serve a process. This group normally resides within the *system* being improved or are directly affected by it or have a direct effect on it.

The ***Interface*** category is seen as the group that forms the link between the direct and indirect stakeholders. They consist of the **facilitators**, who are responsible for aiding the system development and negotiating with other stakeholder groups. They will be guiding the PISO methodology and may have been gathered together as a result of the project. This category will in effect facilitate the redesign the project.

The ***Indirect*** stakeholder category is subdivided into two groups; outside agencies and decision-makers.

- **Outside agencies** are generally in the *wider external boundary* and may consist of the Government and other regulatory bodies who might be the impetus for the impending change within the system, e.g. Government initiatives, changes in law, etc. This group could also include suppliers and contractors who may not be apparent within the area of change but could indirectly affect a project.

- The **Decision-makers** are the management or bodies within an *organisational boundary* who will ultimately enable any changes to a system to be implemented. They are likely to act on the results of the PISO analysis and are likely to be responsible for, if and how the changes occur.

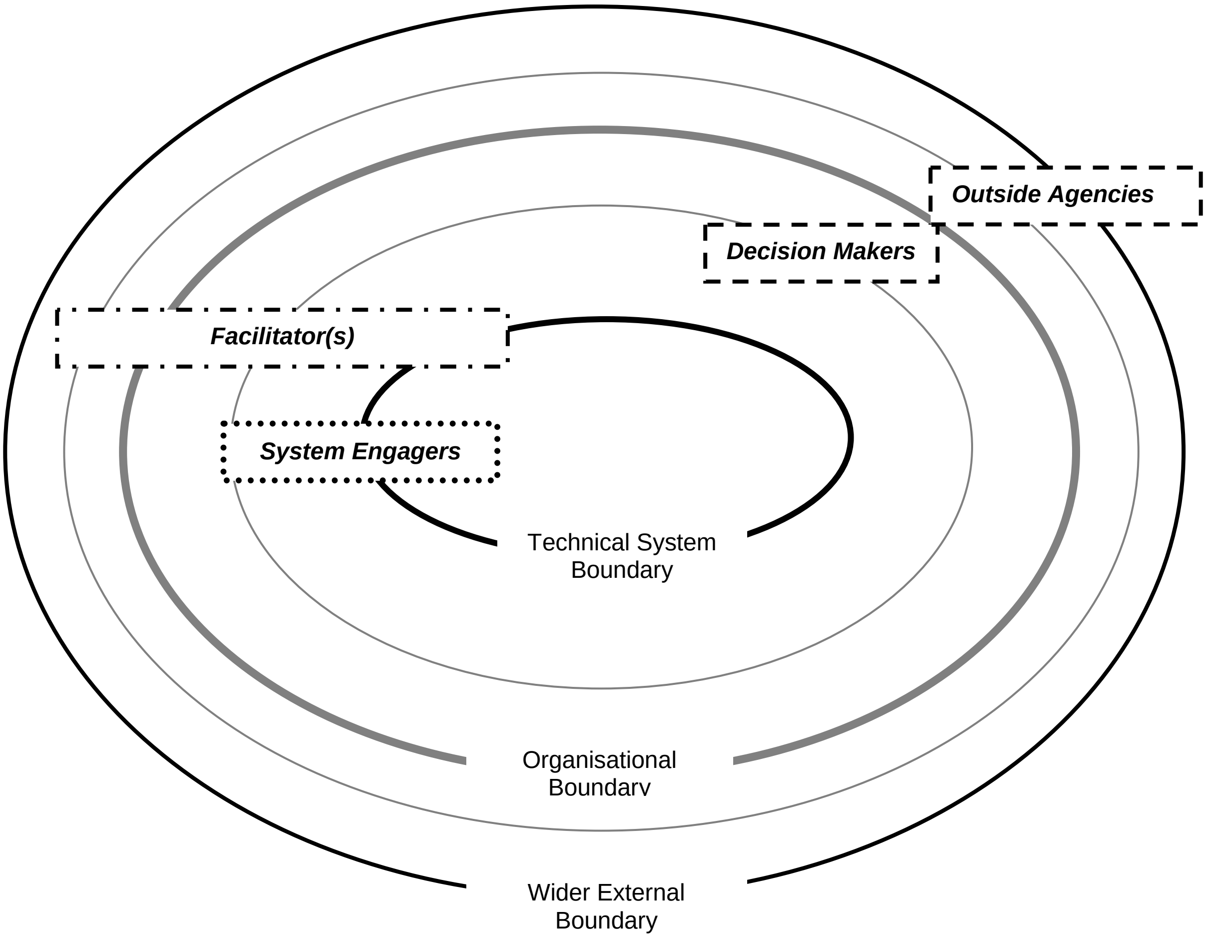
Checklist for identifying stakeholders

- **Have all initial direct, interface and indirect stakeholders been listed.**
- **During information gathering (Stage 2, Step 2.1) invite initial stakeholders to identify any further stakeholders or groups; add these to the list.**
- **Further stakeholders may be identified from organisational literature and information, e.g. names on letters.**
- **On production of physical data flow diagrams further stakeholders may be identified; add to the list.**

It should be remembered that stakeholders might have various roles within an organisation. For the purpose of the reengineering project, their roles within the information system should be considered. In the case of outside agencies, they may not appear to be directly involved but will be affected by or have some affect on the system at some point in the reengineering project.

A1.2. pisoSIA Course Material Instructions. Source: Davison, J. (2006). *Stakeholder Identification an Analysis as an Enhancement to PISO® (Process Improvement for Strategic Objectives).* PhD Thesis. The University of Sunderland.

Stakeholder Boundary Guide



Key

.... Direct Stakeholders
- - - - Indirect Stakeholders
- · - · - Interface Stakeholders

(Adapted from Coakes and Elliman 2001)

Stakeholder Analysis (applying attributes and considering influence)

Stakeholder analysis will occur at Stage 1, step 1.2 in the PISO framework.

The purpose of analysing the stakeholders is to ascertain the likely impact the various stakeholders will have on the system being reengineered. By assessing the relevant priority and interests of stakeholder groups will show who should be included within negotiations of change and if those changes will affect any stakeholders. In turn this will highlight the likelihood of potential areas requiring negotiation, and consequently this will identify any areas of risk within the project.

To help in the analysis of stakeholders three attributes, power, legitimacy and urgency (based on the work of Mitchell et al 1997), are applied to each identified stakeholder using the SIA matrix. From the various permutations of attribute the stakeholder influence type can be obtained.

Using the "Quick Assessment of Power, Legitimacy and Urgency" schedule on pages 7 to 10 consider which attributes each stakeholder or group holds; bearing in mind that the attributes relate most closely to the project rather than the organisation as a whole. For example, the power of information flow relates to the information flow within the system rather the organisation in general. It should also be borne in mind that power, legitimacy and urgency are transitory. During the reengineering process these attributes are likely to change for some groups.

Quick Assessment of Power, Legitimacy, and Urgency

Power

Power can exist in many forms within an organisation; it can be seen as the influence a person or group has over another person or group. In many cases it is often what one individual believes another can do, rather than what they actually do, that influences a decision. It can be defined in six forms and by asking the following questions it can be ascertained if a stakeholder or stakeholder group possesses one or more forms of power;

- *Reward Power* - Does the person or group influence the rewards of others (e.g. promotion, rises, assignments, emotional well being?
- *Coercive Power* - Does the person or group influence the negative outcomes received by others (e.g. dock pay, fire them, give poor references)?
- *Legitimate Power* - Does the person or group's position or title give them the authority to tell other what to do?
- *Referent Power* – Do other people like to admire the person or group and show willingness to do what they want?
- *Expert Power* – Do other people seek the person or group's advice or suggestions on technical matters or on special skills that they possess?
- *Information Keeper* – Does the person or group control the flow of information or know how to find that information?

One form is sufficient for analysis at this stage.

Legitimacy

Legitimacy is linked with right. It can be conferred by an organisation, that is, linked to the position a person or group occupies within that organisation. It can be seen as socially pleasing in that it refers to socially accepted and expected forms of behaviour, in other words someone is carrying out their expected work or performing accepted roles within an organisation, or some relationship exists between the stakeholder and the firm. Combined with power it creates authority, therefore legitimate power can also be seen as a form of authority in which case both attributes exist within a stakeholder.

The following questions can be asked to ascertain if a stakeholder or stakeholder group possesses the attribute of legitimacy.

- Has the person or group authority over others or groups within the organisation (linked to legitimate power)?
- Does the person or group carry out work or roles within the system to be developed (e.g. normal duties within a system)?
- Does the person or group have any other rights, responsibilities or relationships within the system (e.g. a patient within a hospital system, customer at a bank)?

Urgency

Urgency refers to some claim a person or group may have on a system, but it is the urgency of the claim that is attributable. Urgency exists when a relationship or claim is time-sensitive, and when a relationship or claim is important or critical to the stakeholder. Time sensitivity is the duration to which a delay in attending to a claim is unacceptable to the stakeholder. Criticality is the importance of the claim to the stakeholder. A stakeholder will only press a claim if they wish to.

Also, within a system redesign the project may require input from a particular stakeholder or stakeholder group and it is the system which has a claim on a stakeholder.

The following questions can be asked to ascertain if a stakeholder or stakeholder group possesses the attribute of urgency.

- Does the person or group have a claim on the system that requires urgent attention? (For example, a patient or customer of an organisation expecting a service; an outside body or management requiring some action from the system).

    - If so, the claim should only be pertinent within the area of improvement.

- Does the person or group view the claim as critical or highly important?

    This question can be subdivided as;

    - Does the stakeholder or group possess certain assets that would make it costly to end a relationship with the organisation? (E.g. a stockholder)

    - Does the stakeholder or group have long-term link with the organisation? (E.g. a customer, patient, service provider).

    - Does the stakeholder or group expect the organisation to continue providing value for them or place importance on risk in their relationship? (E.g. the benefits of employment, continuation of treatment).

- Does the area of improvement require attention from a stakeholder/stakeholder group during any improvement or redesign of a system?

Stakeholder Influence

A combination of the above attributes gives a dynamic model based on stakeholder interests, based on the work of Mitchell et al (1997). The table below shows how they seven areas of influence are produced.

Stakeholder Influence	Attributes		
	Power	Legitimacy	Urgency
Latent			
Dormant	#		
Discretionary		#	
Demanding			#
Expectant			
Dominant	#	#	
Dependent		#	#
Dangerous	#		#
Highly Salient			
Definitive	#	#	#

Depending on which attributes and in what ratio they are held, then stakeholder saliency to a project can be gauged.

Dormant (power) – they can impose their will but without legitimacy or urgency their power may not be used [e.g. customer with money to spend but no will to do so].

Discretionary (legitimacy) – no power to influence a firm, and there is no pressure on an organisation to associate with this group [e.g. receiver of donation, outside consultancy].

Demanding (urgency) – they have claims but no influence to press them [a lone picket, someone wanting employment without relevant qualification].

Dominant (power and legitimacy) – influence is assured, they have a legitimate claim and the power to act upon it. Once they feel their claim is urgent then they will become highly salient and move into *definitive* influence.

Dependent (legitimacy and urgency) – they have a legitimate and urgent claim but lack the power to exert their will. They rely on a champion to give them the necessary power [e.g. a patient relying on a GP for referral, a supplier pressing for business].

Dangerous (urgency and power) – they have no legitimacy or right, but could be coercive or even violent [e.g. wildcat strikes, environmentalists sabotaging property, someone with passionate beliefs using the power of the internet].

Definitive (all attributes) – group with most impact. Any of the last three groups can become definitive; if a claim becomes urgent in the dominant group. The dependent group can gain a powerful ally. The dangerous group may gain legitimacy, e.g. terrorist organisations may not be recognised then get legally elected.

Checklist for assessing the relevant priority and interest of stakeholder groups

- **Using the Quick Assessment Schedule consider each stakeholder or stakeholder group and decide which attributes apply to them. Some analysts may choose to show the degree to which an attribute occurs, whilst others may tick if an attribute applies. Either way gives a useful analysis.**
- **Using the Stakeholder Influence Guide apply the relevant stakeholder influence**.

<u>Stakeholder Analysis (considering likely changes to system and possible effect of changes on stakeholders</u>)

During Stage 2, step 1.3 within the PISO framework the relevant stakeholders are invited to define the strategic objectives relating to the system redesign. Again at Stage 3, step 3.2 they are invited to resolve any conflicts between the strategic objectives. At these points the stakeholders will be discussing any potential changes to the system and considering how these changes will affect themselves and other stakeholders.

To help understand the effects of change on stakeholders, Mullins (1999) gives a list of factors that could elicit some resistance to change (see page 11).

This point in the stakeholder analysis becomes much more subjective. As you are dealing with individuals each stakeholder will have differing perceptions of the effects of change. Some stakeholders may relish change and be happy to lose a role in a particular system, whilst others may wish to cling onto familiar activities.

After indicating the likely changes that would occur within the reengineered system in the “Indicate Changes” column, then consider which stakeholders will need to be closely involved in any negotiations. Definitive and dominant stakeholders must be considered in any negotiation; however, a Discretionary stakeholder is unlikely to have any impact on the likely changes.

Two important factors to consider are that good communication is essential; and that stakeholders do not feel that a change has been imposed on them.

Checklist for Stakeholder Analysis (considering effect of changes)

- **Consider the likely system and changes and which stakeholders will be affected. This may include shifts in form of power, role change or removal from a system of a stakeholder.**
- **Consider which stakeholders will be involved within negotiations of change and what aspects of change will need to be discussed.**

Resistance to Change Factors (from Mullins 1999)

- Selective perception. A person's own interpretation of a situation can give them a unique picture of an incident resulting in selective perception. This can create a biased view or circumstances resulting in resistance to any change.
- Habit. People respond to situations in a familiar way. Habits are also a means of comfort and security, as such any threat to regularity can result in resistance.
- Inconvenience and loss of freedom. Any change likely to be bothersome or impinge on freedom will incite resistance.
- Economic implications. People will also resist if there is any likelihood of reduction of pay and rewards or in job security.
- Security in the past. In times of confusion or worry or if faced with the unfamiliar, people may ponder on the past and wish to retain familiar and comfortable ways.
- Fear of the unknown. Faced with the unknown people will face anxiety or fear and are likely to resist change.

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A2.1. Guidelines on CLD's. Source Available at: http://www.amcreativityassoc.org/creativitytools/organization/Causal%20Loop%20Diagrams.doc/ (Accessed 6 May 2008)

Causal Loop Diagrams

Duke Rohe, Performance Improvement

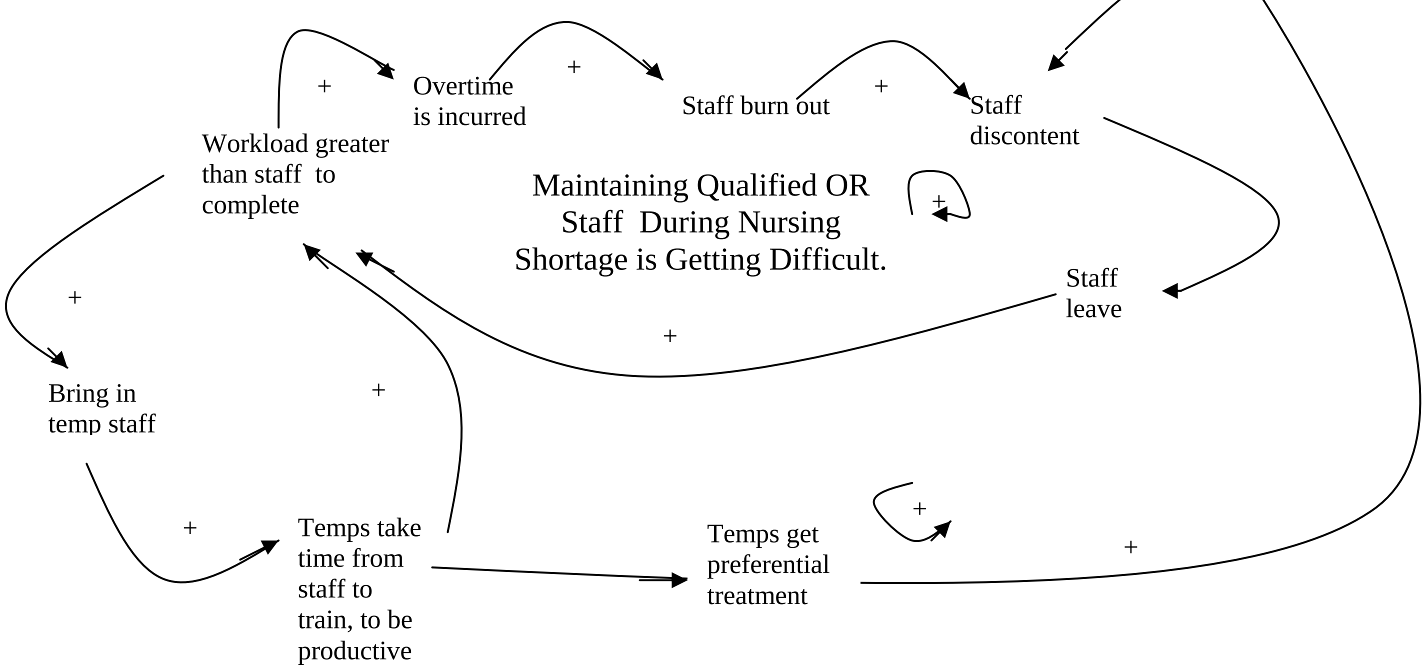
Causal loops diagrams are used to display the behavior of cause and effect from systems standpoint. Fishbone diagrams may elicit the categories of causes that impact a problem. Causal loops show the interrelation causes and their effects. When finished you have a diagram of the positive and negative reinforcements which describe the system of behavior. Neat thing about causal loops is it is depersonalizing. People can point at the arrows in the loop that are reinforcing the problem instead of pointing at people. It becomes a model of system behaviors that create the outcome of the system.

One way to create a Causal Loop Diagram:

Step 1 Start with a problem – characterize it in simple terms such that it would be clear to all who have even peripheral understanding of it. What is wrong? What is it you don't like? What is the root source of the problem?

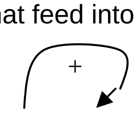
Step 2 Begin defining the causes of the problem. Start with a fact in the loop. State it in sentences such that there is a relationship between cause and effect. The reason OR staff are dissatisfied is because too much overtime is being incurred. There is always a noun in the sentence.

Step 3 Each cause becomes an effect of the next. To find a cause, ask, Why. To find out the effect, ask, what happens. It's a probing process of Why's. And when you discover a why, you ask, well what happens next. Free hand the loops with the sentence at both ends of the loop. Directional relation → of the loops goes from Cause to Effect.



Step 4 Show relation between Cause to Effect as reinforcing (+) or negative (-). This does not indicate good or bad it just means as the cause goes intensifies, effects does too (+) and as cause diminishes, effect does also (-).

Step 5 Seek out systems and sub systems (series of loops that feed into each other) of loops. If a subsystem of loops is reinforcing place a notation:
The set of loops is completely reinforcing.



A negative or balancing loop (-) is referred to as a "**goal seeking**" loop. There is a mechanism in this loop that is trying to maintain some level of stability.

Step 6 Distinguish between perceived and real facts. Graph over time to better characterize them.

Step 7 To begin reducing an effect of a cause, take a loop out and ask: if this effect were 'fixed' or did not matter what could be done to lessen its impact on the loop. This entertains possible solutions. By lessening or eliminating any arrow in the loop, you make an impact on the overall behavior of the system. If you are stuck on how to lessen an impact of the loop, imagine having a conversation a year from now and saying "I overcame this by…..)

What I like most about Causal Loop Diagrams is they illustrate that our organizations are human nature on mass scale. And by understanding the assumptions behind its actions allows one to make profound change.

Reference: This site and material has been recommended to me
Good little site - http://www.pegasuscom.com/cld.html

The Virtue of Causal Loop Diagrams (CLD): From an email comment by Jim Hines, a Professor at MIT, to the system dynamics listserv on February 23,2000.

> "In consulting, I usually start with causal loop diagrams before going on to stock and flows. The exception is when I see immediately a very clear and important stock and flow structure (the I-Think folks might call this a "main chain") in which case, I might dive into the stock and flow right from the start.
>
> "In teaching the SD applications course here at MIT, we encourage students to start with causal loop diagrams. One reason for this is that students who start with stocks and flows often never complete any important feedback loops.
>
> "Other reasons to start with causal loop diagrams include:
>
> 1. CLD's are usually more dramatic and hence capture the interest of students and clients alike (its good to start with a bang).
> 2. Causal loop diagrams lead to insights on their own more frequently than stock and flow diagrams do. (Note, I am distinguishing between stock and flow diagrams and the simulation model).
> 3. Causal loops are easy to develop at a relatively high level of abstraction - this means that they can provide an overview of the system you are modeling, before getting down to the nitty gritty.
> 4. Causal loop diagrams are fuzzier, so they can be drawn even if you are not yet clear on every single concept (this is a common state at the beginning of the project).
> 5. Causal loop diagrams are cheap relative to simulation modeling (and cheap relative to an equation-level stock and flow diagram). This means you can more quickly get a comprehensive feel for the problem area. And inexpensively generate some initial insights."

However, CLDs have some shortcomings: they don’t adequately illustrate details that are important to the larger picture. They don’t note which of the terms is something flowing into the system and which is something accumulating in the system. Nor do they indicate which term comes first in a process, if this is important to the diagram logic. In addition, sometimes users don’t adequately account for causality and so a CLD can be drawn inaccurately, which can lead to confused thinking.

Interesting Causal Loop Diagram on Doing the Right Thing

http://www.9types.com/epd/causal_loops.html

John J. Shibley / The Portland Learning Organization Group

This is a great method of developing loop. Article is on the site.

http://www.systemsprimer.com/making_loops_intro.htm

Here's the method...

1. Sense a story
2. Listen to the story
3. Listen to the story again, with "variable ears"
4. Create variables
5. Create links
6. See if the links make a loop

There are also two general rules that permeate the method:

Rule #1: As you move through the model, freely use what you learn to revisit and refine work done in earlier stages.

Rule #2: During it all, attend to the assumptions being made, and the way those assumptions are formed out of data.

.

A3.1. Example of an Original Alexandrian Pattern. (Source: Erickson, T. (2000). *Lingua Francas* for Design: Sacred Places and Pattern Languages. Available at: http://www.pliant.org/personal/Tom_Erickson/LinguaFranca_DIS2000.html. Accessed [28 April 2008]).

88 Street Cafe

[*picture omitted*]

...neighborhoods are defined by Identifiable Neighborhood (14); their natural points of focus are given by Activity Nodes (30) and Small Public Squares (61). This pattern, and the ones which follow it, give the neighborhood and its points of focus, their identity.

The street cafe provides a unique setting, special to cities: a place where people can sit lazily, legitimately, be on view, and watch the world go by.

The most humane cities are always full of street cafes. Let us try to understand the experience which makes these places so attractive. We know that people enjoy mixing in public, in parks, squares, along promenades and avenues, in street cafes. The preconditions seem to be: the setting gives you the right to be there, by custom; there are a few things to do that are part of the scene, almost ritual: reading the newspaper, strolling, nursing a beer, playing catch; and people feel safe enough to relax, nod at each other, perhaps even meet. A good cafe terrace meets these conditions. But it has in addition, special qualities of its own: a person may sit there for...

[*nine paragraphs of rationale omitted*]

Therefore:

Encourage local cafes to spring up in each neighborhood. Make them intimate places, with several rooms, open to a busy path, where people can sit with coffee or a drink and watch the world go by. Build the front of the cafe so that a set of tables stretch out of the cafe, right into the street.

[*diagram omitted*]

Build a wide, substantial opening between the terrace and indoors-OPENING TO THE STREET (165); make the terrace double as A PLACE TO WAIT (150) for nearby bus stops and offices; both indoors and on the terrace use a great variety of different kinds of chairs and tables-DIFFERENT CHAIRS (251); and give the terrace some low definition at the street edge if it is in danger of being interrupted by street action-STAIR SEATS (125), SITTING WALL (243), perhaps a CANVAS ROOF (244).

[*text omitted*]...

A3.2. Example of a Descriptive Pattern.

(Source: Lancaster University projects website. Available at: http://www.comp.lancs.ac.uk/computing/research/cseg/projects/pointer/patterns/workingWithInterruptions/theSmallOffice.html/ Accessed 28 April 2008).

Working with Interruptions

Vignette 1: The Small Office - Hotel Training Centre (Rounceﬁeld et al. 1994)

Next Vignette

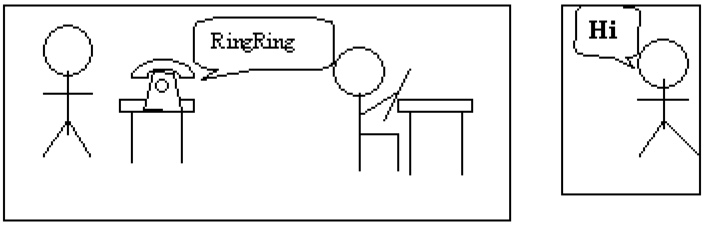
Cooperative Arrangement

Small group of workers (manager plus three other employees). Location within a site and close co-location. Focus on the different forms of 'interruptions' from different sources. Interruptions are both an integral feature of their work and its generation. Interruptions are contrasted with 'routine' paperwork.

Representation of Activity

The activity and the outcome of the interruptions becomes represented in the *"massive volume of paperwork"*, generated by the office. Interruptions come from phone calls, the front desk and from clients and other hotel workers. Interestingly, workers see the interruptions as the main activity of their job yet they are interruptions to the paperwork that is generated by them. The paperwork representations contain a lot of repeated information but this duplication is a lot to do with the different purposes and destinations of the various documents.

Ecological Arrangement



One worker sits at their desk doing paper work while the phone rings and a client arrives at the front desk.

Coordination Techniques

Workers must coordinate doing various paperwork tasks with dealing with the interruptions that come from various sources - telephone, front desk and so on. This involves deciding which types of paperwork can be interrupted, how long different tasks take and so on and coordinating this with different times of day and notions of the likelihood of outside interruptions. Workers must also coordinate with one another to decide who should deal with a particular interruption, who is in the best or most appropriate position to deal with it.

Community of Use

Inter organisational group of workers in a hotel training centre small office undertake various interactions with outside clients.

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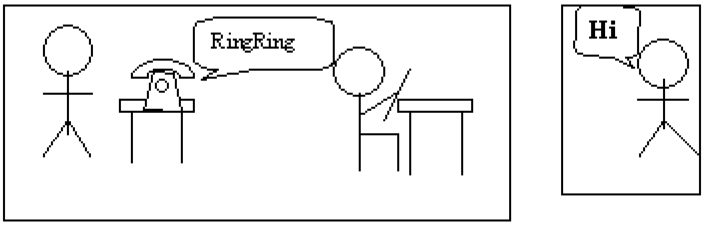

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Appendix B

Case Study Research and Design

B1. EStaC User Assessment

B1.1. User Assessment Question Generation

B1.2. User Assessment Questionnaire

B2. Collaboration Patterns

B2.1. Collaboration Patterns Template Sheet

B2.2. Encapsulated Collaboration Patterns (in the CD)

Developing the User Assessment Questions

The user assessment questionnaire for EStaC was generated through the use of GQM. The main concept behind the questionnaire is to understand the impact of implementing Stakeholder Collaboration Evaluation Approach on determining the nature and discovering and applying collaboration patterns within the requirement collection phase of software projects.

The following presents the concept, goal and objectives of the evaluation extracted from the research aim and question.

The research question which was:

> *Can a suitible approach be developed to evaluate the collaboration of stakeholders involved in the requirement collection of software development?*

The main research question leads to the following query:

Does the new developed evaluation approach satisfy the criteria in a real environment?

An answer relies to finding answers to the following questions:

First; collaboration is a complicated problem that involves uncontrolled factors. Can this proposed approach handle the *complex nature of stakeholder* collaboration within requirement collection? How can this complexity be visualized?
Second; requirement collection has been distinctively specified as a *social act of interaction between stakeholders* during which many context specific issues are at stake to ensure proper collaboration of stakeholders involved in the project. Can this approach uncover hidden issues other means failed to? Is there a mean to validating these issues?
Third; during requirement collection stakeholders involved in the project are the basic building block of the collaboration system between them. Can this approach *distinctively identify these stakeholders*? Give them priority and analyze conflict areas that might hinder collaboration?

To answer the above questions, a goal is developed, and according to the GQM, several goals are derived from the main goal and questions are developed related to them.

The goal of this questionnaire is to:

> *Analyze Stakeholder Collaboration Evaluation Approach to better understand the impact of implementing Stakeholder Collaboration Evaluation Approach on determining the nature and discovering and applying collaboration patterns within the requirement collection phase of the KMOD Automation project from the viewpoint of project management and analysis team of both KMOD and the developing company.*

This goal is achieved through the analysis of the following objectives:

1) Distinctively identify relevant stakeholders in the project.
2) Identify the social act of interactive collaboration in requirement collection.
3) Identify the complex nature of collaboration.
4) Discover the compliance of participant perceptions to EStaC results.
5) Discover potential user opinion of EStaC.

I am considering these objectives as sub-goals of the main goal. By doing this and employing concepts of GQM, these goals are then associated with the following questions.

Stakeholder Identification

1. The approach identified all the relevant stakeholders in the system
2. The approach identified stakeholders overlooked in the project
3. The stakeholders are categorized in distinctive groups
4. The stakeholder groups are comprehendible
5. Stakeholder influence affects the collaboration between them
6. Stakeholder prioritization increases the collaboration process in RC
7. Conflict recognition improves the chances of smoother collaboration
8. Stakeholder identification at the planning phase ensures better collaboration during the requirement collection
9. Using this approach ensures the identification of all the stakeholders needed for collaboration during the requirement collection
10. Involving the point of views of all the stakeholders in the project has a positive affect on collaboration during requirement collection

Stakeholder Interaction of Collaboration in Requirement Collection

1. Requirement collection is a social act
2. Requirement collection involves the interaction of all the relevant stakeholders
3. The approach synthesizes the social nature of requirement collection
4. The approach enables the user to define collaboration from the involved user perspectives
5. Factors affecting the collaboration of stakeholders are clearly defined
6. Encapsulating the factors through perceived reality of stakeholders within the projects makes their identification in affecting collaboration strong
7. Without the approach it is difficult to identify non-linear factors affecting collaboration
8. Non-linear factors affecting stakeholder collaboration during requirement collection are overlooked in the project
9. Hidden issues affecting collaboration is uncovered by the approach

Complex Nature of Collaboration

1. Collaboration is a complicated concept
2. The approach gives a holistic picture of collaboration
3. The approach diagnoses collaboration problems at different levels
4. The approach provides a comprehendible way to encapsulate collaboration patterns in a specific context
5.The approach realizes the non-linear relation of factors affecting collaboration
6. The approach filters out the factors that affect collaboration in a certain context
7. Complexity of collaboration factors are simplified to a comprehendible manner by the use of the approach
8. The approach acknowledges the dynamic nature of collaboration
9. Collaboration Patterns links the factors to the project
10. The use of rich pictures simplifies the collaboration process and provides a way of emphasizing conflicts that affect it

Approach Results

1. The approach identified overlooked stakeholders by the analysis team
2. The defined factors affecting collaboration match with my experience in the project
3. The dynamic nature of collaboration is clearly acknowledged by the approach
4. Factors affecting collaboration in a non-linear relation are identified through the use of the approach appropriately
5. Rich pictures developed emphasize basic factors affecting collaboration
6. Patterns provide a practical way to link the collaboration factors to the project
7. Problems in collaboration are diagnosed at early stages of implementation of the approach
8. Viability of collaboration is clearly evaluated through the use of the project
9. Deficiencies affecting collaboration diagnosed by the approach represent the reality I perceived through my involvement in the project
10. Intervention points identified by the approach are found useful

User Opinion

1. The approach is useful in the planning of software projects
2. The approach is useful throughout the requirement collection process
3. Identifying all stakeholders is important
4. I find defining collaboration from the perspectives of the stakeholders involved appealing
5. Patterns of collaboration are useful and can be used to infer future projects
6. I find the approach being used in future project
7. I will use the approach in future software projects
8. Using the approach in the current project could have saved development time
9. Using the approach in the current project could have made collaboration in requirement collection smoother
10. Using the approach in the current project could identified non-linear factors affecting the collaboration of stakeholders during requirement collection

These questions base the user assessment questionnaire.

System Name	

Personal Information	
Name	
Position	
Years of experience	
At what stage where you involved?	
What was your role?	

The goal of this questionnaire is to analyze Stakeholder Collaboration Evaluation Approach to better understand the impact of implementing Stakeholder Collaboration Evaluation Approach on determining the nature and discovering and applying collaboration patterns within the requirement collection phase of the KMOD Automation project from the viewpoint of project management and analysis team of both KMOD and the developing company.

This goal is achieved through the analysis of the following objectives:

1) Identify the complex nature of collaboration.
2) Identify the social act of interactive collaboration in requirement collection.
3) Distinctively identify relevant stakeholders in the project.

It is also required to establish how useful the approach will is and the likelihood of using it in future projects.

Your completion of the questionnaire is highly appreciated and will affect the development of the approach.

	Strongly Agree	Agree	Neutral/ No Opinion	Disagree	Strongly disagree
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1. The approach identified all the relevant stakeholders in the system					
2. The approach identified stakeholders overlooked in the project					
3. The stakeholders are categorized in distinctive groups					
4. The stakeholder groups are comprehendible					
5. Stakeholder influence affects the collaboration between them					
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9. Using this approach ensures the identification of all the stakeholders needed for collaboration during the requirement collection					
10. Involving the point of views of all the stakeholders in the project has a positive affect on collaboration during requirement collection					
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10. Using the approach in the current project could identified non-linear factors affecting the collaboration of stakeholders during requirement collection					

F. Please indicate if there are other comments relating to stakeholder collaboration that you think should be considered

B2.1.Collaboration Patterns Template Sheet

Name

Vignette Number:

Predecessor

Collaborative Arrangement

Representation of activity

Ecological Arrangement

Collaboration Technique

Community of Use

Successor

Name Better Communication

Vignette Number: 1

CASE8 F.P.

Predecessor

Knowledge Sharing, More Empowerment, More Commitment, Clear Awareness

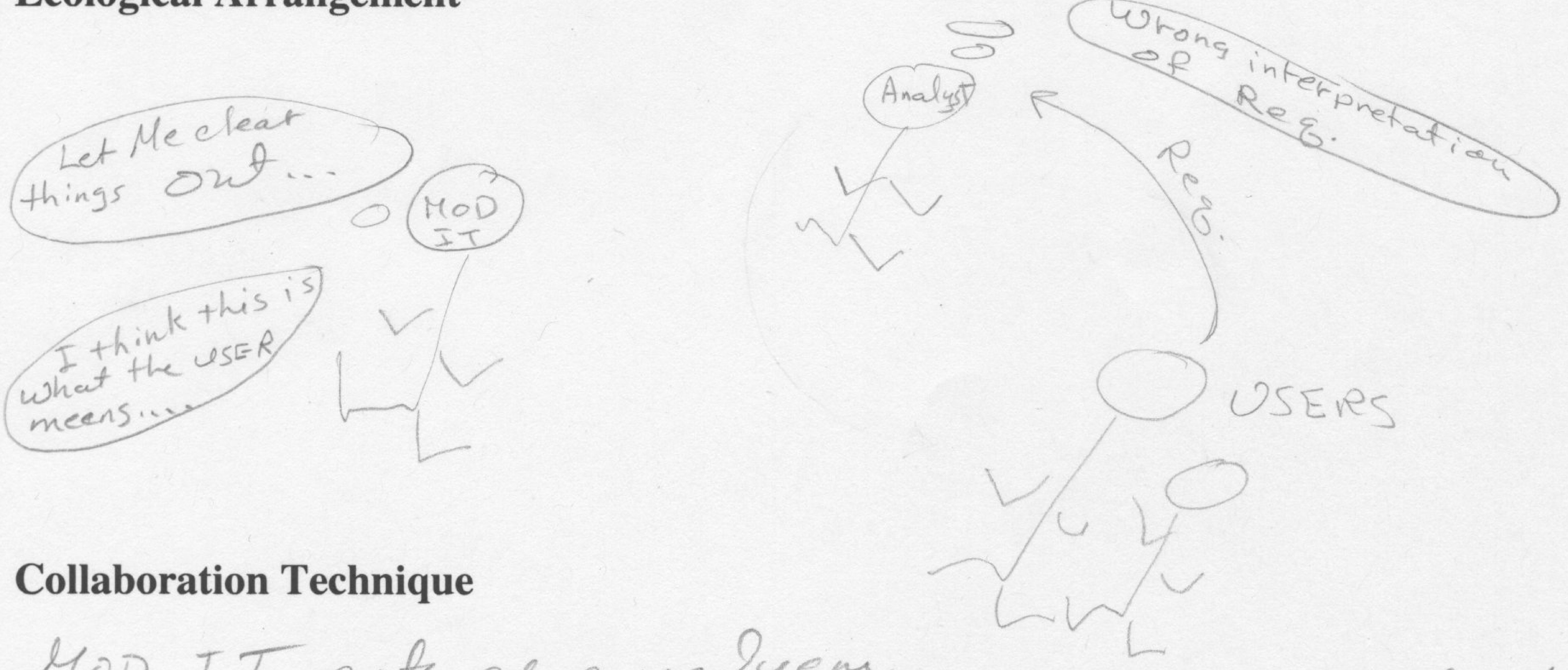
Collaborative Arrangement

SW Analyst, IT staff and F.P. user going over the statements in the requirement documentation

Representation of activity

Users stating their requirements. SW Analysts interpreting back what they understood from the user. They have diffrent perceptions.

Ecological Arrangement



Collaboration Technique

MOD IT acts as a meduem to translate users perception to the analyst. They have more shared Info. between them and they understand eachother easily.

Comunity of Use

IT Scheduler, Communication officer

Successor

Knowledge Sharing, Clear Awareness

Name Better Communication

Vignette Number: 2

CASE: Legal Affair

Predecessor

Knowledge Sharing, More Empowerment, More Commitment, Clear Awareness

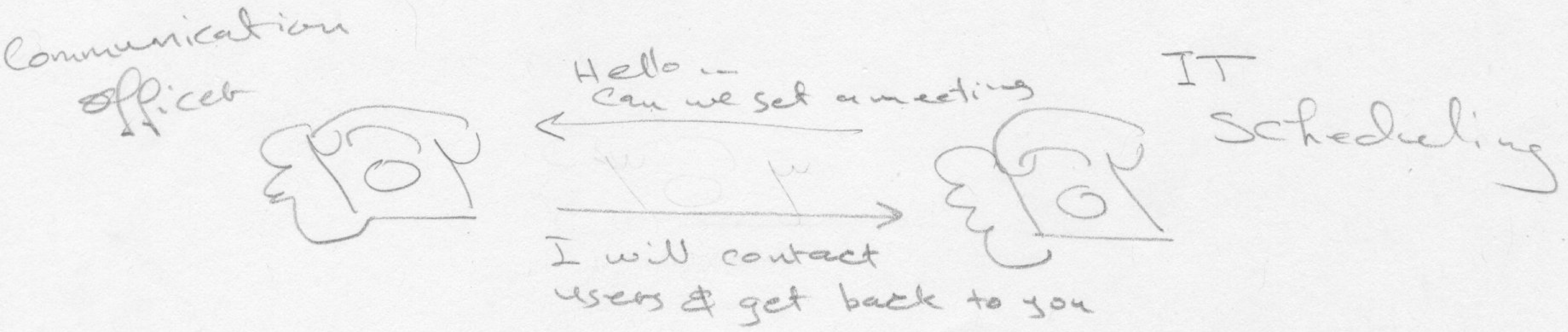
Collaborative Arrangement

Communication officer of each department needs to collaborate with IT staff responsible for scheduling. Telephone is used for scheduling

Representation of activity

IT Scheduling staff contacts dept. communication officers to organize a meeting with the dept. users

Ecological Arrangement



Collaboration Technique

IT scheduler contacts Communication officer, which in turn contacts the users in the dept. The users do not have commitment and not aware of project importance, When the analysts arrive to schedule they reschedule (cannot postpone current job).

Community of Use

IT Scheduler, Communication Officer

Successor

Knowledge Sharing, Clear Awareness

Name Better Communication

Vignette Number: 3

CASE: National Assembly

Predecessor

Knowledge Sharing, More Empowerment, More Commitment, Clear Awareness

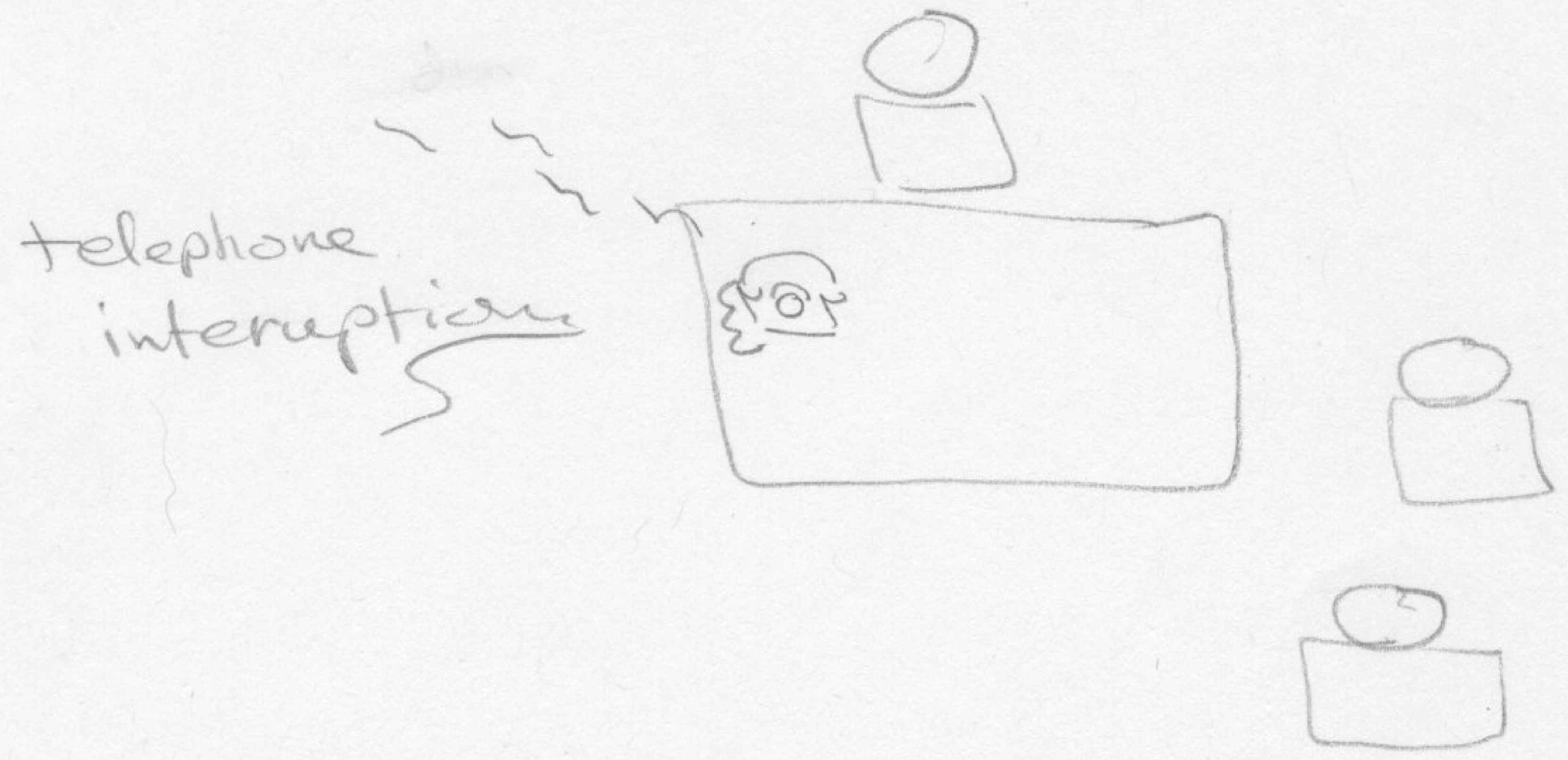
Collaborative Arrangement

Analyst, head of Dept. and IT Staff engaged in requirement collection in a small office

Representation of activity

Durring requirement collection, lots of interuptions happen. Commitment should let the user discard any interuptions.

Ecological Arrangement



Collaboration Technique

Analyst and user engaged in Req. Col., the telephone keeps interrupting the discussion. The user answers the phone, they need time to get back to their conversation.

Community of Use

IT Scheduler, Communication officer

Successor

Knowledge Sharing, Clear Awareness

Name Bad Shared Experience

Vignette Number: 1

CASE: العلاج بالخارج

Predecessor

Knowledge Sharing

Collaborative Arrangement

IT staff and user have bad personal experience. SW house analyst joining.

Representation of activity

An IT personal is in contact with a user, to discuss potential collaboration of req. collection. These two had bad personal experience.

Ecological Arrangement

Collaboration Technique

The analyst had to talk over. IT had minimal interaction with user. Requirement document used as a medium.

Comunity of Use

IT staff, facilitator

Successor

Increase Trust Built

Name Bad Shared Experience

Vignette Number: 2

CASE 8 Legal Affairs

Predecessor

Knowledge Sharing

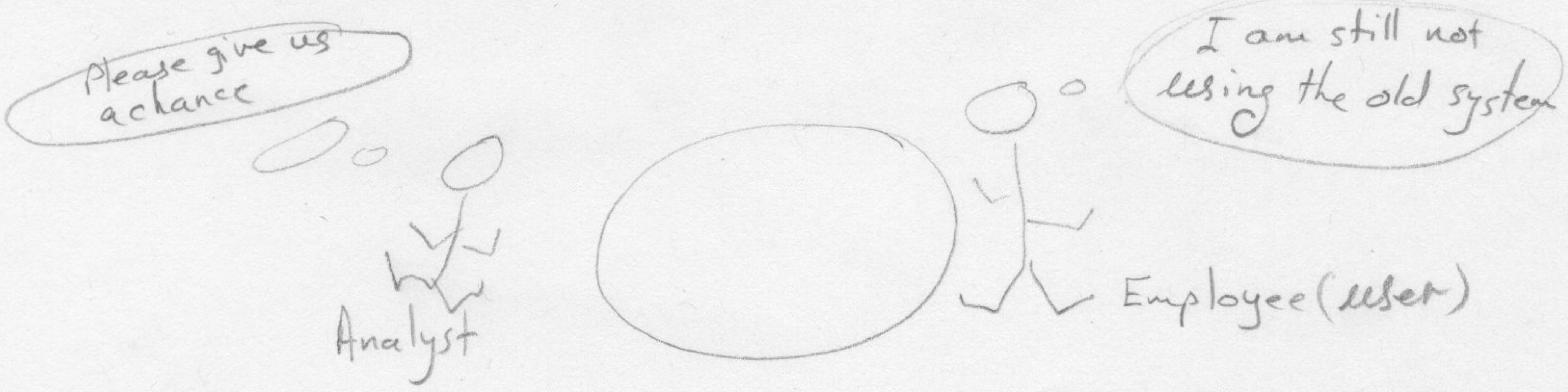
Collaborative Arrangement

The analyst, communication officer, IT personal and system user sit togather to discuss needed system requirements

Representation of activity

The analyst and user start at different points. User unwilling to give information to the analyst due to bad experience of previous system

Ecological Arrangement



Collaboration Technique

By dialogue the analyst manage to convince the employee to open up and start requirement facilitation. The user managed to put behind his experience & start new.

Comunity of Use

IT Staff or facilitator at the begining of a project

Successor

Increase Trust Built

Name Bad Shared Experience

Vignette Number: 3

CASE: Ministers Office

Predecessor

Knowledge Sharing

Collaborative Arrangement

IT Staff + Manager, Head of Minister office, SW Analyst Staff

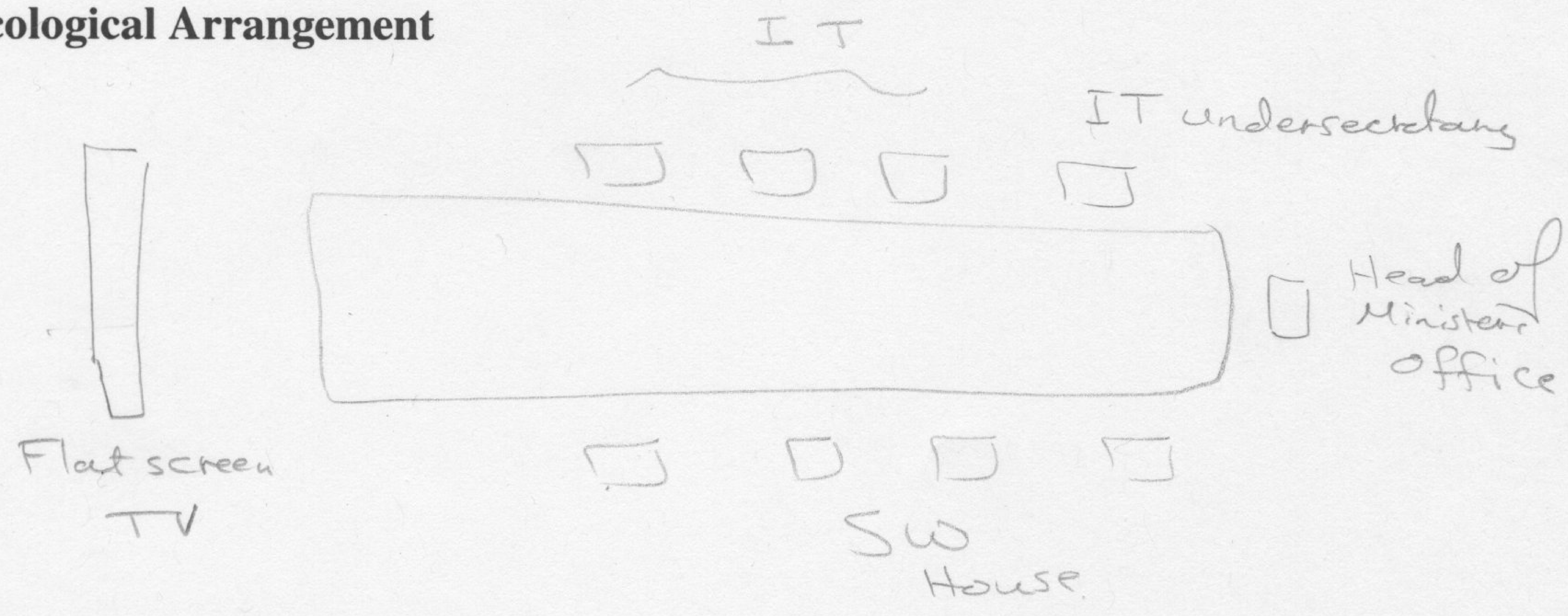
Introductory Meeting to grant permission to meet with potention users in the Sector. Datashow of prototype used.

Representation of activity

IT & software staff start thier discussion by dialogue

Some resistence was expected from head of Ministers office due to previous bad experience, Prototype of other department is used

Ecological Arrangement



Collaboration Technique

The use of prototype made the information sharing more approachable, it made trust in the system higher. Even if it was not for the same department

Comunity of Use

IT staff, facilitador

Successor

Increase Trust Built

Name Clear Awareness

Vignette Number: 1

CASE: National Assembly

Predecessor

Better Communication

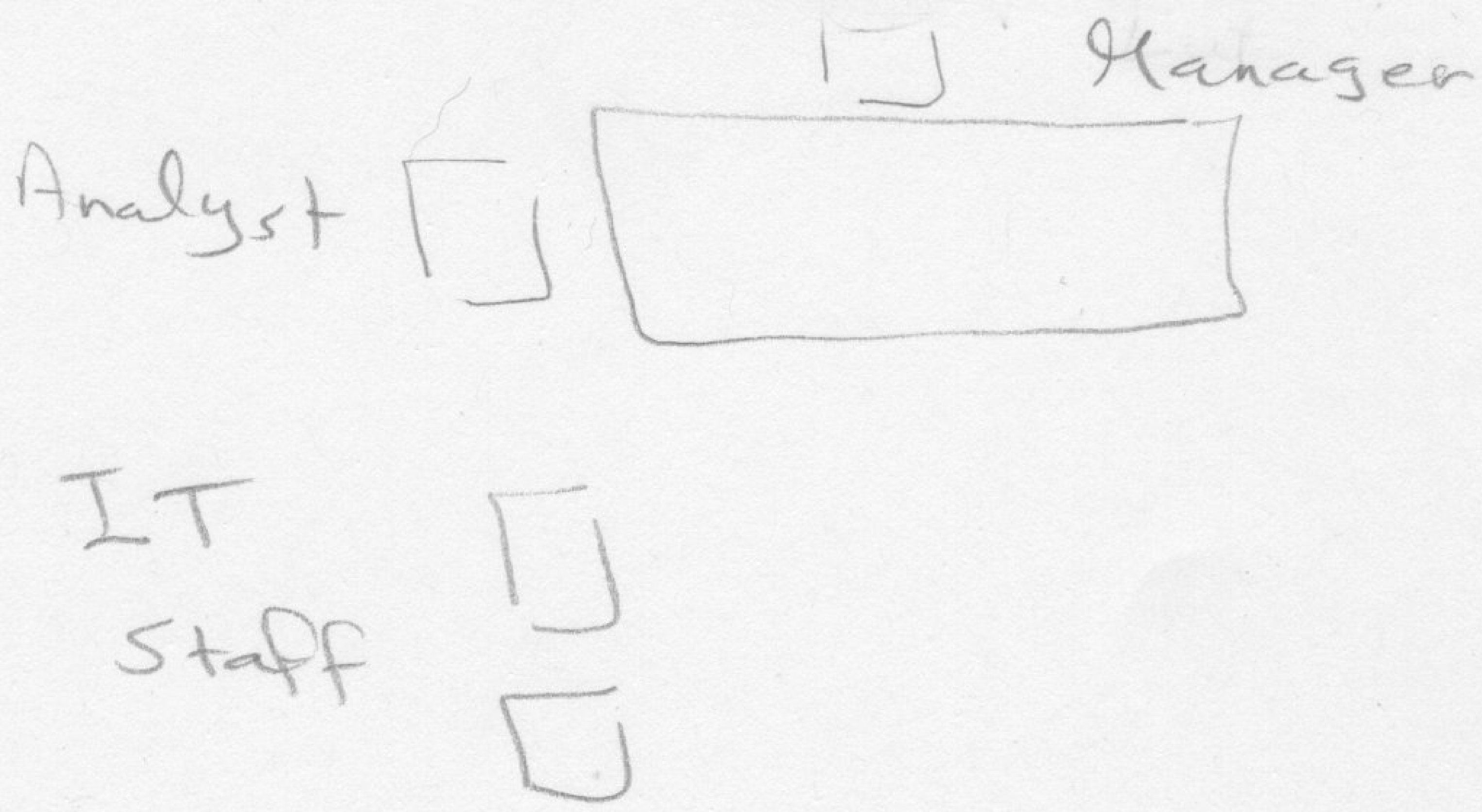
Collaborative Arrangement

SW Analysts & IT meeting with Dept. manager. The aim was to gather info. for req. collection. Also to get contact with dept. users. Meeting in Manager office. Manager has military Rank.

Representation of activity

Manager asking questions, he wants to know what the SW will do for their work.

Ecological Arrangement



Collaboration Technique

Once the IT staff explained to the Manager the SW Potential. How it will make thier work faster & easier. He was more willing to communicate & puts pressure on his employees to commit. He called an employee from his vacation.

Community of Use

Project Manager, Higher Management

Successor

More Commitment, Better Communication

Name Clear Awareness

Vignette Number: 2

CASE: Wharehouse

Predecessor

Better Communication

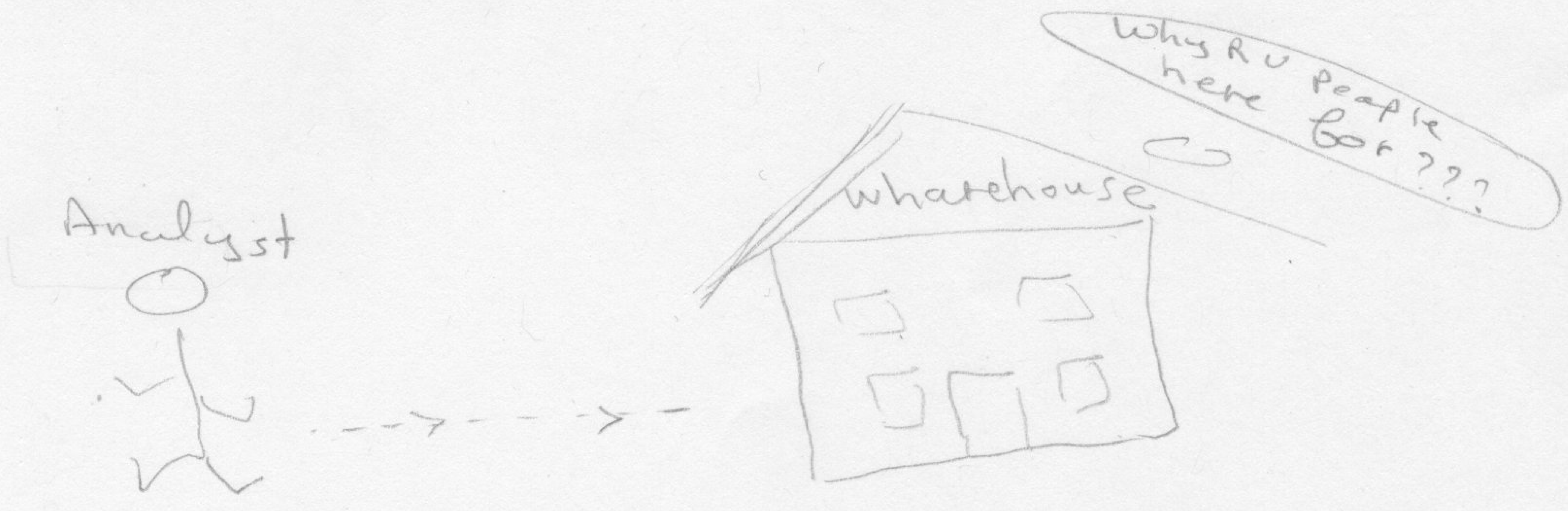
Collaborative Arrangement

Wharehouse system users and system analysts are in a session for requirement collection. An old req. doc. is used. Session in Wharehouse meeting room.

Representation of activity

Communication regarding time scheduling was not properly dealt with. No awareness to objectives of project, No time commitment

Ecological Arrangement



Collaboration Technique

SW Analysts arrived on time. Wharehouse users were not notified. Requirements were not ready. Need to conduct meeting again.

Community of Use

Project Manager, Higher Management

Successor

More Commitment, Better Communication

Name Clear Awareness

Vignette Number: 3

CASE: F.P.

Predecessor

Better Communication

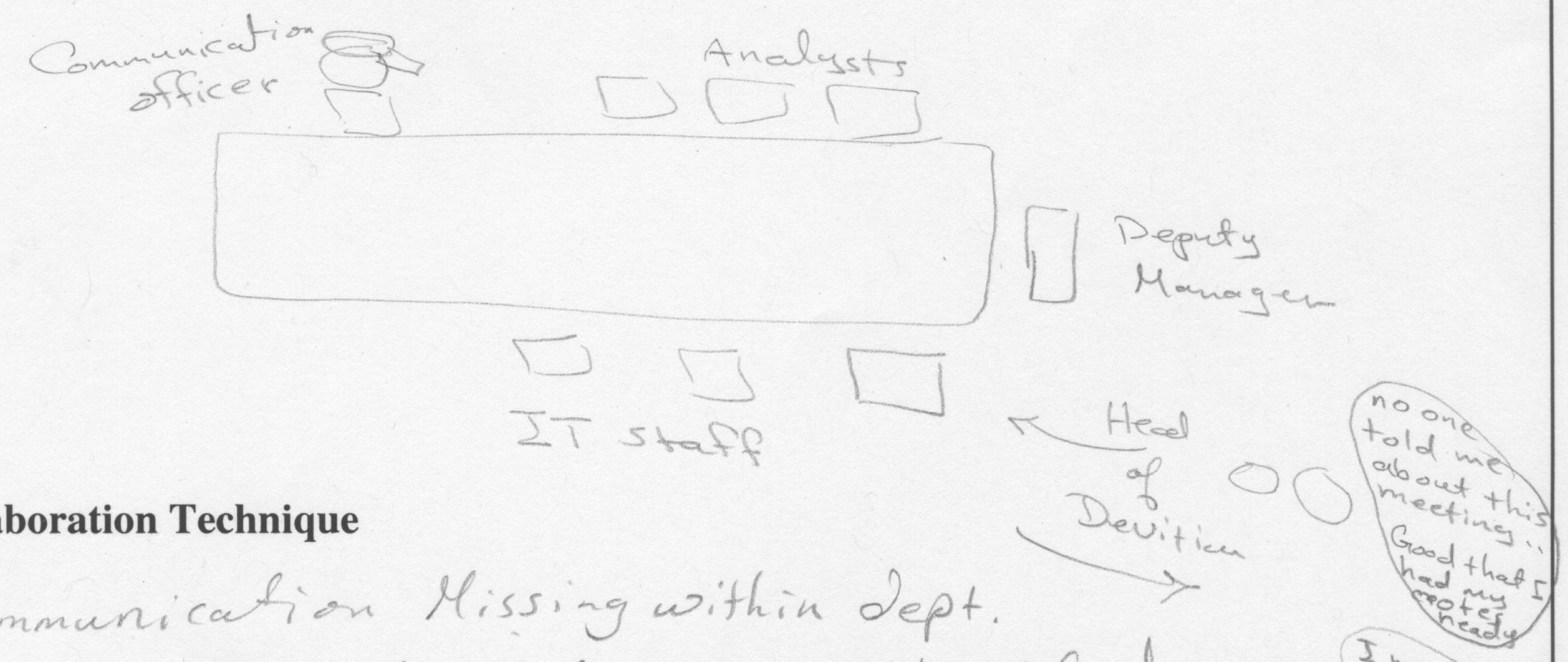
Collaborative Arrangement

SW Analysts & IT staff meeting with head of devision of F.P., the aim was to validate the old Reg. Doc. The meeting is conducted in the F.P. meeting Room.

Representation of activity

Reg. OLD Doc. was given to head of devisions of F.P. they were to put thier comments and then they will be discussed in the meeting with analyst. Head of devisions were not notified about the meeting scheduled only the communication officer knows

Ecological Arrangement



Collaboration Technique

Communication Missing within dept.
People involved in the meating were not notified.
an awareness of project activities should be increased

Community of Use

Project Manager, Higher Management

Successor

More Commitment, Better Communication

Name Dialogue Improves through Trust

Vignette Number: 1

CASE: Ministers Office

Predecessor

Knowledge Sharing

Collaborative Arrangement

Head of Ministers office in meeting with IT Staff and SW Company Staff (Analysts + Project Managers)

Trust gap between stakeholder decreases as the SW house converse

Representation of activity

IT Staff need to get approval to commence Req. Col.

Ecological Arrangement

Collaboration Technique

Prototype used to build trust.

Community of Use

Facilitator, IT Staff

Successor

Dialogue Leads to knowledge Sharing

Name Dialogue Improves through Trust

Vignette Number: 2

CASE: National Assemply

Predecessor

Knowledge Sharing

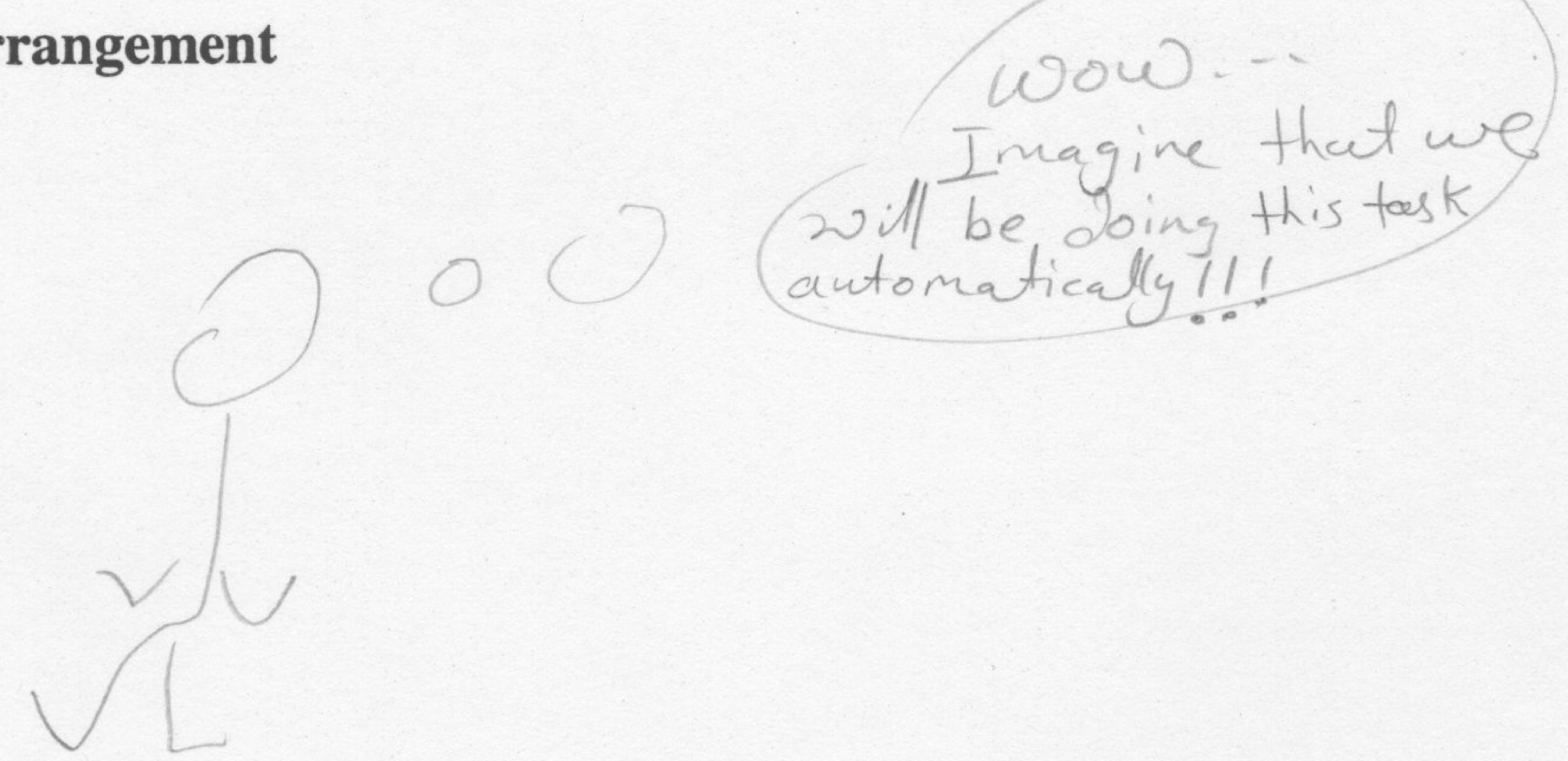
Collaborative Arrangement

Analysts (IT + SW Developer) collecting Req.s from Users. One specific user used to work in IT Dept. He starts talking of Potential Gain from Software. Other users trust is gained

Representation of activity

Talking about potential gain from a trust-worthy person promotes other users to open and submerge in dialogue as well

Ecological Arrangement



Collaboration Technique

Face-to-Face

Community of Use

Facilitator, IT Staff

Successor

Dialogue Leeds to Knowledge Sharing

Name

Dialogue Improves Through Trsust

Vignette Number: 3

CASE ← العلاج بالخارج

Predecessor

Knowledge Sharing

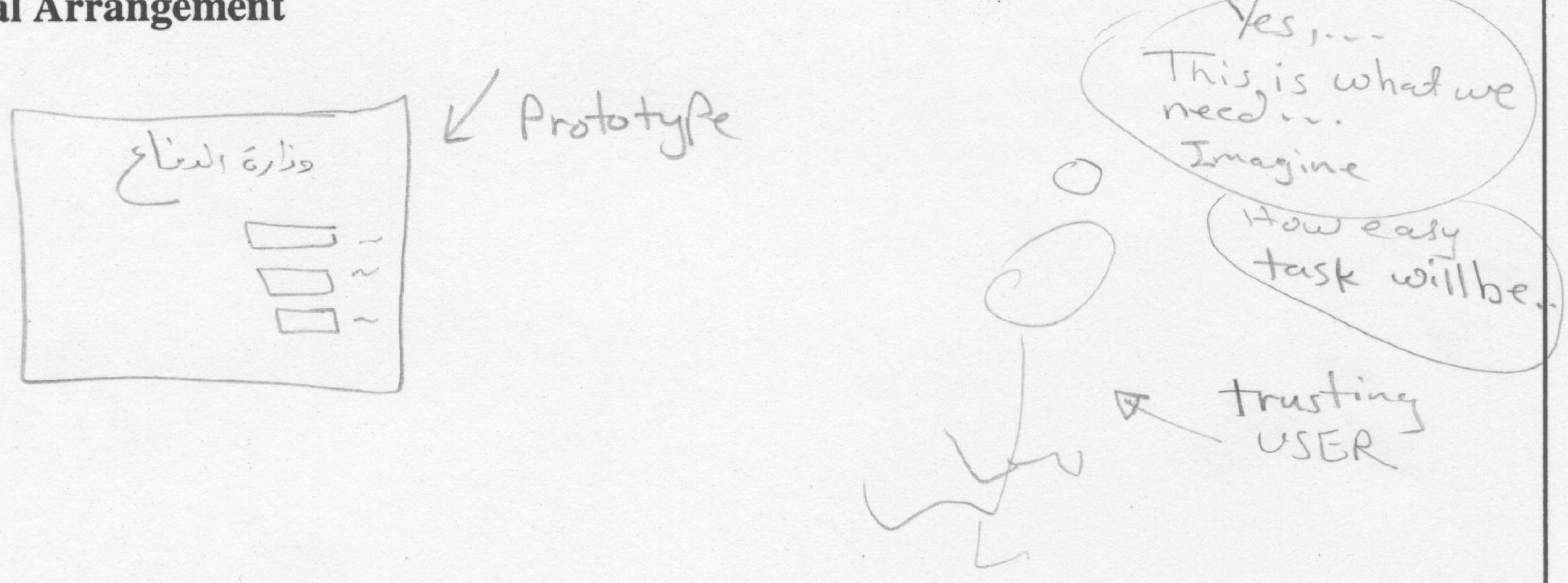
Collaborative Arrangement

R.C. meeting of IT analysts + SW House analysts with stakeholder representative. One spetific Stakeholder

Representation of activity

A trusting users will open in dialogue with analysts. This trust is gained through shared understanding of what the system has to offer

Ecological Arrangement



Collaboration Technique

Prototype used as a collaboration artifact

Community of Use

Facilitator, IT Staff

Successor

Dialogue Leeds To Knowledge Sharing

Name Dialogue Leeds to Knowledge Sharing

Vignette Number: 3

CASE : العلاج بالخارج

Predecessor

Increase Trust Buit, Increase Intrest

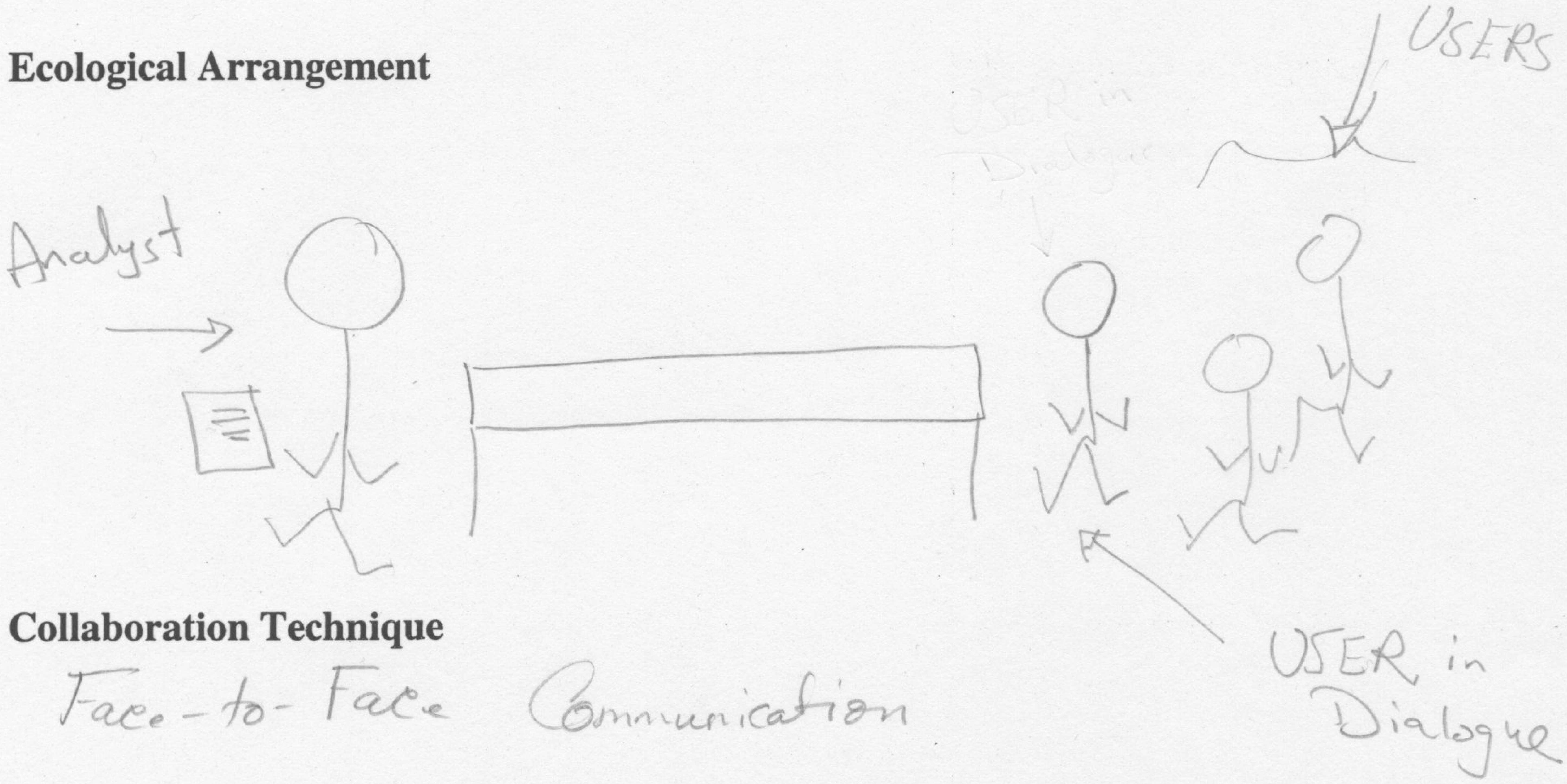
Collaborative Arrangement

A Stakeholder involved in open conversation and negotiation with other Stakeholders and analyst. The More they open up and discuss processes the better understanding of Reqs. Others get intrested and participate.

Representation of activity

Face-to-face negotiation

Ecological Arrangement



Collaboration Technique

Face-to-Face Communication

Community of Use

IT Staff

Successor

Knowledge Sharing

Name

Dialogue leads to Knowledge Sharing

Vignette Number: 1

FP

Predecessor

Increase Trust Built , Increase Intrest

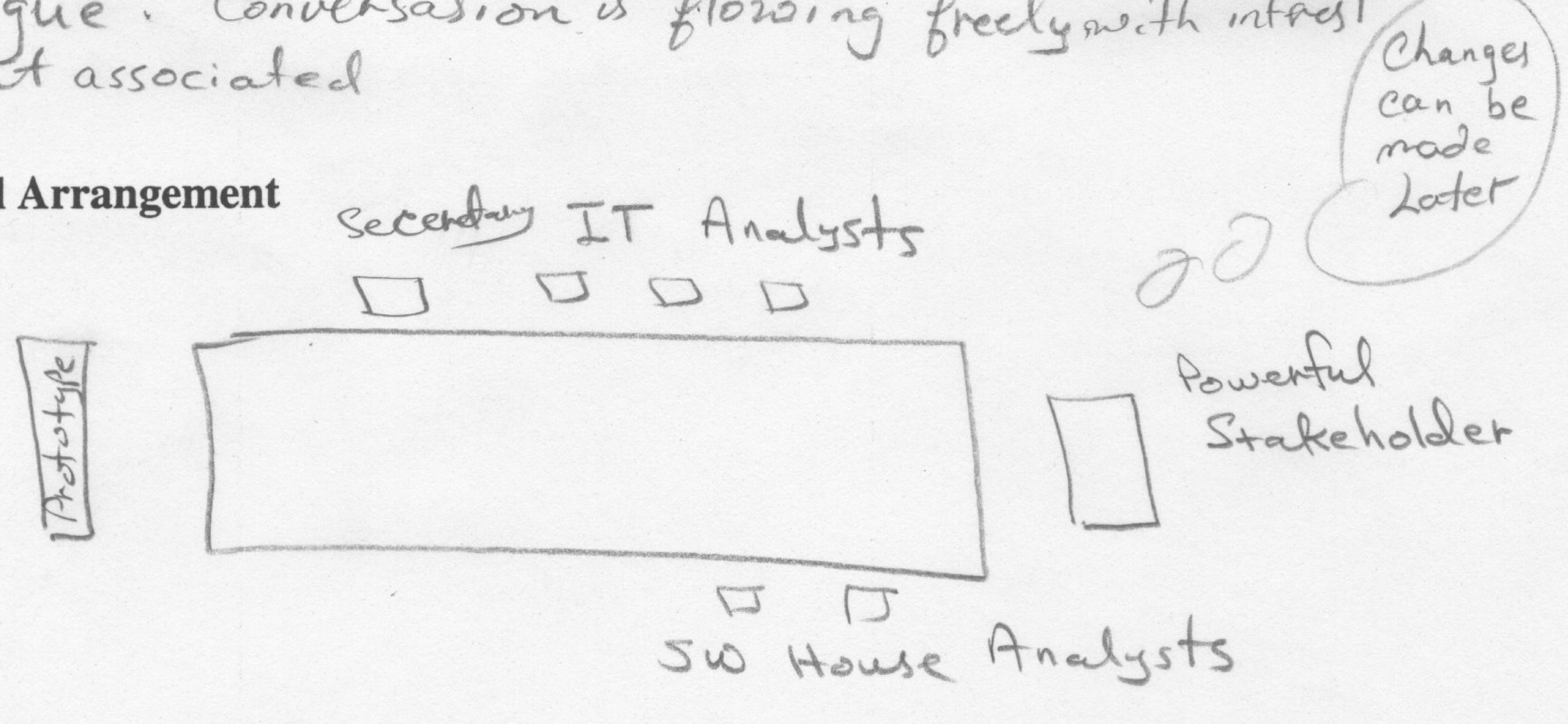
Collaborative Arrangement

The Director of the FP department could not agree with staff needs. Issues were raised to a stakeholder with more Power influence. IT staff, SW House analysts meeting to conclude RC collected.

Representation of activity

The activity of collaboration is through open dialogue. Conversasion is flowing freely with intrest evident associated

Ecological Arrangement



Collaboration Technique

Face to face communication, open dialogue reflected

Use of Prototype aided the process. Having empowerment Made things associated to RC defenitive.

Community of Use

IT Staff , Facilitator

Successor

Knowledge Sharing

Name Dialogue Leads to Knowledge Sharing

Vignette Number: 2

FP

Predecessor

Increase Intrest, Homegeneity

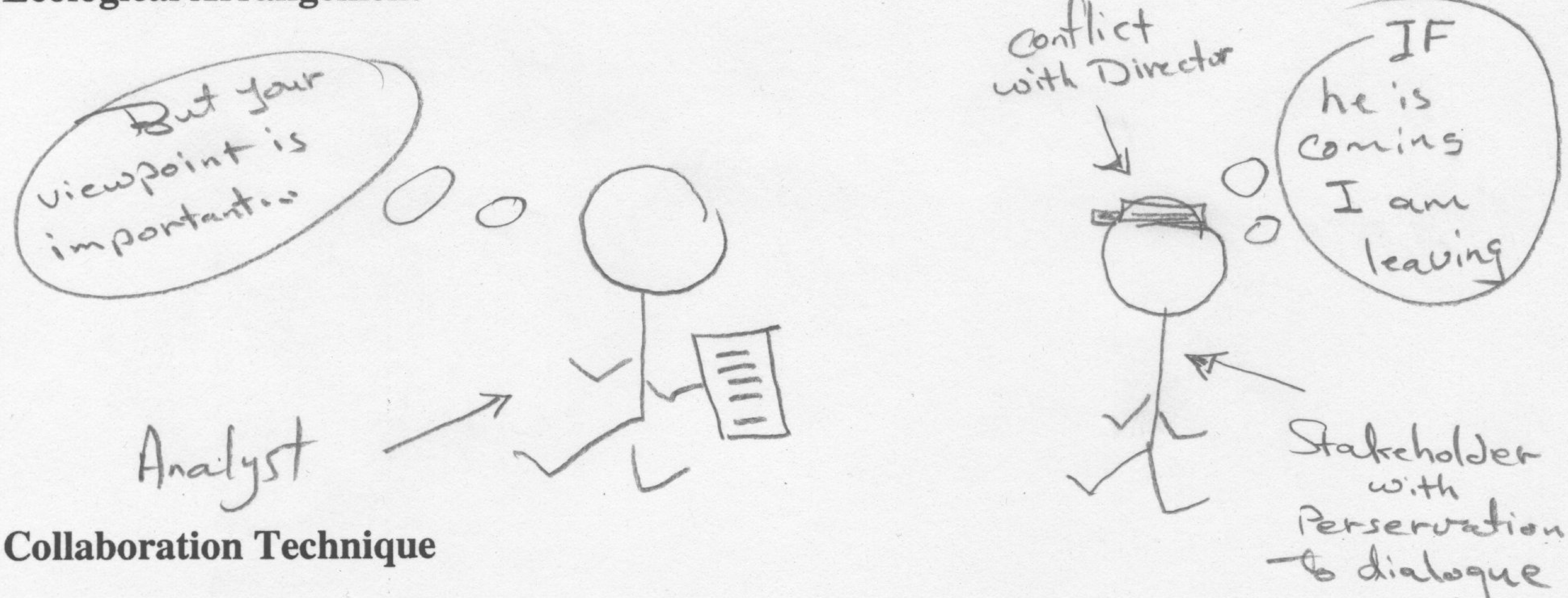
Collaborative Arrangement

FP Director meeting with IT & SW House Analysts to discuss Requirements. A specific stakeholder makes implications that he will leave if a specific stakeholder will attend. Issues concerning dialogue are raised.

Representation of activity

Negotiation with important stakeholder to attend the RC meeting done through dialogue

Ecological Arrangement



Collaboration Technique

Face to Face

Community of Use

IT Staff

Successor

Increase Knowledge Sharing

Name

Empowerment Increases Intrest

Vignette Number: 1

IT

Predecessor

Role Knowledge Increases Empowerment

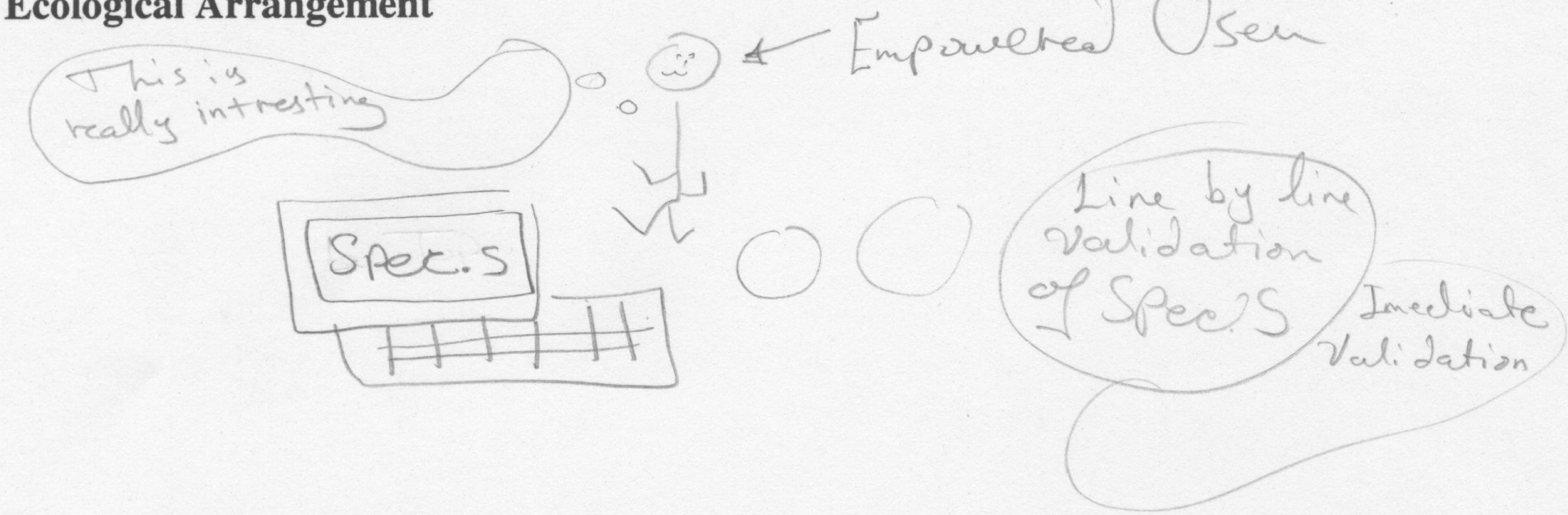
Collaborative Arrangement

IT staff negotiating with SW house analyst
Req. of specific control division

Representation of activity

The stakeholder is empowered to negotiate and decide on Req.

Ecological Arrangement



Collaboration Technique

Lap top used to present previous req.s and validate & modify each one

Community of Use

IT Analyst

Successor

Intrests Lead to Dialogue

Name

Empowerment Increases Intrest

Vignette Number: 2

Ministers Office

Predecessor

Role Knowledge Increases Empowerment

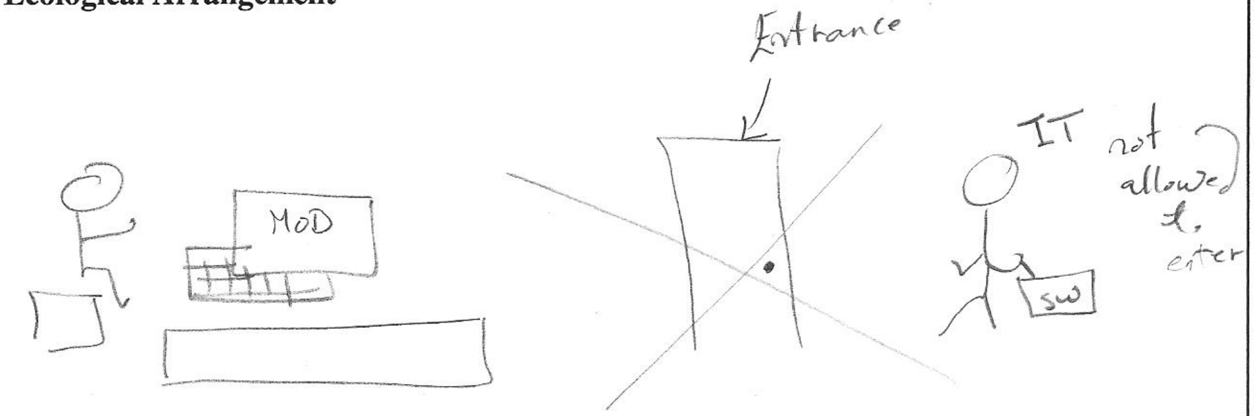
Collaborative Arrangement

IT staff installing an early version of the SW. At the Minister Office and Secreterial Dept. Users resisting IT staff to work on PC's

Representation of activity

For security reasons, users whre not impowered to allow staff to proceed. They had no intrest to listn to what IT staff are saying

Ecological Arrangement



Collaboration Technique

Negotiation through dialogue. No reselts. Military Personality of users (following order of superiors) stopped them from being intrested to even listn.

Community of Use

Analyst

Successor

Intrests Lead To Dialogue

Name Empowerment Increases Intrests

Vignette Number: 3

الحاتج باطاج

Predecessor

Role knowledge Increases Empowerment

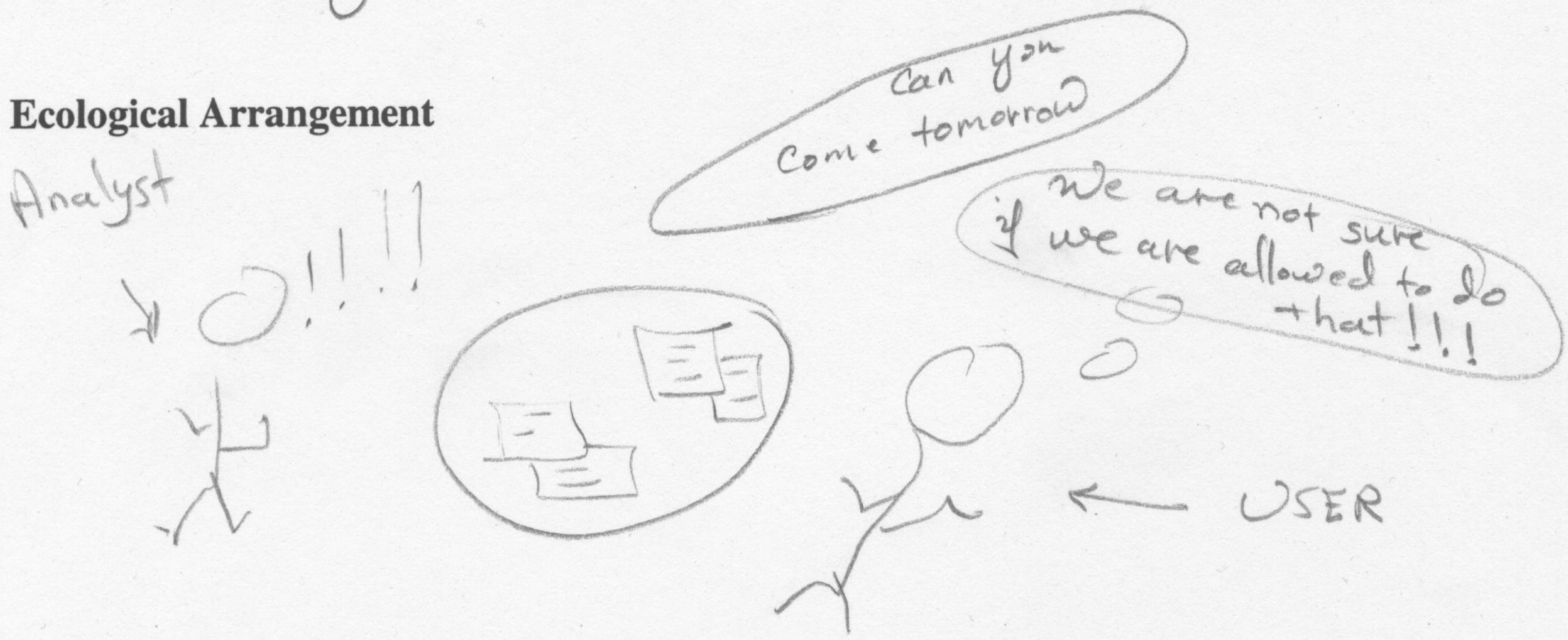
Collaborative Arrangement

2nd Session in collecting requirements from user in dept. but still users are not sure if they are allowed to ask for what they need. (Users, IT staff, SW developer)

Representation of activity

Not having impowerment make them loose intrest to continue negotiation

Ecological Arrangement



Collaboration Technique

Negotiation of Req. through dialect, Previous collected requirements documentation circulated

Community of Use

Analyst

Successor

Intrests lead to Dialogue

Name

Facilitator Involvement Effects Interpretation

Vignette Number: 1

FP

Predecessor

Modification of Specs

Collaborative Arrangement

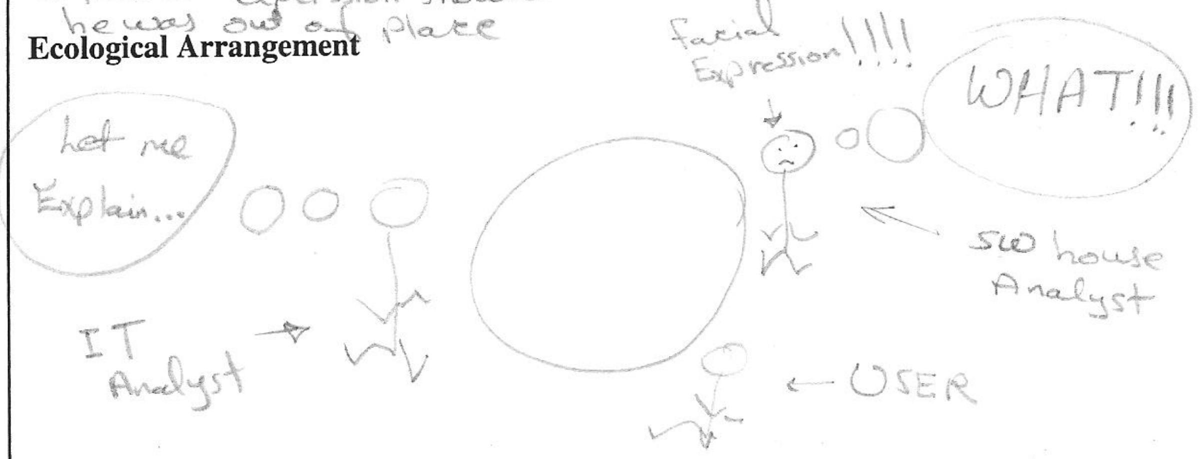
IT & SW developer IT engaged in RC with users. Diffence in accent is affecting knowledge transfer No Facilitator involved

Representation of activity

Accent of users not familiar to analysts. IT analyst interevented and took the role of facilitator instinctivly.

⇒ facial experssion showed he was out of place

Ecological Arrangement



Collaboration Technique

Further explaination through direct face-to-face

Community of Use

Facilitator

Successor

Modification of Specs.

Name

Facilitator Involvement Effects Interpritation

Vignette Number: 2

FP

Predecessor

Modification of Specs

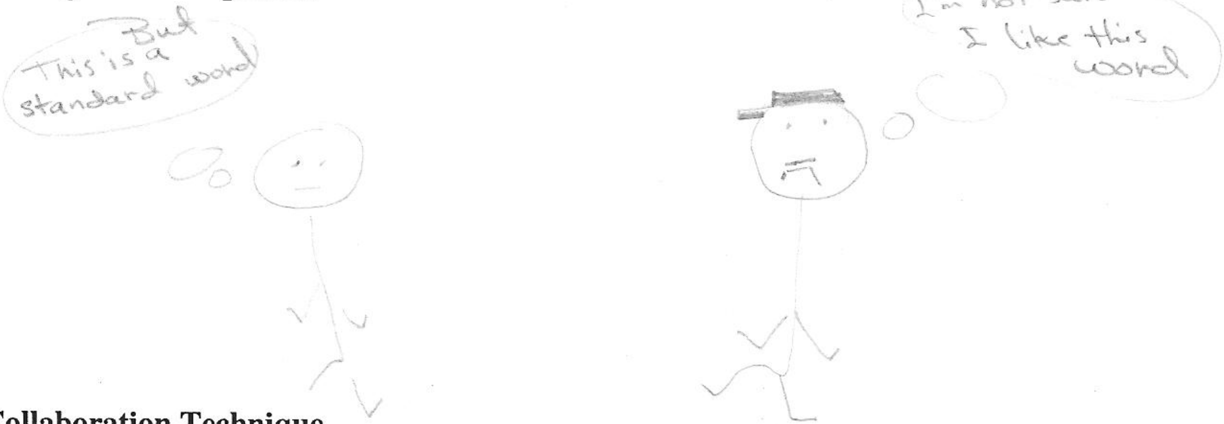
Collaborative Arrangement

FP Manager, IT & SW house analyst discussing a final version of the prototype. A specific word is not appreciated by the user. The analyst interprets the meaning of this word in relation to SW process

Representation of activity

The IT Analyst steps in and tries to interfere, the manager does not understand

Ecological Arrangement



Collaboration Technique

Use of Prototype

Negotiation & dialogue, Facilitator skill in communication can avoid conflict between user & SW developer analyst

Community of Use

Facilitator

Successor

Modification of Specs.

Name

Facilitator Involvement Effects Intepritation

Vignette Number: 3

Puplic Relations

Predecessor

Modification of Specs

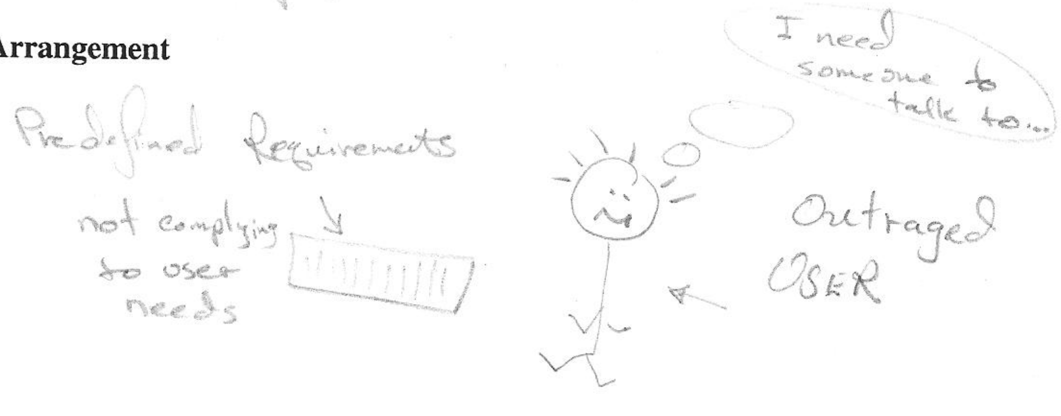
Collaborative Arrangement

User surprised with a set of requirements written in a documentation she was required to state whether they satisfy their needs

Representation of activity

User is outraged ... requirements predefined do not represent their needs... Makes lots of contacts to reach someone responsiple in IT dept.

Ecological Arrangement



Collaboration Technique

User gets in contact with IT Staff... User needs a personal contact rather then a set of predefined req
Facilitat involvement was needed to ensure propper interpritation

Community of Use

Facilitator, Project Manager

Successor

Modification of Specs.

Name Good Shared Experience

Vignette Number: 1

CASE 8 IT / operation

Predecessor

Knowledge Sharing

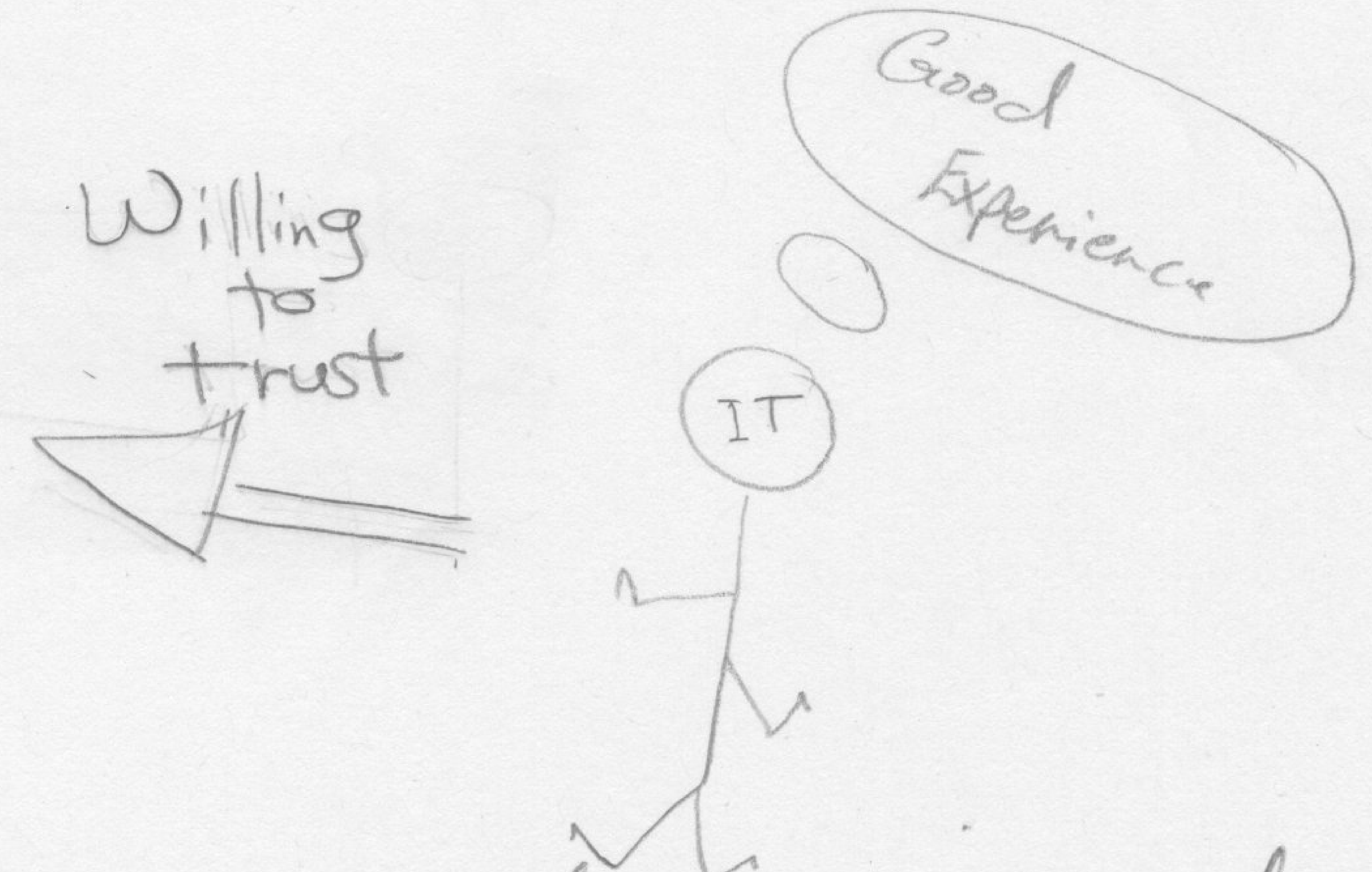
Collaborative Arrangement

IT staff in a session with SW house analyst to discuss the requirements of the IT Dept. work flow. A prototype is used. Previous req. where given by another staff befor heads of staff were rotated

Representation of activity

IT staff already has an accumilated good perception of what the new system would do. IT staff collaborating freely. Trust between IT staff and analyst increasing.

Ecological Arrangement



Collaboration Technique

IT staff and analyst share the vision & goal of of system. This makes collaboration maximum, The more they share info, the more the IT is willing to trust the analyst, even though the actual req. were elicited by other employees

Comunity of Use

Analyst

Successor

Increase Trust Built

Name Good Shared Experience

Vignette Number: 2

CASE: العلاج بالخارج (Treatment Uboard)
T.U.

Predecessor

Knowledge Sharing

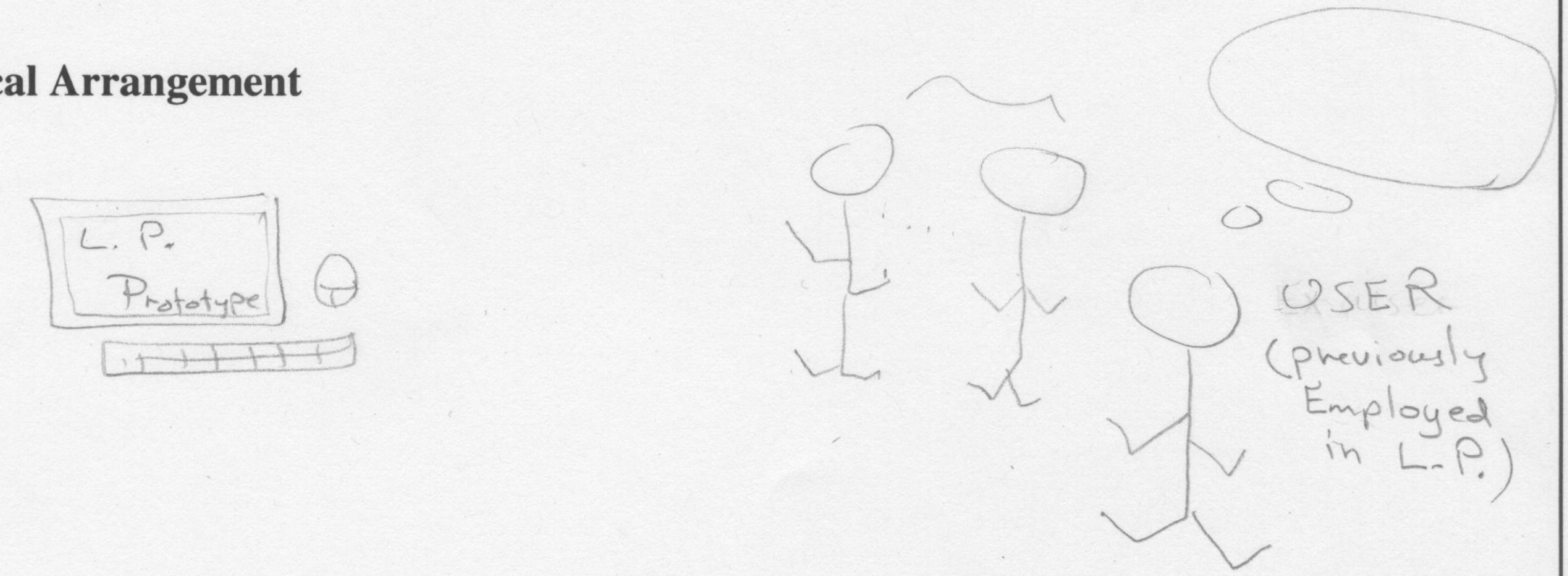
Collaborative Arrangement

Group of users, analyst & IT staff in a session for requirement collection. Req. old document used. A prototype of another department was used.

Representation of activity

The sw analyst wants to collect requirements from users. They want to gain thier trust to get the requirement info.

Ecological Arrangement



Collaboration Technique

The analysts started by showing the T.U. users a final version of a prototype for the (L.P.) Dept., by coincidence, one user used to work in that department. Her enthosiasum of how the prototype reduces & fastens the work she used to do made the other users trust the analysts more.

Comunity of Use

Analyst, IT staff

Successor

Increase Trust Built

Name Good Shared Experience

Vignette Number: 3

CASE: National Assembly

Predecessor

Knowledge Sharing

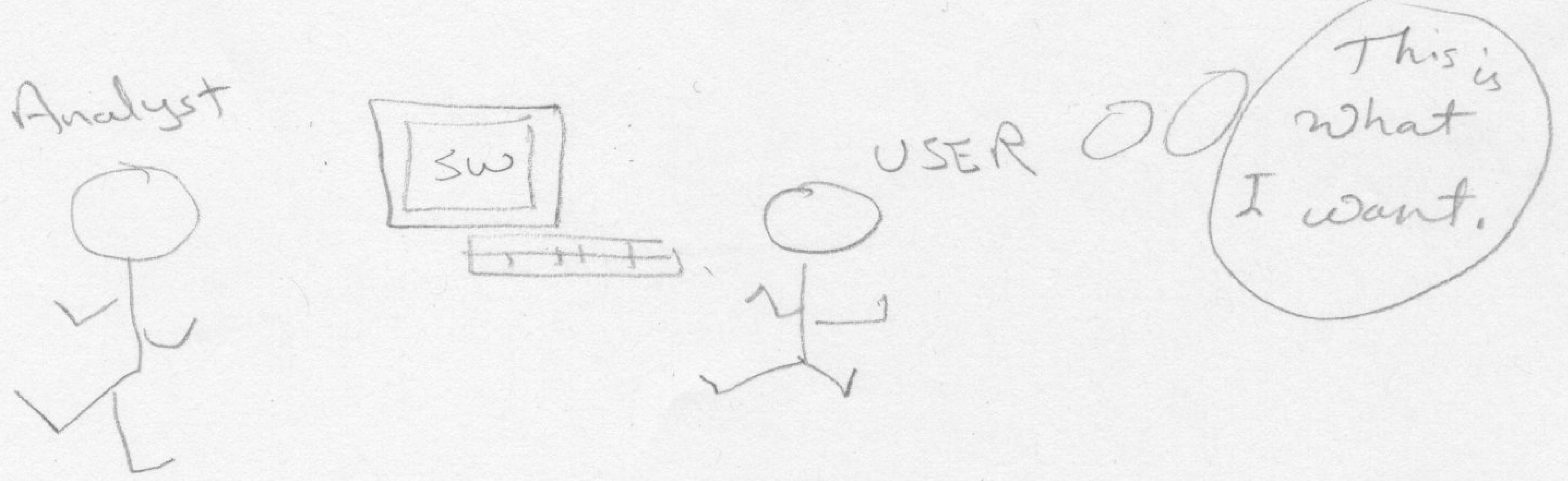
Collaborative Arrangement

Analyst and user getting together to start requirement collection. A current software is used as a benchmark by the user

Representation of activity

User shows the analyst a software he is presently using successfully. Some minor difficulties are expressed.

Ecological Arrangement



Collaboration Technique

Current SW used by the user acts as a medium to share the knowledge, his good experience increases the trust in future systems.

Comunity of Use

Successor

Increase Trust Built

Name

High Collaboration Reduces Modifications

Vignette Number: 4

National Assembly

Predecessor

Modification of Specs

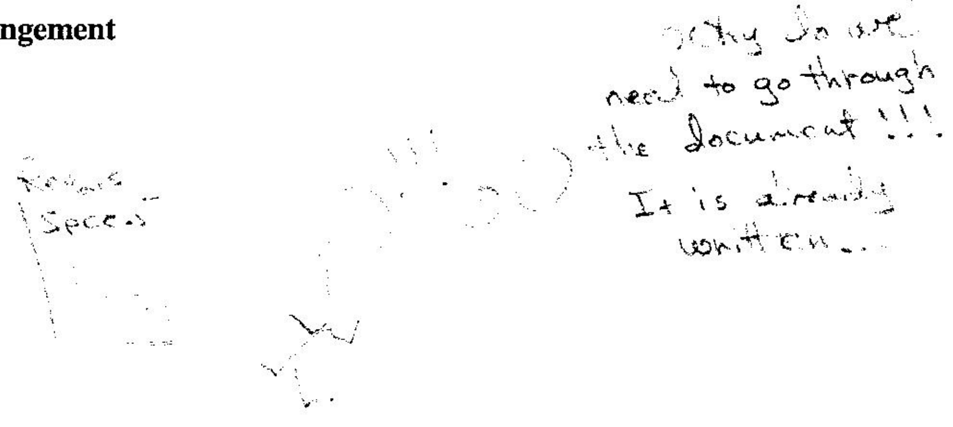
Collaborative Arrangement

IT & OO developer analysts meeting with head of Dept to validate a set of previously requirements

Representation of activity

higher collaboration on the part of the user in Req. Elicitation reduces the modification in later stages

Ecological Arrangement



Collaboration Technique

Requirement specification used to validate previously set requirements. Investing in dialogue to convince user to collaborate more to avoid changes in future.

Community of Use

Analyst

Successor

Modification [illegible]

Name

High Collaboration Reduces Modification

Vignette Number: 2

IT

Predecessor

Modification of Specs

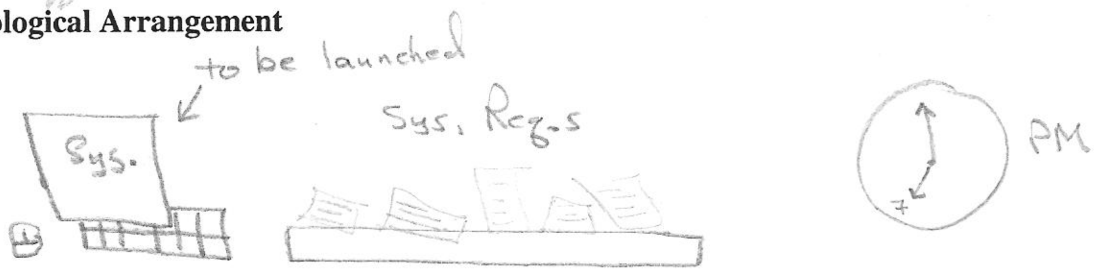
Collaborative Arrangement

IT analysts working after hours to audit specs collected from users against the last version of SW to be launched

Representation of activity

IT analysts working after hours, there is an uncertainity of being paid for their effort. Previous encounters have not affected their dedication

Ecological Arrangement



Collaboration Technique

IT Analysts working after hours to meet deadline for system launch.

Community of Use

Management

Successor

Modification of Specs

Name

High Collaboration Reduces Modification

Vignette Number: 3

General Affairs

Predecessor

Modification of Specs

Collaborative Arrangement

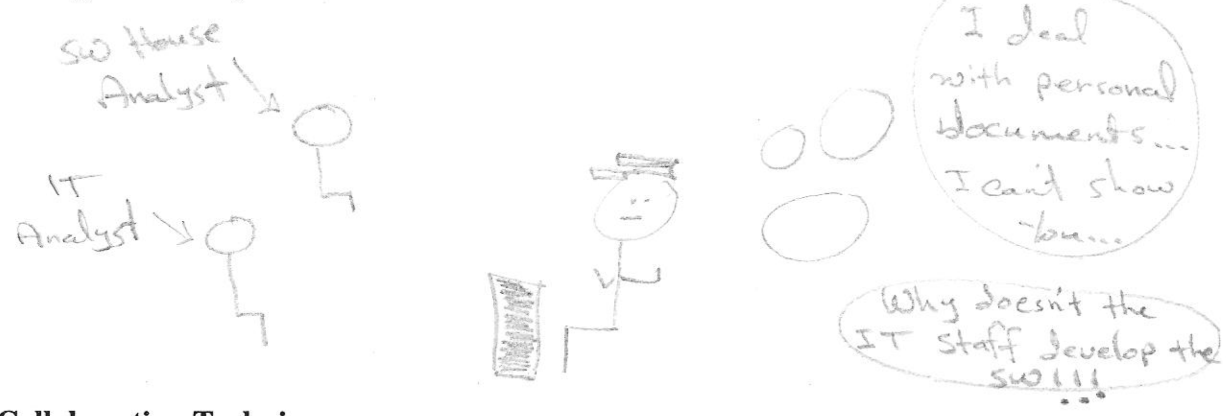
Dept. Manager meeting with IT & SW house developer in his office. Meeting was not scheduled in advance.. it was fit into schedule the same day..

Representation of activity

Dept. Manager was aggresive at first more appreciative and understanding as the meeting progressed... Confused why KHOD needs an outside SW developer...

(Military Personality Stereotype)

Ecological Arrangement



Collaboration Technique

Personal relation between IT/controller & Dept. Manager made the meeting possible in the same day...

Face-to-face meeting, dialogue made manager more understanding & willing to collaborate ... But not to the extent of total collaboration.

Community of Use

Facilitator

Successor

Modification of Specs

Name Increase Collaboration

Vignette Number: 1

CASE: F.P.

Predecessor

Requirement Consensus, knowledge Sharring

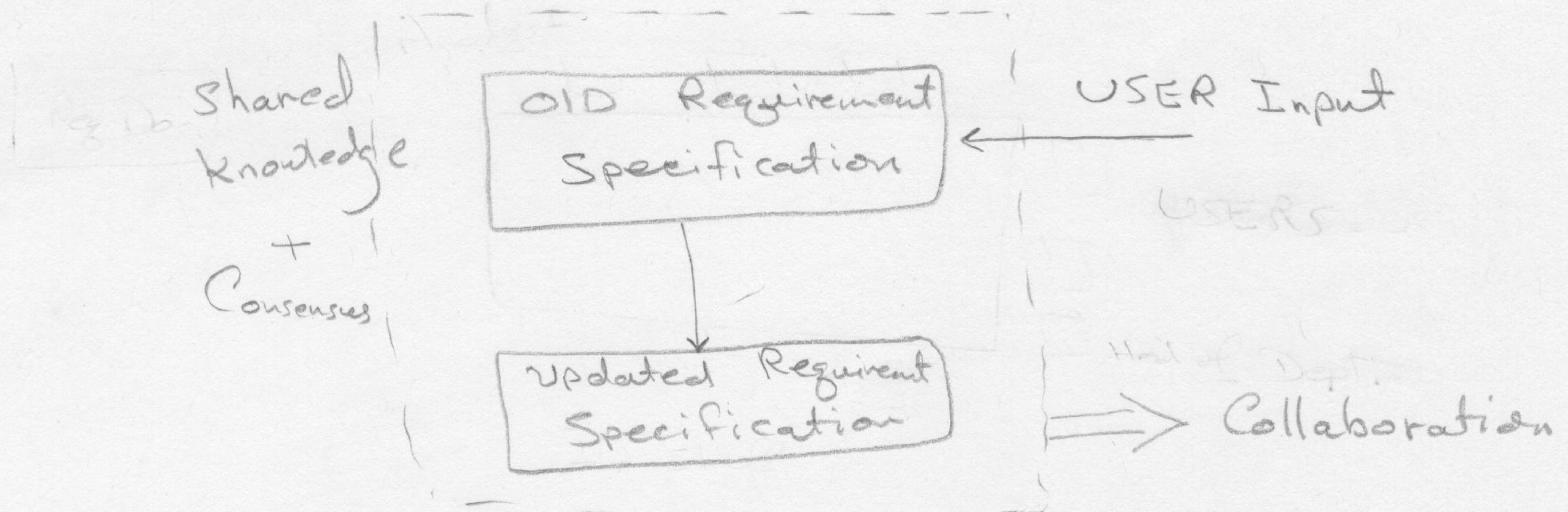
Collaborative Arrangement

Analyst, IT staff and users sit togather to discuss requirements. A previous requirement documentation is used as a starting point, given in hardcopy and presented by a datashow.

Representation of activity

The old document of requirement acted as a base for knowledge and information that is to be discused. Each requirement needs to be discussed.

Ecological Arrangement



Collaboration Technique

The old requirement document presented on a datashow has been used as a tool to facilitate requirement collection. Old specifications were validated, updated and new ones have been added.

Comunity of Use

Analyst, IT Staff in preliminary phase of Req. Col.

Successor

Requirement Consensus

Name Increase Collaboration

Vignette Number: 2

CASE 8 Technical Office

Predecessor

Requirement Consensus, Knowledge Sharing

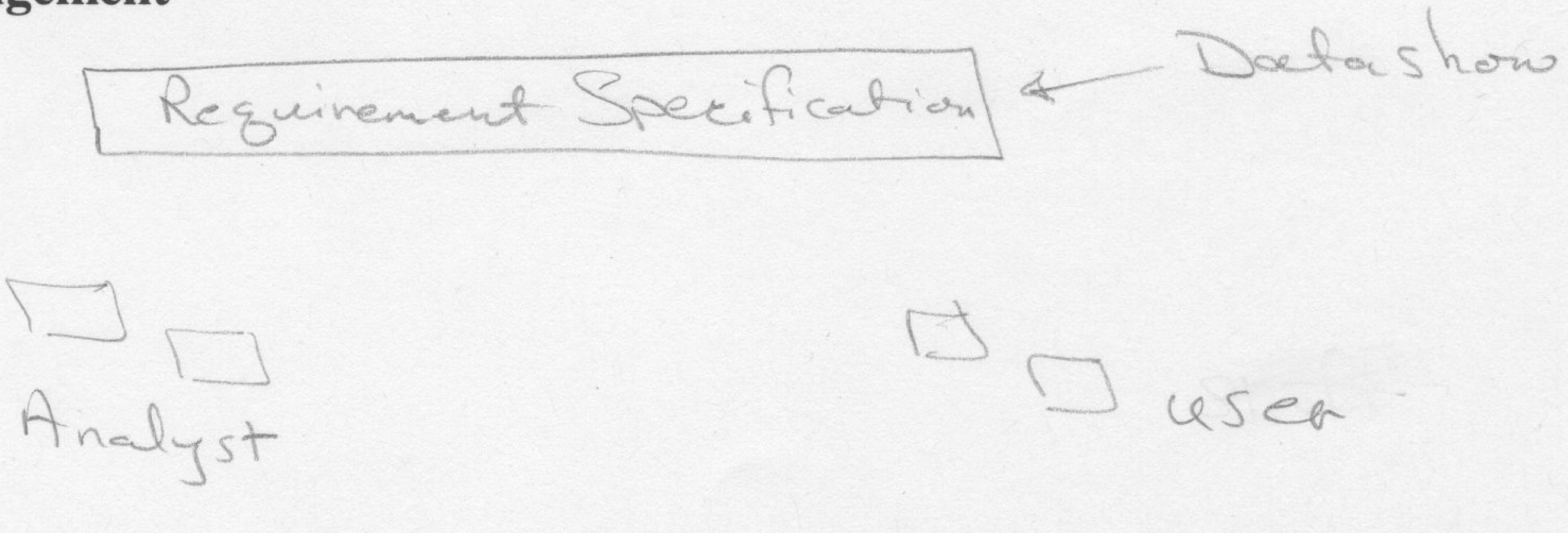
Collaborative Arrangement

SW Analyst, IT staff (Technical Office). An old document specification in paperformat and presented by a datashow

Representation of activity

A datashow is used to present an old requirement specification. Analysts and users (also IT staff). No hardcopies were used.

Ecological Arrangement



Collaboration Technique

The datashow presenting the requirement specification acted as a medium to transfer knowledge. It acts as a motivation tool to start requirement elicitation.

Comunity of Use

Preliminary phase of Req. Spec. by analysts & IT staff.

Successor

Requirement Consensus

Name Increase Collaboration

Vignette Number: 3

CASE: National Assembly

Predecessor

Requirement Consensus, Knowledge Sharing

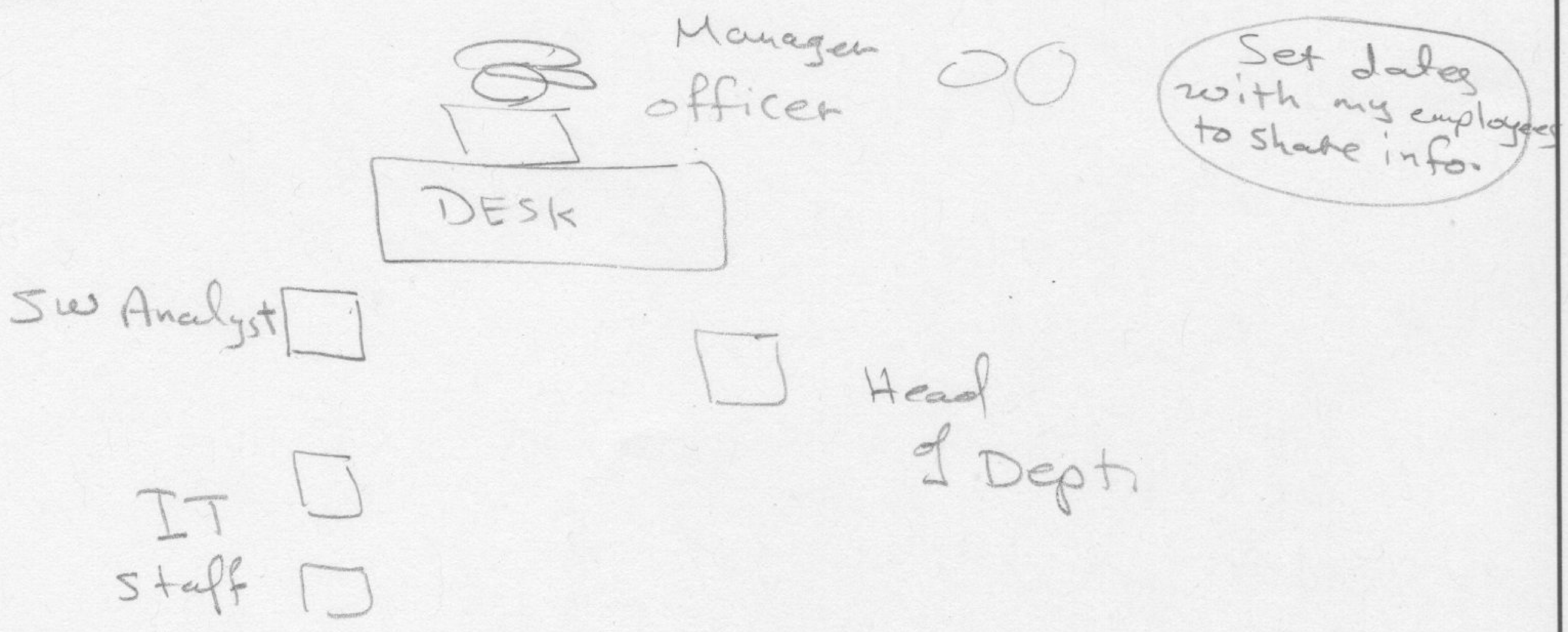
Collaborative Arrangement

The manager of the sector, head of department, analyst & IT staff. One Req. document with analyst, he reads it out load for the manager.

Representation of activity

Manager validates, changes and adds Req. Hes gives information and asks Head of Dept. to contribute more info.
He plans other session to share info with Dept. employees

Ecological Arrangement



Collaboration Technique

Sharing information between manager & Head of Dept. boosted the requirement collection. Requirement OID document acted as a medium of shared info.

Comunity of Use

Req. Collection. Analyst + IT staff.

Successor

Requirement Consensus

Name Increase Trust Built

Vignette Number: 1

CASE: Legal Affair

Predecessor

Good Shared Experience, Bad Shared Experience

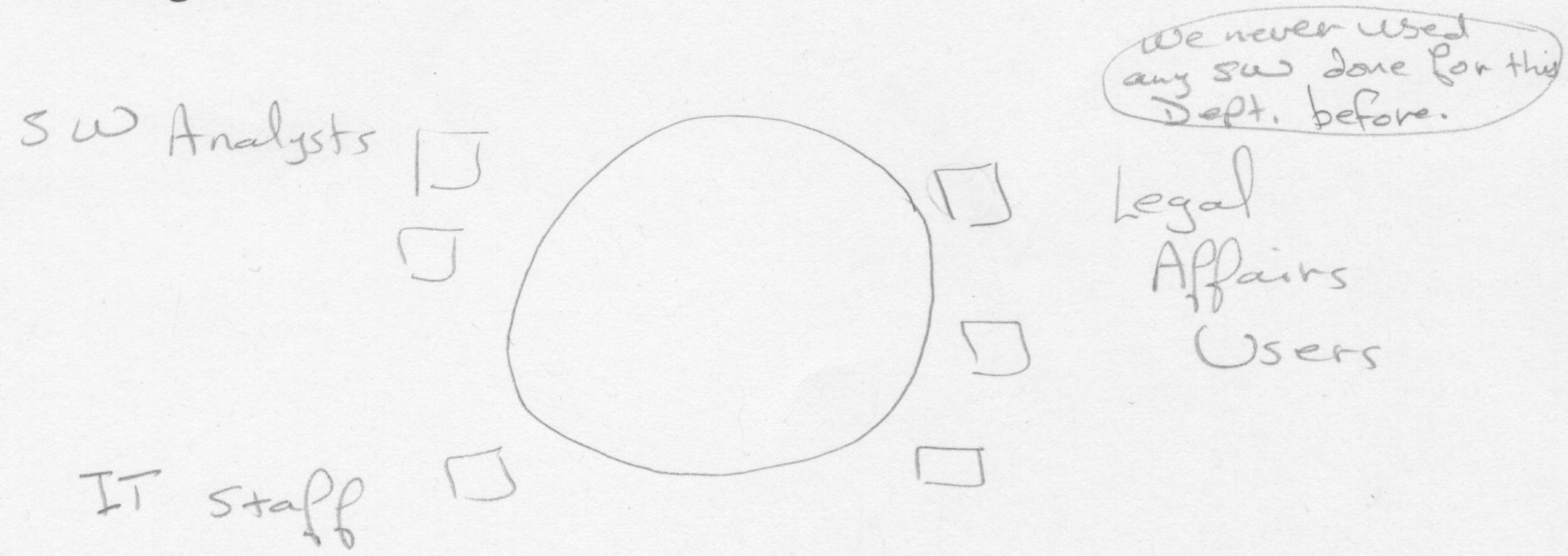
Collaborative Arrangement

SW Analyst, IT staff and legal affairs user in a session (preliminary) for req. collection in a small meeting room.

Representation of activity

Analysts need to gain the trust of users in order for them to open up and collaborate. The users own experience (Good or Bad) has a direct affect.

Ecological Arrangement



Collaboration Technique

SW Analysts started talking about a system that is designed for another organization. The features of the systems made the users more relaxed. However they are still in doubt

Comunity of Use

SWAnalyst, IT staff, facilitator

Successor

Knowledge Sharing

Name Increase Trust Built

Vignette Number: 2

CASE: IT Dept

Predecessor

Good Shared Experience, Bad Shared Experience

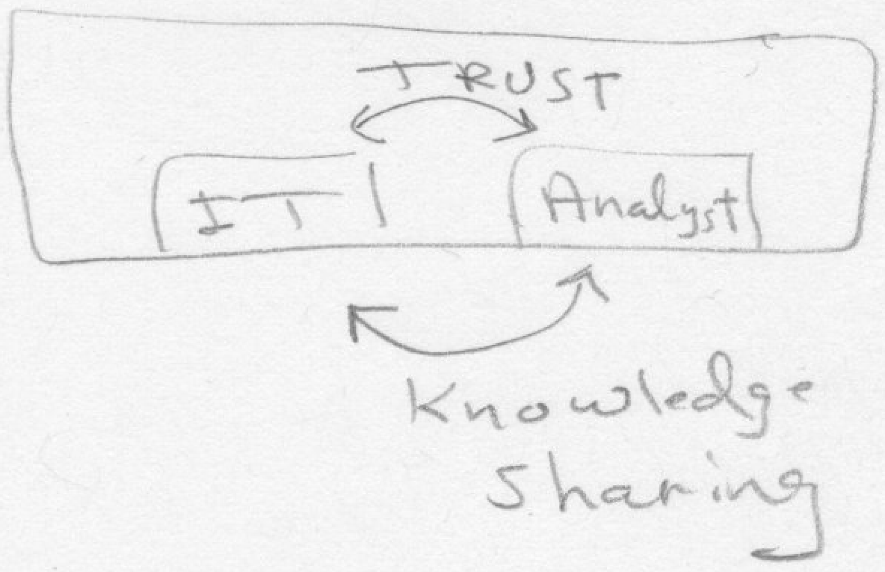
Collaborative Arrangement

IT users and analyst discussing department requirement. OLD requirement documents used to make changes on.

Representation of activity

IT staff needs to discuss department needs and work procedures to the analyst, using the Req. doc. There is already an amount of trust between the analyst and the IT staff.

Ecological Arrangement



Collaboration Technique

IT staff willingly states his needs and work procedure to the analyst. An initial amount of trust is between them. As the two interact and share information the trust between them increases.

Comunity of Use

SW Analyst, IT Staff, facilitator

Successor

Knowledge Sharing

Name Increase Trust Built

Vignette Number: 3

CASE: Ministers Office

Predecessor

Good Shared Experience, Bad Shared Experience

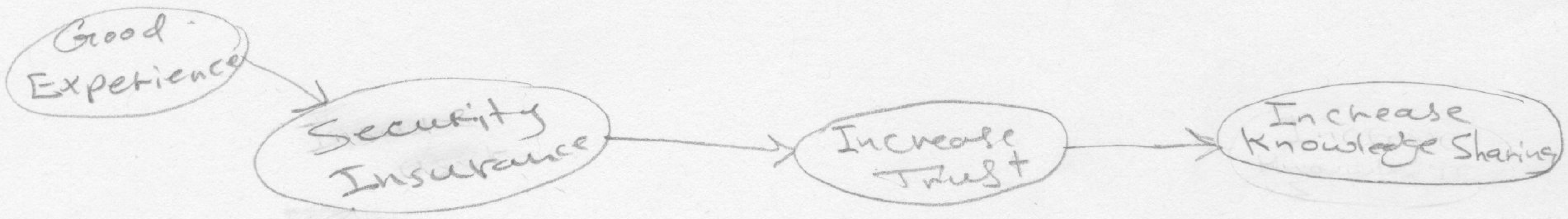
Collaborative Arrangement

Head of Ministers office, in meeting with IT staff and SW company staff.

Representation of activity

IT and SW company staff want to gain approval from head of ministers office to be granted access to employees.

Ecological Arrangement



Collaboration Technique

Head of Ministers office starts by expressing his security worries. He is demanding a seperate server with no connection to others. IT staff by dialogue and by sharing their experience of successful security access, made him increase his trust in the system

Comunity of Use

SW Analyst, IT staff, facilitator

Successor

Knowledge Sharing

Name Intrests Leed to Dialogue

Vignette Number: 1

National Assembly

Predecessor

Increase Intrest

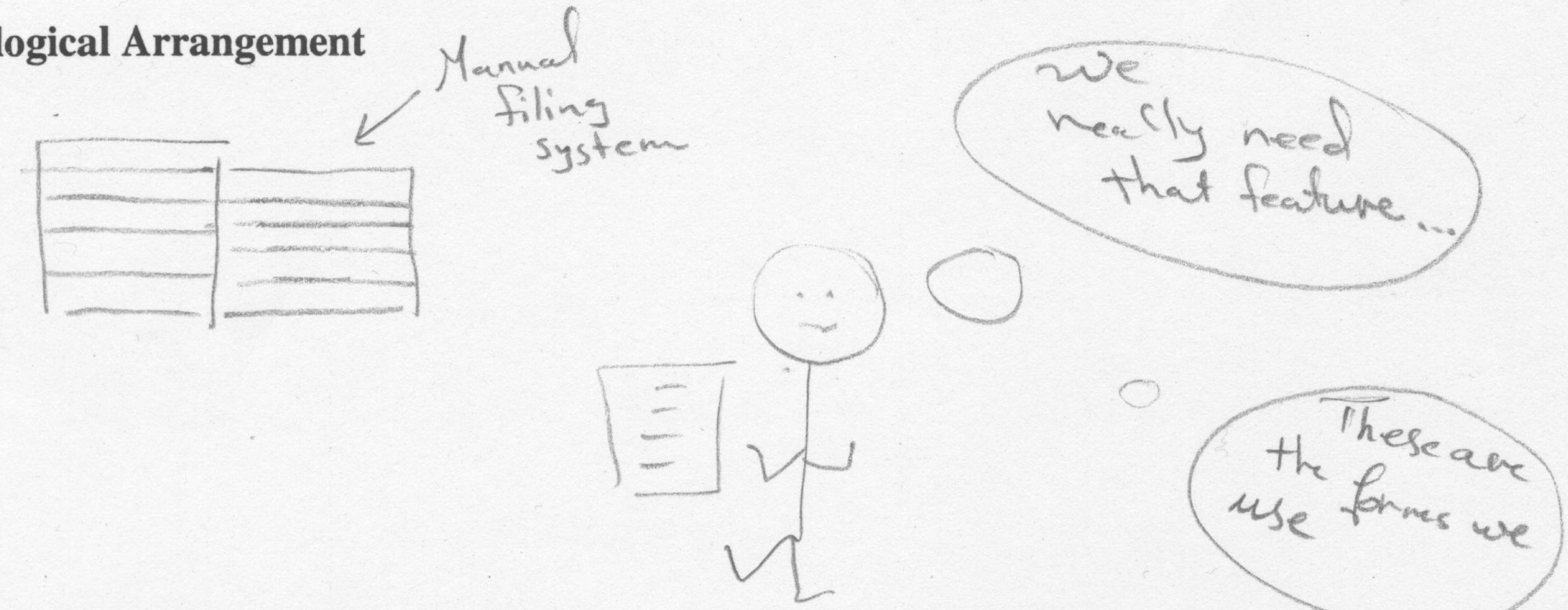
Collaborative Arrangement

knowledgeble user with SW & IT, very intrested with the meeting for RC. Analyst questioning them about thier work process.

Representation of activity

Observation of what the users do for thier daily tasks
Users describing ethousiematicly what they usually do

Ecological Arrangement



Collaboration Technique

Dialogue & observation

Community of Use

IT Staff, Facilitator

Successor

Dialogue leads to ~~These~~ knowlodge Sharing

Name

Intrests Leeds to Dialogue

Vignette Number: 3

Financial

Predecessor

Increase Intrest, Homegeneity

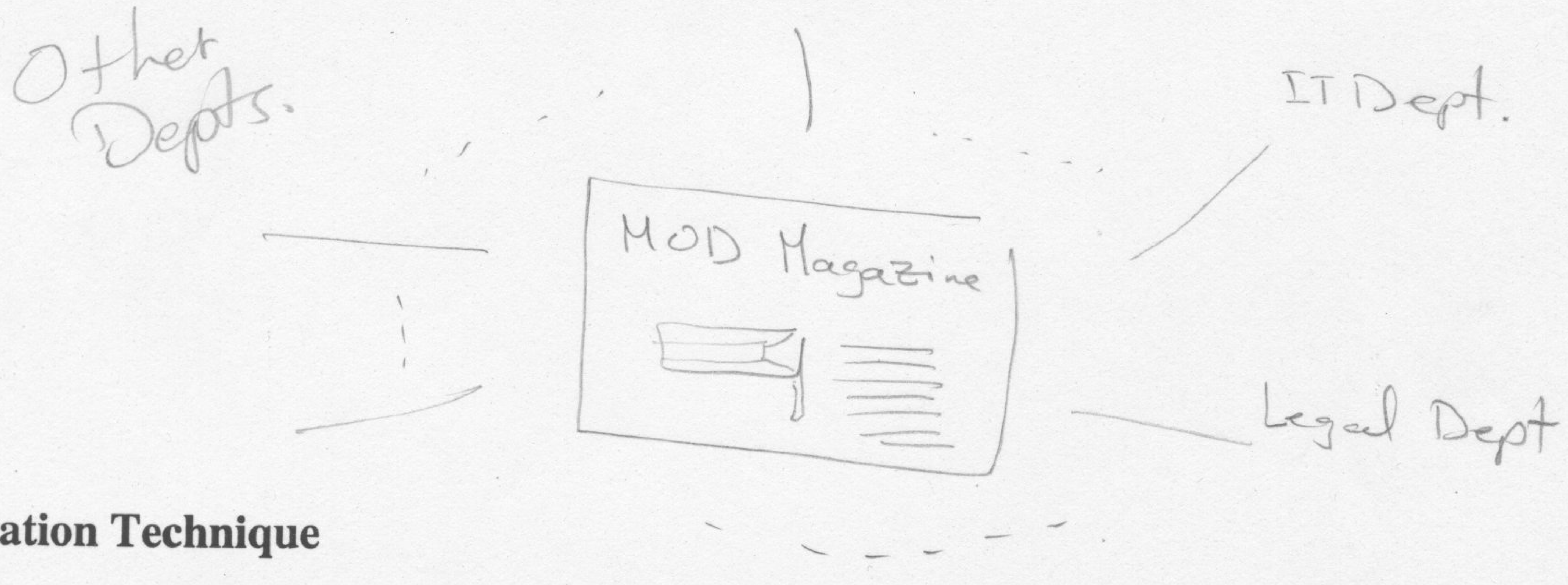
Collaborative Arrangement

MOD Magazine, distributted to all MOD employees focusing on specific departments, their goals, responsibilities knowing what is going on in other departments increases intrest

Representation of activity

Sharing documents related to job description & department perspectives through Periodical Publications

Ecological Arrangement



Collaboration Technique

Distribution & Through Sharing Documents

Community of Use

IT Staff, Facilitator

Successor

Increase knowledge Sharing

Name Intrest Leeds to Dialogue

Vignette Number: 2

FP.

Predecessor

Increase Intrest

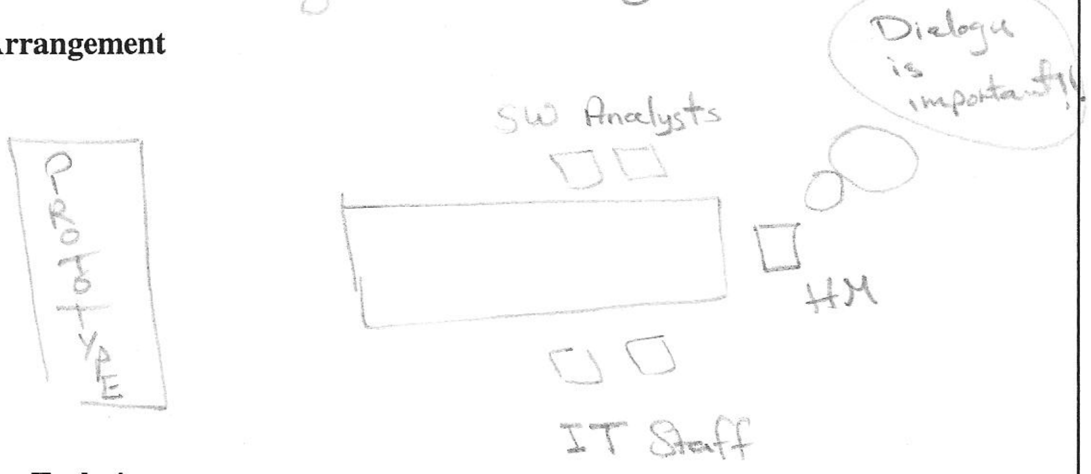
Collaborative Arrangement

IT & SW house discussion with higher Management of FP dept. to resolve a dispute regarding Req. of dept.

Representation of activity

Undersecretary intrested to make the project successfull his relation with the Planning Sector of the state & his background in IT reflects his dialogue with analysts.

Ecological Arrangement



Collaboration Technique

Dialogue through dialect is the main collaboration technique used.

Prototype was secondary in this time

Community of Use

IT Staff, Facilitator

Successor

Dialogue leads to Knowledge Sharing

Name Knowledge Sharing

Vignette Number: 1

CASE 8 National Assembly

Predecessor

Better Communication, Increase Trust Built

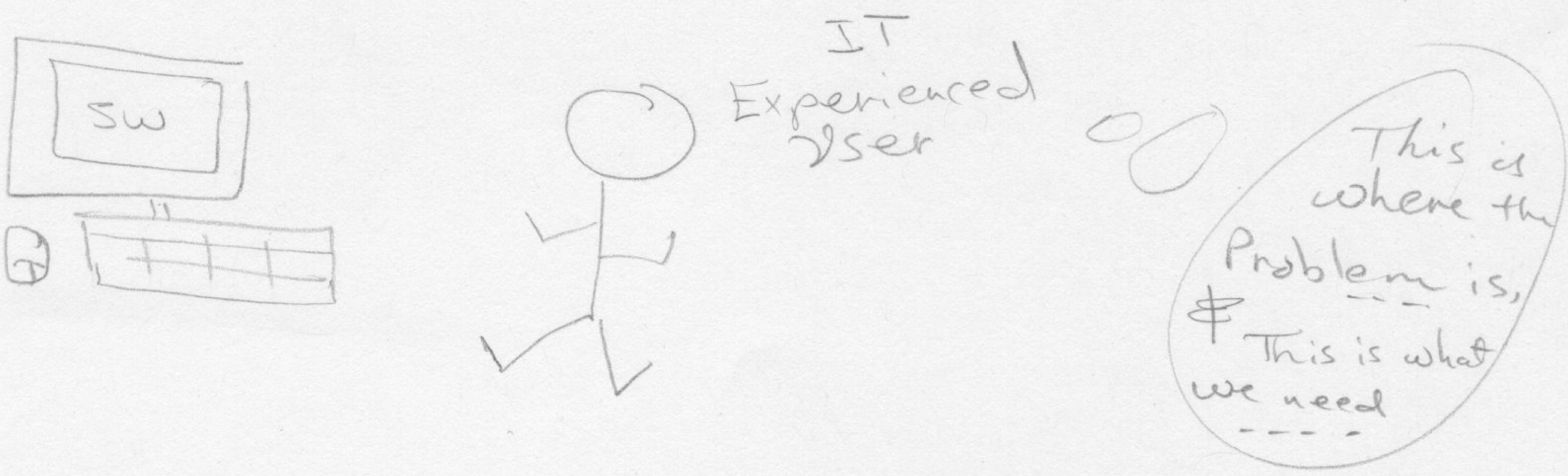
Collaborative Arrangement

IT staff, analyst, user and an IT expert user from the same department. Group expecting users to give info of data flow and procedures.

Representation of activity

Experienced IT user showing analyst occuring problems auf current system, what needs to be done to make work more efficient.

Ecological Arrangement



Collaboration Technique

IT expert user made the transition of knowledge faster between the analysts & other users. He knew that the system will make work easier and managed to convince the employees because he used to make small programs for them that made thier work faster and easier.

Comunity of Use

Successor

Increase Collaboration, Bad Shared Experience, Good Shared Experience

Name

Knowledge Sharing

Vignette Number: 2

CASE 8 Legal Affairs

Predecessor

Better Communication, Increase Trust Built

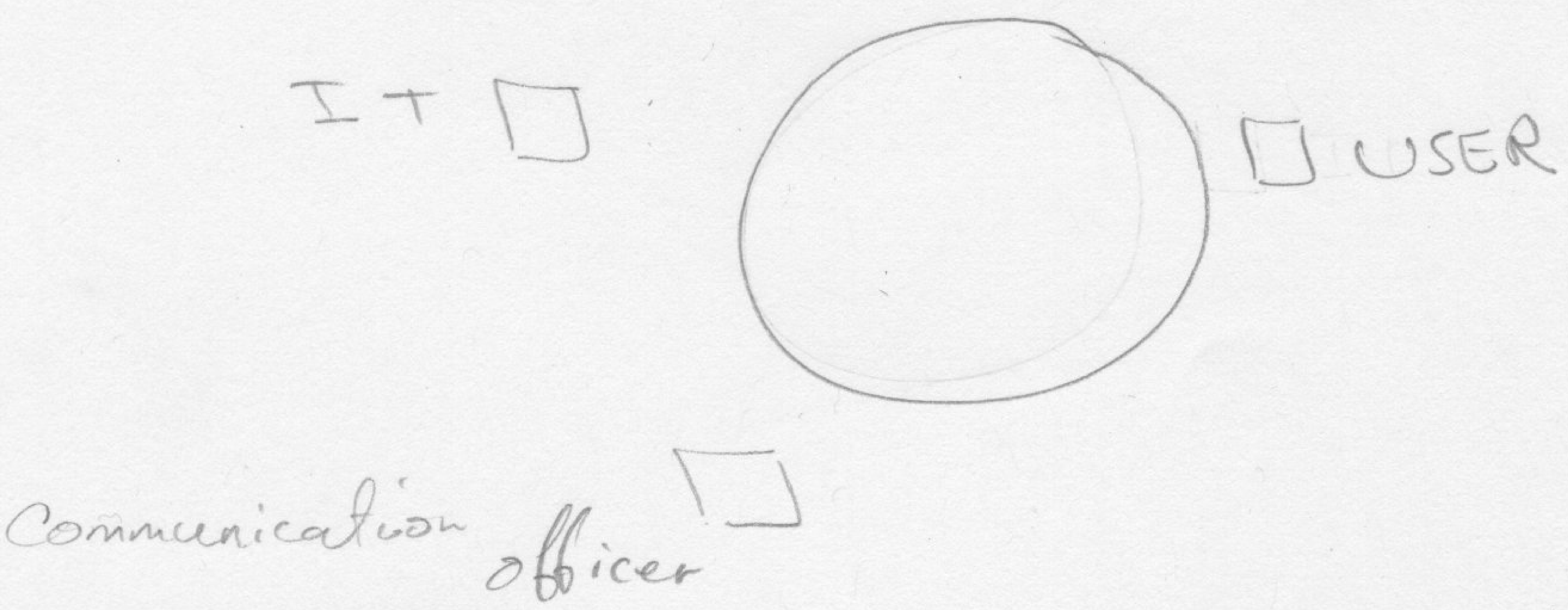
Collaborative Arrangement

Legal affairs users, IT staff, and communication officer
Negotiation made for req. collection. Users hesitating to collaborate due to previous experience in older projects.

Representation of activity

IT staff negotiating with user to locate time to sit with SW analyst to give information for requirements.

Ecological Arrangement



Collaboration Technique

IT staff presented to the user the qualifications of the SW House, he made reassurances that the new system will be beneficial

Comunity of Use

Scheduling, Planning

Successor

Increase Collaboration, Bad Shared Experience, Good Shared Experience

Name Knowledge Sharing

Vignette Number: 3

CASE: National Assembly

Predecessor

Better Communication, Increase Trust Built

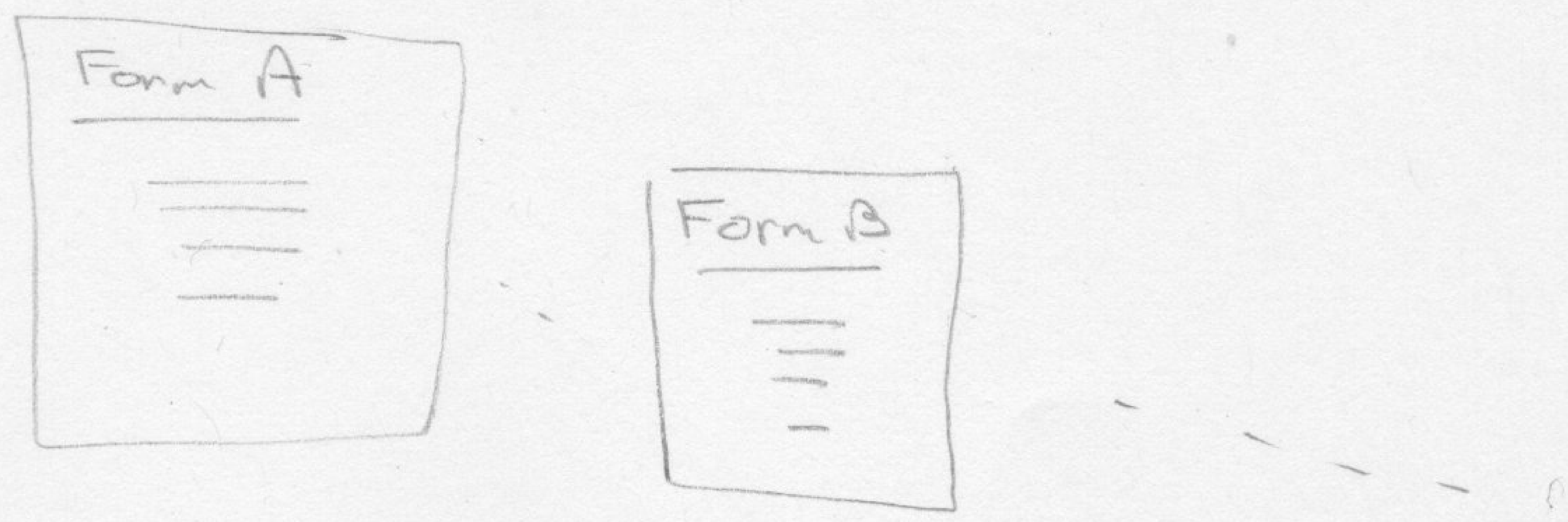
Collaborative Arrangement

Analyst, IT staff and user discussing the requirements required. Requirement Doc. was used to elicite info.

Representation of activity

Analyst started out by asking strategic questions. Reading sections from old req. doc., Analyst asking for current empty & filled templates

Ecological Arrangement



Collaboration Technique

Forms and templates were used to share knowledge between user & analyst. It was used as a mean for better communication.

Comunity of Use

Analyst and user

Successor

Increase Collaboration, Bad shared Experience, Good Shared Experience

Name

More Commitment

Vignette Number: 1

CASE: F.P.

Predecessor

Clear Awareness

Collaborative Arrangement

A Communication officer changes durring the course of the project.

Representation of activity

Communication officer of a department is aware of how vital the project is, and his commitment leads to better communication.

Ecological Arrangement

Collaboration Technique

A new communication officer in the middle of the project disturbes the balance of the scheduling process. Caution should be taken before proceeding with such action.

Community of Use

Manager, Head of Dept

Successor

Better Communication

Name More Commitment

Vignette Number: 2

CASE: F.P. Ministers Office

Predecessor

Clear Awareness

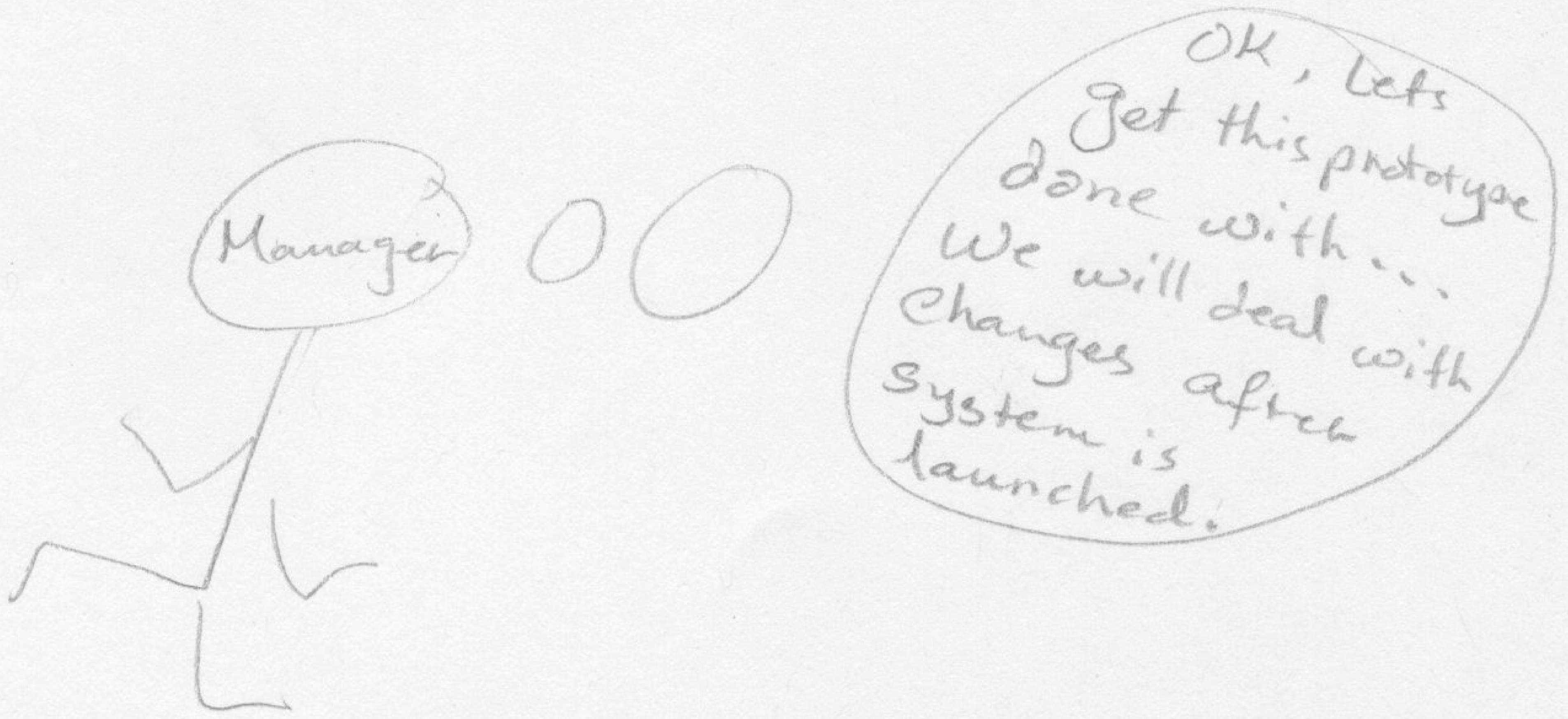
Collaborative Arrangement

A prototype presentation to the head of Division Presented by analysts and IT Staff.

Representation of activity

Head of Division had a clear understanding of project steps, the integration of the project and expected problems

Ecological Arrangement



Collaboration Technique

Because the manager had a clear understanding of what is expected durring implementation, he was committed to conclude the prototype and deal with uncertainities at a later stage.

Community of Use

Managers, Head of Dept.

Successor

Better Communication

Name More Commitment

Vignette Number: 3

CASE: National Assembly

Predecessor

Clear Awareness

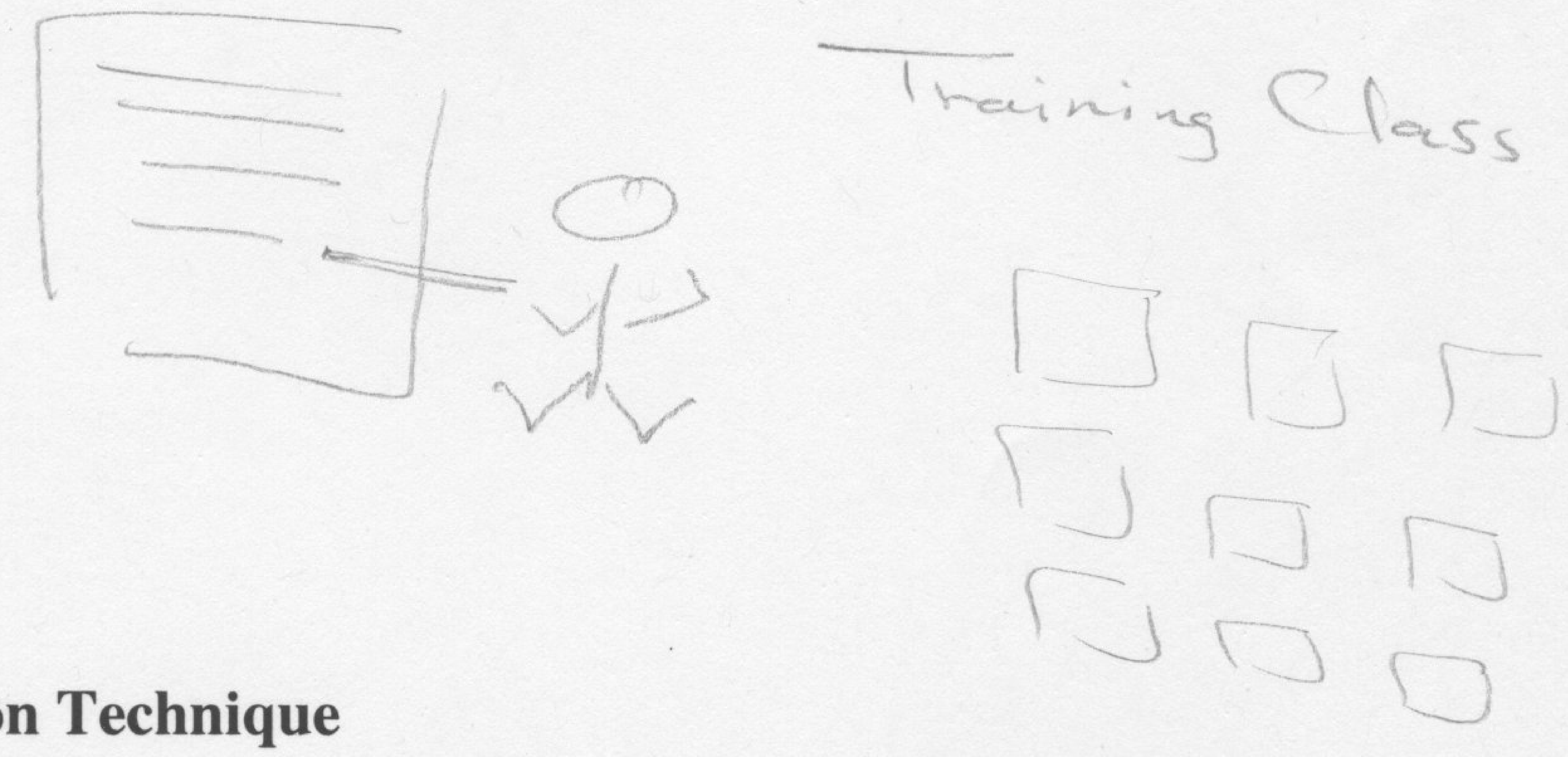
Collaborative Arrangement

System analyst, IT staff and National Assembly Manager in preliminary discussion prior to Reg. Col.

Representation of activity

Manager questioning training after system launch. Clear understanding of what is expected led to more commitment

Ecological Arrangement



Collaboration Technique

Analyst and IT Staff ensures the manager that the contract includes SW training from the SW House. IT Staff will also be on call for any problems.

Community of Use

Managers, Head of Dept.

Successor

Better Communication

Name More Empowerment

Vignette Number: 1

CASE: F.P.

Predecessor

Clear Awareness

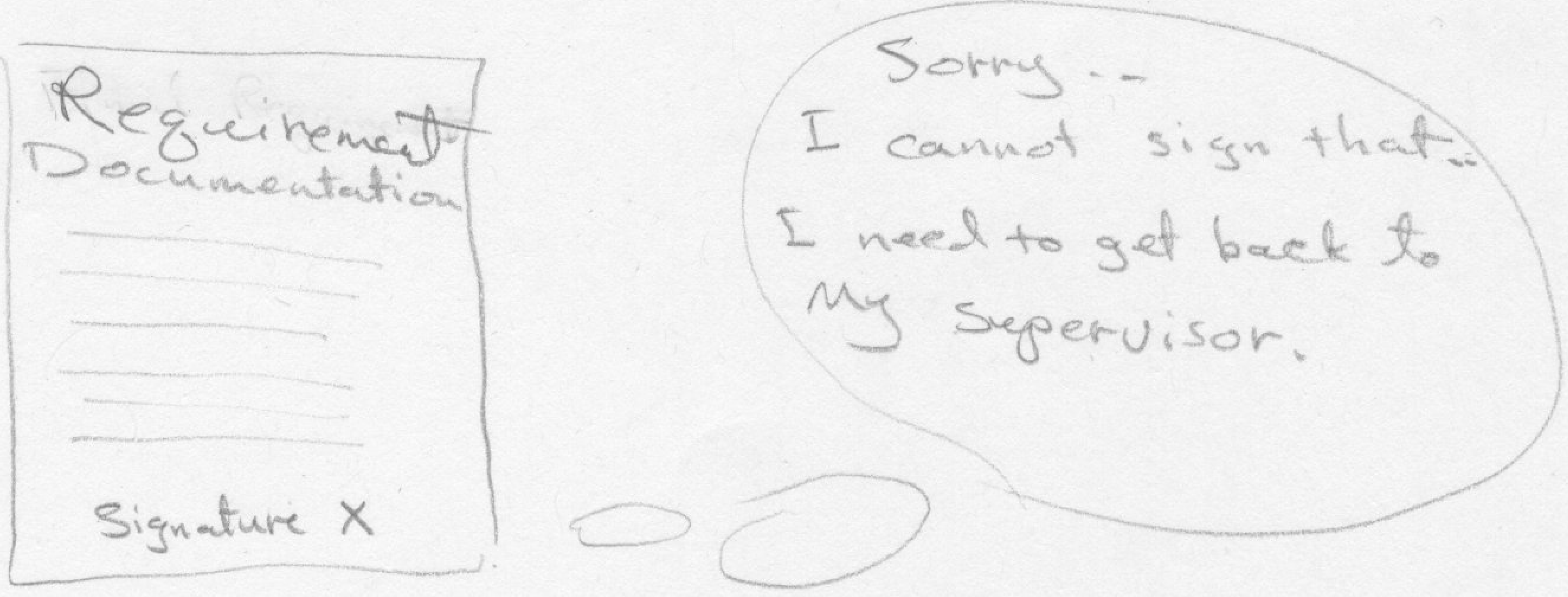
Collaborative Arrangement

SW Analyst, IT Staff and Head of Devision discussing requirement specifications from the document aided by a datashow in F.P. meeting room

Representation of activity

The analyst should take the comments from the employee make changes to old requirement documentation, then get employee to sign off his requirements.

Ecological Arrangement



Collaboration Technique

Users tell you what they want but not officially until they talk it through with their supewiser. They are not given the authority to do that. Increasing awareness of project goals leads to more empowerment which leads to better communication and thus better collaboration.

Community of Use

Successor

Better Communication

Name More Empowerment

Vignette Number: 2

CASE: F.P.

Predecessor

Clear Awareness

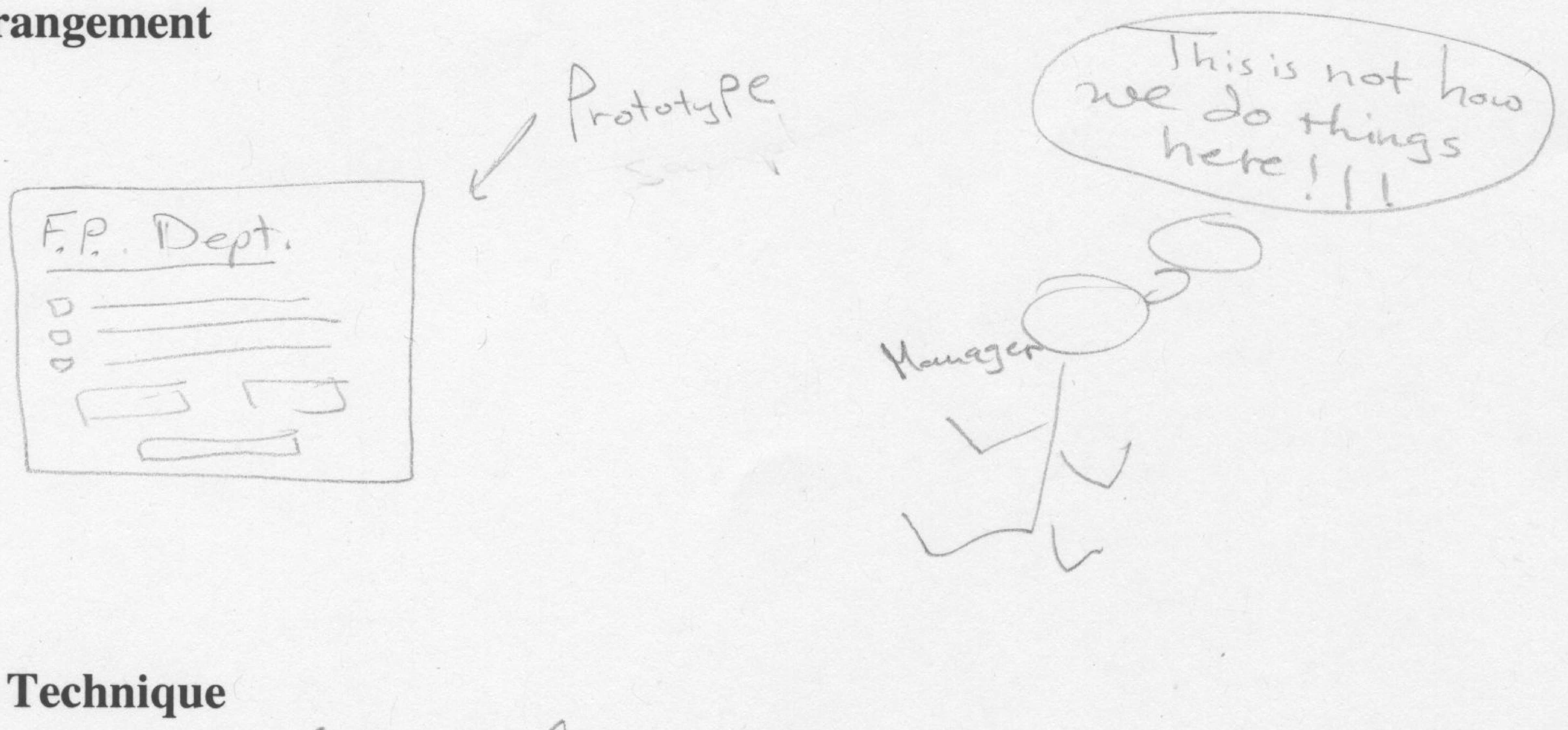
Collaborative Arrangement

Manager back from vacation, prototype is shown by the SW house analysts.

Representation of activity

After presenting the prototype, Managers needs to approve requirements collected from Employees.

Ecological Arrangement



Collaboration Technique

Manager not happy of empowerment given to employees. The collected data was not to his approvel. Previous awareness of the project was not considered. Problem would have been overseen if the manager was aware of the project before his vacation.

Community of Use

Successor

Better Communication

Name

More Empowerment

Vignette Number: 3

CASE: IT

Predecessor

Clear Awareness

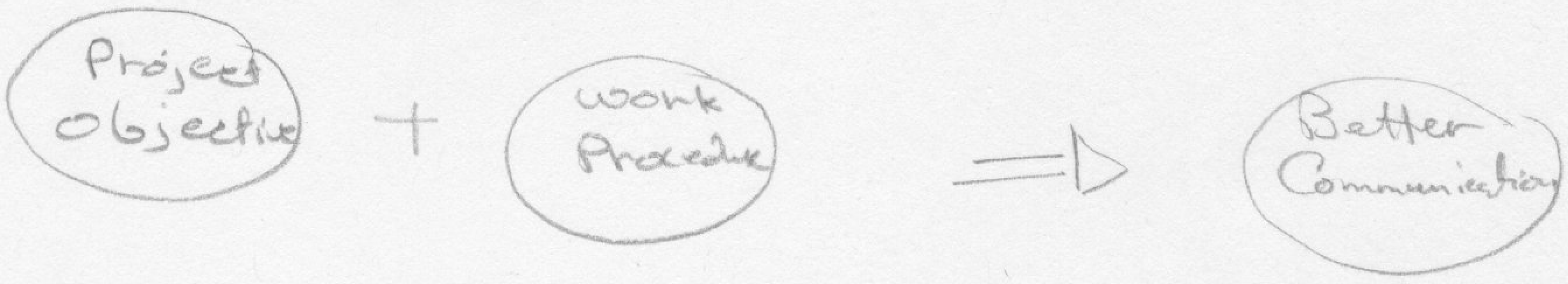
Collaborative Arrangement

Analyst and IT users in a meeting to collect requirements for the department. Old req. doc. is used.

Representation of activity

Analyst meeting with IT user. Users express their requirements.

Ecological Arrangement



Collaboration Technique

IT users express their requirements. Users not affraid to sign the req. doc. They have clear outline what the projects needs to do. clear aims & objects, this led to better communication.

Community of Use

Successor

Better Communication

Name Requirement Concensus

Vignette Number: 1

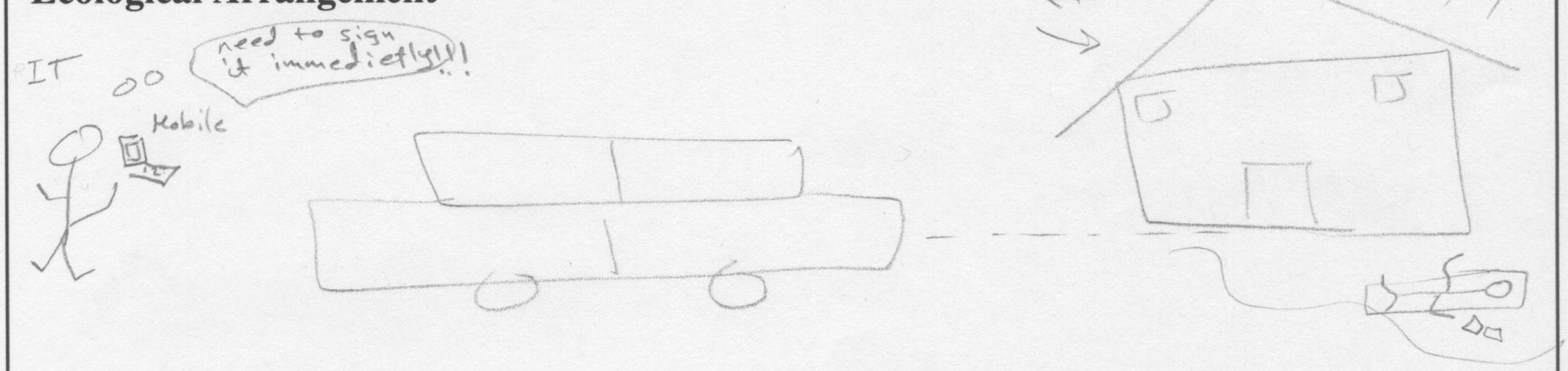
CASE: → العلاج بالخارج

Predecessor
Increase Collaboration

Collaborative Arrangement
IT personals tracking down stakeholders to get their approval of the requirement collection document.
Mobile communication used to track employees on vacation

Representation of activity
There is no one way of dealing with such situation. It depends on the person in charge and how willing he is to succeed in the project. Keeping track of where employees are on vacation & ways of contact is important.

Ecological Arrangement



Collaboration Technique
The IT employees collaborate in untraditional way. An IT personal goes out on an excursion to reach an employee in vaction on a remote vacation house

Comunity of Use
IT staff

Successor
Increase Collaboration

Name Requirement Consensus

Vignette Number: 3

CASE: F.P.

Predecessor

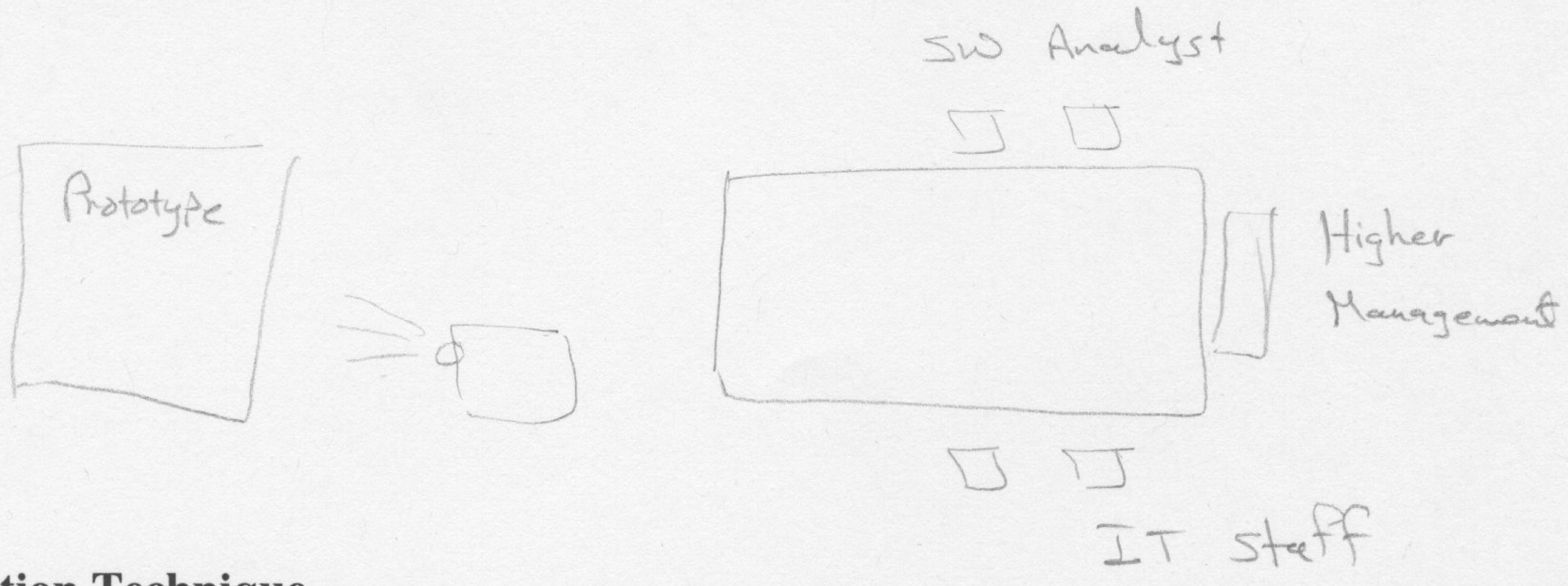
Collaborative Arrangement

Higher management, IT staff & SW House analysts need to sign off the final requirement documentation. Data show used to show prototype

Representation of activity

The SW House analysts go through a final version prototype

Ecological Arrangement



Collaboration Technique

The collaboration went place through dialogue. Higher managment where impressed. They understand that their needs to be an integration gradually, and that problems will accur and will be handeled after implementation

Comunity of Use

IT Staff , Analyst

Successor

Increase Collaboration

Name Requirement Consensus

Vignette Number: 2

CASE : Foreign Procurement

Predecessor

Increase Collaboration

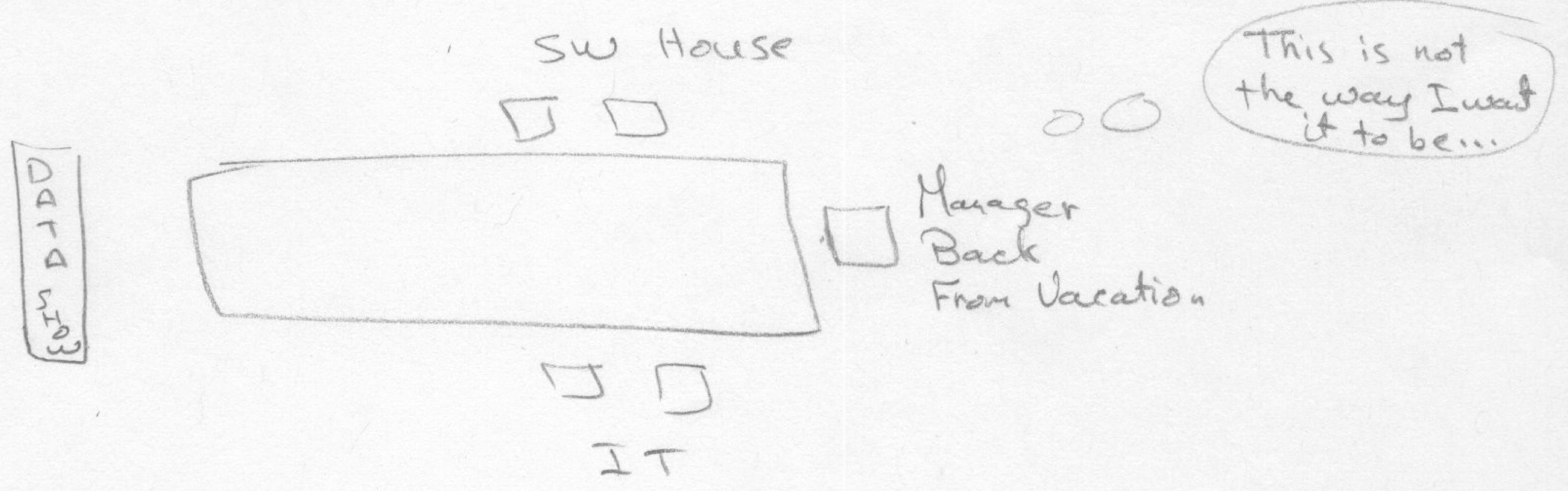
Collaborative Arrangement

The final phase of the requirement documentation, the manager missed out on the early phases. The IT staff & SW House briefing him. Data show used, early version prototype used

Representation of activity

The early version prototype used made collaboration worse not working feature made the manager upset. Collaboration was improved by intervension of IT Staff in explaining what will actually happen in the real SW.

Ecological Arrangement



Collaboration Technique

The collaboration was achieved by personal face to face discussion of how the SW will appear. Better collaboration would have happened if a final vesion of the prototype was used

Comunity of Use

IT Staff

Successor

Increase Collaboration

Name

Role knowledge Increases Empowerment

Vignette Number: 8

IT

Predecessor

Orginizational Role Spec.

Collaborative Arrangement

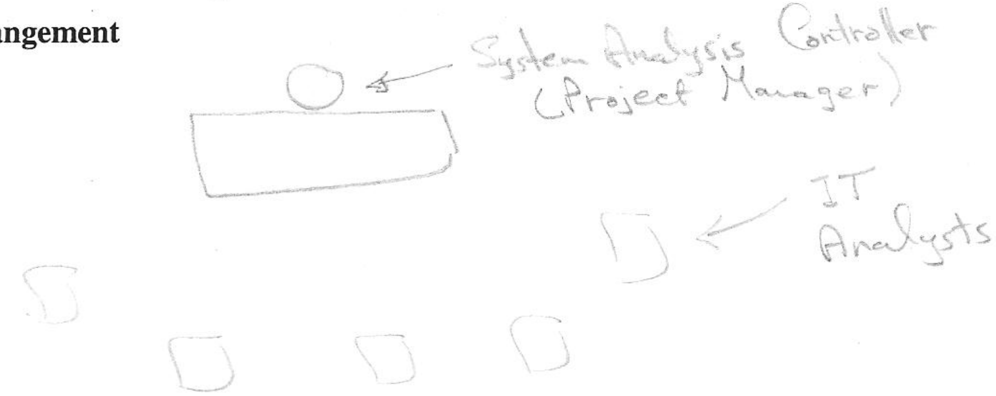
S.A. Controller meeting with IT analysts befor instalation of SW. KMOD IT realise big problems in software developed

The purpose of meeting was to discuss audition of Req.& if SW is satisfying.

Representation of activity

Negotiation on the need to know the roles of each dept.
This knowledge empowers IT Analyst to request changes to be done on the system

Ecological Arrangement



Collaboration Technique

Negotiation on how the IT analysts team divide the work
Newly appointed analysts disapointed on their late inovlvement
New Roles were specified knowledge of other rolls required

Community of Use

Project Manager

Successor

Empowerment Increases Trust

Name

Role Knowledge Increases Empowerment

Vignette Number: 2

Ministers Office

Predecessor

Orginizational Role Spec.

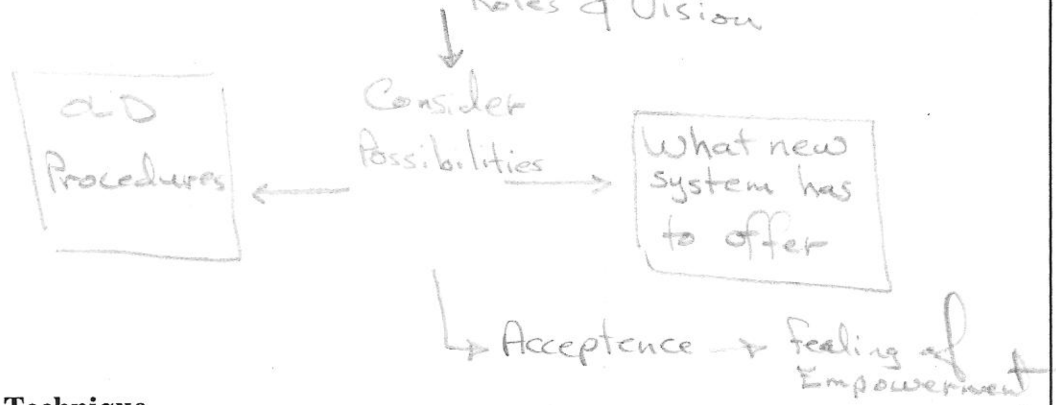
Collaborative Arrangement

Formal meeting in "Ministers Office" Manager Office
Analysts from IT & SW House present. IT Manager present as well, very important to get approval.

Representation of activity

As the SW house analyst presented what could be accomplished, the user started to relate his knowledge of what needs to be done to what facilities presented.

Ecological Arrangement



Collaboration Technique

Dialogue was used to show how the SW house would improve the work process of the Dept.
A prototype was ed showed what type of facilities implmentation would offer

Community of Use

IT Management, Project Manager

Successor

Empowerment Increases Trust

Name

Role knowledge Increases Empowerment

Vignette Number: 3

Military Affairs

Predecessor

Collaborative Arrangement

Discussion of Req. of Dept. System analysts & SW house analysts with Dept. Manager

Representation of activity

Specific knowledge of Roles in relation with the procedure & work process increases the ability to decide what needs to be included in the system

Ecological Arrangement

Collaboration Technique

To maximize the empowerment of the analyst, a destinction needs to be done between specified roles & actual Roles

Community of Use

System Analyst

Successor

Empowerment Increases Trust

Appendix C

Foundation Research

C1. Phone Interviews

- C1.1. Background to the Phone Interviews
- C1.2. Initial Collaboration Constructs Validation Form
- C1.3. Summary of Phone Interviews

C2. Access to Site Authority Approval Certificate

C3. Pilot Study Progress Report

C4. Preliminary Interviews (in CD)

Phone Interviews

Aim: Gain Confidence in the extracted Stakeholder Collaboration Initial Constructs

Initial collaboration constructs:
Trust
Knowledge Sharing
Empowerment
Dialogue
Roles
Interest

In the literature foundation stage of the study, initial collaboration constructs identified were followed by a set of structured interviews with experienced software analysts' and project managers involved in major projects in Kuwait, the interviews were conducted over the telephone. The reason the interview were conducted over the phone was to cover as much interview as possible in a relatively small time frame of two weeks (my Christmas break excluding the New Year holiday in Kuwait).

The interviewers were faxed a one page document that explained the problem of *stakeholder collaboration* in software requirement collection. The document had the Initial Collaboration Constructs, followed by a brief explanation of each element. There were four outcomes I wanted to achieve from these interviews:

- What is their feelings regarding stakeholder collaboration in requirement collection?
- Do they relate to the Initial Collaboration Constructs?
- They were required to prioritize the set from most significant to least significant.
- Can they come up with other constructs they think are significant?

There was an emphasis on the importance of their opinion on how much they thought that these constructs shape stakeholder collaboration.

The sample population was chosen from key public sector organizations in Kuwait. They were chosen on the bases of their experience and position in the sectors they represent. Middle management was the aim of the study (at this level of analysis) because in my point of view they either represent project managers or analysts with experience of at least ten years. They were all given the following introductory section and were asked personal information questions:

My name is a Bareeq Al-Ghannam. I am a researcher engaged in studying the collaborative nature of stakeholders involved in the process of designing a system. As an experienced analyst/project manager working in the IT department, I would like you to take the time to answer my question. Your feedback is vital for my research and will base part of the research foundation.

Name:

Organization:

Role:

Have you been involved in designing a new system or redesigning an old system for the past five years?

How many projects were you directly involved in?

How many projects were completed successfully?

Is stakeholder collaboration important in requirement collection?

Do the constructs given in the page important to promote collaboration in requirement collection?

Then they were asked to give their view of how important the given collaboration constructs are according to collaboration of stakeholders:

Initial collaboration constructs:

Trust
Knowledge Sharing
Empowerment
Dialogue
Roles
Interest

Other constructs of importance:

Validation of Initial Collaboration Constructs Form

Site	

Personal Information	
Name	
Position	
Years of experience	
At what stage where you involved?	
What was your role?	

The goal of this questionnaire is to validate the context specific factors affecting Stakeholder Collaboration within the requirement collection phase of the KMOD Automation project from the viewpoint of FP stakeholders.

This goal is achieved through the analysis of the following objectives:

Validate the encapsulated context specific constructs of collaboration

Construct
Knowledge Sharing
Trust
Empowerment
Dialogue
Interests
Roles

It is also required to establish a prioritization list of the factors.

Your completion of the questionnaire is highly appreciated and will affect the development of the approach.

	Strongly Agree	Agree	Neutral/ No Opinion	Disagree	Strongly disagree
A. Collaboration Constructs					
1. The correct perception of information transferred from the stakeholder to the analyst during requirement collection positively affects collaboration					
2. Trust developed between a system analyst and the users promotes the user to collaborate and talk freely without constraint					
3. Authorizing stakeholders of lower power to decide on matters regarding their daily tasks promotes the collaboration during requirement collection					
4. Stakeholders aware of the system goals, functionalities and limitations are easier to collaborate with					
5. Communication between stakeholders is key to collaboration					
6. Stakeholder feeling of commitment to the requirement collection team increases the collaboration between them					

B. Please list the construct starting from one indicating highest priority
Knowledge Sharing
Empowerment
Trust
Awareness
Commitment
Communication
C. Please indicate if there are other collaboration constructs that you think should be considered

C1.3. Summary of Phone Interviews

Summary of Foundation Phone Interview

Twenty phone interviews were conducted for the purpose of empirically finding confidence of the Initial Collaboration Constructs extracted from the litreture. They took place. The following table shows details of the number of participants and the public sector they represent.

No of participants	Public Sector
5	Ministry of Defense
3	Ministry of Finance
2	Municipality
2	Central Bank
2	Public Authority of Applied Education and Training
1	Kuwait University
3	Ministry of Planning
2	Institute of Scientific Research

Results show mutual recognition of the importance of these constructs. However, different results on the prioritization of these constructs were obtained. No pattern of prioritization was reflected. Some analysts emphasized the importance of communication.

My reflection to their responses is that different stakeholders under different context may regard what is important to collaboration differently. The methodology under development should be able to synthesis such elements. A very important conclusion complies with my decision to emphasize communication as a default embedded in the evaluation; communication is very important and should be a necessary condition for evaluation. Other constructs recognized could be considered contextually specific and constructs could be removed or added to the list as seen to be sufficient for each evaluation.

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وبه نستعين

STATE OF KUWAIT
MINISTRY OF DEFENCE

دولـــة الكويت
وزارة الدفـــاع

Date: 14/01/2005

<u>Subject: To Whom It May Concern</u>

In reference to the letter has been issued - on Wednesday (14/12/2005) (REF- 26210071) by the Manager of secretary office department - copy attachments - we would like to inform you that the Information Systems & Technology department (IT Department) in the Ministry of Defense (MOD), will be collaborating with the researcher/ Bareeq Al–Ghannam to conducts her studies on systems developed, being developed and will be developed for (MOD), collaboration starts on (December 2005) until the end of (December 2008).

With best regards,,,

Manager of IT Department

14/1/2006

مدير ادارة نظم المعلومات
خليفة المالك الصباح

* copy of the letter (REF 26210071).

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STATE OF KUWAIT
MINISTRY OF DEFENCE

دولــــــة الكـويـت
وزارة الـــدفـــــاع

2011206555
2005/12/14

السيـــد / مديـــر إدارة نظم المعلومات   المحـــترم

تحية طيبة وبعد ،،،

<u>الموضـــوع : تقديم رسالة الدكتوراه</u>

نرفق لكم الكتاب المقدم من قبل المهندسة / بريق الغنام (الهيئة العامة للتعليم التطبيقي والتدريب) بتاريخ 2005/12/9 ، بشأن الموضوع أعلاه .

برجاء التفضل بالإطلاع وإجراء اللازم وتسهيل مهمة المذكورة.

مع أطيب التمنيات ،،،

مدير إدارة مكتب الوكيل

المقدم/ عبدالله جاسم الحوطي
مدير إدارة مكتب وكيل الوزارة بالوكالة

المرفقات :
- نبذة عن موضوع البحث
نسخة - 203000-210000
01/201120

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STATE OF KUWAIT
MINISTRY OF DEFENCE

دولـــــة الكـويـت
وزارة الـــــدفـــــاع

رقم الوارد: 137413
تاريخ الوارد: 11 ديسمبر 2005
رمز الموظف: 33 62 60

إجراءات متابعة الوارد

جهة التوزيع
27 26 25 24 23 22 21 X 00
الإدارة | مرفقات | سري

وقت الوصـول / التـاريخ
200٥/12/12 — ساعة: ٥ — دقيقة: ٥٥

تأشيرة سعادة/ وكيل الوزارة — المحترم
علـم | للمتابعة | للمراجعة ☒ | عاجل | لعمل اللازم | للتنسيق | للإفادة

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وقت الوصـول / التـاريخ
200 / / — ساعة — دقيقة

تأشيرة السيد/ وكيل الوزارة المساعد — المحترم
علـم | للمتابعة | للمراجعة | عاجل | لعمل اللازم | للتنسيق | للإفادة

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وقت الوصـول / التـاريخ
200 / / — ساعة — دقيقة

تأشيرة السيد/ مدير إدارة — المحترم
علـم | للمتابعة | للمراجعة | عاجل | لعمل اللازم ☒ | للتنسيق | للإفادة

جـهـات التـوزيع
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20/12

وقت التـحـويل / التـاريخ
200٥/12/13 — ساعة: 11 — دقيقة: 30

تأشيرة السيد/مساعد المدير — التوقيع والتاريخ

تأشيرة السيد/المراقب — التوقيع والتاريخ

تأشيرة السيد/رئيس القسم — التوقيع والتاريخ

1 . يرجى عدم التأشير أو الكتابة على الكتاب الأصلي . 2 . يرجى ضرورة كتابة تاريخ وساعة استلام وتسليم الكتاب .
3 . بناءاً على تعليمات سعادة وكيل الوزارة يكون الرد على الكتب الواردة خلال اسبوع من تاريخ الاستلام .

نموذج رقم: 01 - 203000 — نظام تساهيل — مطبعة هندسة المنشآت العسكرية

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التاريخ ٩ ديسمبر ٢٠٠٥

السيد / وكيل وزارة الدفاع المحترم

تحية طيبة وبعد.

وزارة
137413
11 ديسمبر 2005

الموضوع: تقديم رسالة الدكتوراه

بالإشارة إلى الموضوع أعلاه، يرجى التكرم من سيادتكم بالموافقة على منحي فرصة لإجراء دراسة على وزارة الدفاع عن حالة:

(Analysis and Evaluation of Stakeholder Collaboration within System Design)

لتقديمها في بحثي الخاص بالدراسات العليا بجامعة سندرلاند في المملكة المتحدة، وذلك في الفترة من ديسمبر ٢٠٠٥ إلى ديسمبر ٢٠٠٨.

وكلي أمل بموافقة سيادتكم لطلبي هذا والعمل على تعاون بعض الإدارات المختلفة في الوزارة لاستكمال هذا البحث.

وتفضلوا بقبول فائق الاحترام

مقدمة الطلب/ م. بريق الغنام

الهيئة العامة للتعليم التطبيقي والتدريب

مرفق: نبذة مختصرة عن موضوع البحث

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Analysis and Evaluation of Stakeholder Collaboration within System Design

Research Outline

This research is engaged in studying a crucial social aspect of software engineering that has long been neglected. It will critically evaluate the collaborative nature of stakeholders involved in the process of designing a system. There is no one definition of the word stakeholder in the literature, in this research it will be employed to mean any person who will use the system, affect the system or be affected by the system. Where a system is any flow of information that form a process that is usually aided by the use of a computer but not necessarily. Either case stakeholders involved will face the challenge of accepting the transition of change of how the new redesigned processes need to be preformed.

The trend nowadays is to involve the stakeholder in the early stage of the system design in a collaborative manner more than a managerial manner. Making sure that all stakeholders are involved in the early process of design gives a sense of partnership. For this partnership to be fruitful, collaboration must be maximized between all involved parties. Stakeholders' collaborating in a system being designed is a dynamic process which involves feedback. The collaboration is visible in the form of dialogue, flow of information shared between the stakeholders in order to produce the design. It is affected by standard criteria's as well as organizational specific criteria's, both visible and invisible, once recognized; a mean of measuring collaboration may be established.

The importance of measuring the collaboration between stakeholders during the design of any system gives the organization the knowledge of specifying the organization's collaborative culture. It will give indications to the organization what values represent collaboration to the stakeholders involved in the system being designed both horizontally across the organization and vertically within the smallest group/ subgroup. It can also give decision makers the vision to predict how collaborative a group of stakeholders will be and thus the power to intervene in order to ensure smooth system change.

The aim of this research is to develop a systemic approach to analyze and evaluate the collaboration of stakeholders involved in a system design process in order to predict how collaborative a group of stakeholders will be.

In order to achieve the above declared aim, a set of tentative objectives must be achieved:

1. Research current philosophies in collaboration theory, stakeholder theory, Learning theory and system theory.
2. Develop criteria's to evaluate collaboration based on these philosophies.
3. Research current methodologies of collaboration.
4. Intrinsic Evaluation on these methodologies from the aspects of the criteria's developed.
5. Develop a new collaborative methodology that satisfies the criteria's developed based on available theories, experience and interviews.
6. Intrinsic and extrinsic evaluation of the new methodology developed from the aspect of its applicability to the domain of system design.

As a result a set of dynamic guidelines will be developed for an organization to follow within the process of system design in order to ensure smooth change.

C2. Access to Site Authority Approval Certificate.

Meeting with the Undersecretary of the Kuwait Ministry of Defence

Date: 9 December 2005
Time: 10:00am
Place: KMOD Undersecretary Office in G1

Purpose: Request access to KMOD site and approve investigation

Context:

I met with Eng/Shaik/ Subbah Al-Naser Al-Subah, the undersecretary of the KMOD. The meeting was very formal and I felt very awkward at first. I did not know how his reaction would be, and was not sure that my request would be granted. However this feeling subsided as I felt him welcoming the idea of me conducting the study.

I have provided him a brief outline of the research I want to conduct and the reasons why I choose MOD. He was very cooperative and welcomed the idea of conducting the case study on MOD software development projects. He emphasised that some users in MOD had a hard time accepting the fact of using computers to do their work. Several non Kuwaiti citizen employees have actually refused using computers and went on doing their jobs the old way.

Several software projects were recently developed for MOD and a big project for MOD automation will be developed as a step to connect MOD with the e-government project in Kuwait.

MOD Automation Project involves the connection of the 12 departments of MOD. Each department has its own system and a system that connects it to other departments depending on the flow of work.

He told me that after the full implementation of software projects, he would go on unannounced field inspections, for the purpose of uncovering deficiencies from the actual users and to check if they were actually making use of the software. One field inspection of a previous financial system revealed to him that no one was actually using the software, just because they felt insecure about their job positions. This was felt by non-citizens.

Comments:
This meeting was very enlightening; it encouraged and gave confidence in the topic area under investigation.

Access to site was approved officially.

Pilot Study Progress Report
Conducted on Kuwait Ministry of Defence (KMOD)
In the period 10-28 April 2006

Preliminary investigation (4 December 2005- 18 February 2006)

Initial preliminary investigation was conducted over a distributed period. During that time the following outcomes were established:

- Access to MOD premises was authorized.
- Connections with official personal was established, working experience in the organization and previous connections made the process easier and faster.
- One meeting in December 2005 with higher management.
- Four group meetings in February 2006 with middle management and software house developer.
- Access to documentations of a previous requirement investigation of the KMOD Automation project in printed format was given to me (2764 pages), as well as digital format version. The preliminary investigation of the project was conducted in November 2003 in preparation to link MOD with the e-government project. The MOD Automation project was put on the shelf and now the plan is to re-examine the requirements again. A new study is in order to validate the requirements and to collect new requirements. This action is necessary because the hierarchal structure of MOD has changed; new departments and sections were introduced to the structure which calls for new requirements and the amendment of the old.
- An overview of the whole project using systemic tools such as Checklands's rich pictures and Beer's Recursion concept.
- Group meetings were found favourable if conducted in an unofficial environment.
- Fallow up of the meetings was done over the telephone and by e-mail.
- Official requirement collection was scheduled to start 10April 2006. Therefore I arranged to pilot my study at that time.
- Requirement collection were scheduled to be over the periods
  (April- June) and (September-November) 2006; No requirements will be collected during the summer months of July and August 2006 because of summer vacations. Software developer plans to use prototyping in parallel.
- The IT department has planned a procedure that involves the following steps:
  - Send each head of department in MOD the part in the old requirement documentation that related to their department (if it is available in the initial study).
  - Specify a deadline for each department to read their requirement documentation, discuss it with employees within the department.
  - Feedback is expected from each department with a representative to meet with IT and SW house employees.
  - A date is sent to schedule a meeting between the department representatives, IT and SW house employees.
  - Several group meetings will be conducted to negotiate the final requirement for each department as well as observation.
  - A signature is required for final decision.

Kuwait Ministry of Defence Overview

Kuwait Ministry of Defence (KMOD) is considered one of the main ministries in the State of Kuwait. KMOD plays the main role in delivering services and requirements for all the Kuwaiti Army forces (Ground, Air, and Navy forces). To achieve a high calibre services for the forces, KMOD depends on several departments and sub-departments that are assigned roles and responsibilities for better organizational and hierarchical management. From those departments who take care of the business and technical requirements of the ministry as shown in Figure 1:

1. H.E. Minister of Defence Office.
2. Deputy Minister Office.
3. Financial Department.
4. Administration and Human Resources Department.
5. Legal Affairs Department.
6. Information Technology Department.
7. Local Procurement Department.
8. Foreign Procurement Department.

For each of the above departments, several sub-departments work under them, in which they are responsible for procedures and executing tasks assigned to them, depending on the roles and responsibilities and the business procedures cycle.

A “department” is considered the higher management side, followed by the “sub-department” then the “division” as in the following Figure 1:

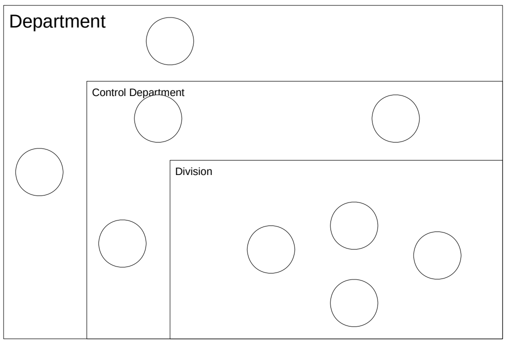


Figure1: Management Hierarchy in KMOD

Currently, KMOD operates in house developed stand alone obsolete practice management systems and wishes to replace these systems and their associated services. The first phase includes the following Implementation Sites:

1. H.E. Minister of Defence Office.
2. Deputy Minister Office.
3. Financial Department.
4. Administration and Human Resources Department.
5. Legal Affairs Department.
6. Information Technology Department.
7. Local Procurement Department.
8. Foreign Procurement Department.

Another business objective is to integrate the mentioned systems using the LAN installed in the ministry, and to insure the security and integrity of the information transferred using that network.

KMOD Automation System Goals

The main goal is to achieve the following business requirements:

1. To seek an open architecture fully integrated management information systems.
2. To seek a management information system that is able to be modified and amended depending on KMOD needs in the future.
3. To seek a cost-effective system, that will provide the tools and methodologies to ease the business procedures and tasks of KMOD departments.

KMOD Automation System Strategic Objectives

The strategic objectives in implementing this system are to:

1. Streamline the daily activities of patient care
2. Improve the level of services
3. Improve productivity and help in increasing the efficiency of the departments
4. Improve the cost control and budgeting to improve the overall performance.
5. Generate accurate and comprehensive statistical information
6. Maintain management and administrative information related to employees or beneficiaries.
7. Improve the accuracy, speed, flexibility, and convenience of business procedures cycles.
8. Achieve an integrated information system providing improved system performance, data capacity, and potential for significant future growth in the number of system users, sites supported, programs managed.
9. Achieve more flexible, user-friendly, and efficient periodic and Ad hoc reporting capabilities to access and analysis of all management data.
10. Improve the management reporting capabilities.
11. Achieve Information Access electronic mail capabilities facilitating intra- and inter-organization communications.
12. Achieve Information Access electronic word processing capabilities facilitating intra- and inter-organization document generation using MS-Office. Also, to integrate MS-Office tools with the required system.

Pilot Study (10 April 2006 – 26 April 2006)

- The system analysis team was not from NCS (Developer Company), they were from an outsourced company from Egypt. They had experience working in Kuwaiti Environment, but no previous experience with KMOD employees.
- The meetings with the stakeholders started 16 April 2006 instead of 10th April 2006.
- Some meetings were rescheduled so the plan had to be altered to fit changes.
- Some difficulty at the beginning with the analysis team regarding entrance to premises. Passes were not ready which also had an affect on the rescheduling of the meetings.
- The system analysis team was divided into three groups to work simultaneously in different departments. Each group consisted of two analysts, one to ask the questions and the other to document. I was appointed to group two; I was to be in all their meeting and take notes with out obstruction to their actions.
- Team two conducted eight meetings with stakeholders. All meetings took place at the stakeholders work space.
- The team had to revisit some stakeolder groups again because some were not ready, some needed to approve some aspects with their higher management and others did not have all their work artifacts (samples of templates, official letter formats,..etc.) with them.
- The team also revisited stakeholders within their work environment to make observation notes of the workflow. The observation was done with continues involvement of the stakeholders as they described their work as it is done now.

Evaluation of Data Collection Tools that are to be Used in the Methodology

Table 1 represents on evaluation of the data collection tools that were tested in the pilot study:

Data Collection	Status	Comments
Observation	▪ It included attending meetings with analysis team and observing the team as they observed the stakeholders. ▪ Notes were taken by hand; advice taken from experienced analysts in the Kuwaiti environment tape recording is not favorable. ▪ Rescheduling of meetings with stakeholders had its affect on meeting with unready users.	▪ I was late in transcription. Immediate transcript of documentation would be to my advantage in the real study. ▪ Making available printed pattern templates to eliminate the need for transcription. I took part of the notes as a pattern format, but did not have printed templates ready for use. Patterns are valuable to be used in the actual study.
▪ Group discussions & ▪ Unstructured interviews	▪ Social and political aspects of collaboration was discussed, key factors were identified. ▪ Rich pictures were used.	▪ Participants enjoyed their discussions and were willing to talk freely; I think part of that is my previous acquaintance of them. ▪ However timing was difficult, so I made most conversation through coffee and lunch break.
▪ Structured Interviews (Questionnaire Format)	▪ Some were conducted individually; others were conducted in groups of two and three. ▪ Individuals were handed the questionnaire, a brief introduction was also given verbally, a brief introduction was also written at the first page, and it also included the objectives of the study as well as the importance of their feedback. ▪ Most were hesitant to participate and thought that it was too early for them to state their opinion. I assured them that the objective at this stage is to discover faults in the questions, their answers to the questions will not be considered. ▪ Major weakness was found in the questions (confusion in the wordings, also in the relevance of the answers to the questions, sometimes I was asking them their opinion regarding a statement and sometimes I was trying to ask them to tell what they think while the answers I provided for them was in the form of (strongly agree, agree, do not know, disagree and strongly disagree)	▪ A need to restructure the question. Number them to relate them to the aspects that I want to validate for easier analysis. ▪ Rewrite the introduction and group it into research summary, objectives of research, anonymity and importance of genuine feedback. ▪ Change the wording. Keep the questionnaire as a validation tool for the mental models developed. ▪ Make another questionnaire to collect feelings of measurement if necessary (not essential if the research is not going to reach the qualitative aspects of collaboration). ▪ New questions must be re-piloted before actual case study.
▪ Documentation	▪ A large amount of previous documentation is available. ▪ New documentation was also accessible.	

The following protocol was used as an introduction to my studies before conducting the interviews.

> My name is a Bareeq Al-Ghannam. I am a researcher engaged in studying the collaborative nature of stakeholders involved in the process of designing a system. When I say stakeholders I mean any person who will use the system, affect the system or be affected by the system. By the word "system" I mean any flow of information that form a process not necessarily what it relates to nowadays as a "computer system or a program". By this convention there is no such thing as a new process unless it is a new organization or department. Every process is a redesigned process.
>
> As a personal working in the IT department, I would like you to take the time to answer my question. Your feedback is vital for my research and will base part of the research foundation.

Some of the guiding questions used during the unstructured interviews included:

> Name:
>
> Organization:
>
> Role:
>
> Have you been involved in designing a new system or redesigning an old system for the past five years?
>
> How many projects were you directly involved in?
>
> Are some of the projects over?
>
> Is there still any ongoing projects?
>
> How many projects were completed successfully?
>
> Are there future plans in future projects?

The following questionnaire was used in the pilot study

بسم الله الرحمن الرحيم

تحليل عوامل التعاون ما بين **Stakeholders** أثناء مرحلة تحليل النظام الآلي
Stakeholder Collaboration Evaluation in Software Requirement Analysis

المقدمـة

الاتجاه الحديث في الإدارة الإلكترونية تدعو إلى تطوير أنظمة آلية في جميع وزارات دولة الكويت لتقديم خدمة أفضل أو تقييم أفضل لمخرجات الأنظمة العامة في الدولة. إن النهوض لتطوير تلك الأنظمة يحتاج تعاون مستمر بين الجهات المختلفة التي لديها المعلومات اللازمة وذلك لاستنباط تلك المعلومات الدقيقة في المرحلة الأولية من تحليل النظام. يحدث هذا التعاون بالتفاعل بالحوار بين الجهات إثناء محاولتهم للتعريف بالمشروع و تحديد الهدف منه، تحديد متطلبات النظام من إجراءات عمل و قواعد بيانات، وتوافق المشروع مع رؤية وأهداف الوزارة وتكامله مع اتجاه الدولة.

الدراسات العلمية الحديثة أثبتت ازدياد فشل المشاريع الآلية على الرغم من التطور التكنولوجي وعلى الرغم من استخدام الأساليب المختلفة للاستخراج المتطلبات وإدخال المستخدم كجزء رئيسي من العملية. و أن المرحلة الأولية من تحليل النظام لاستخراج المتطلبات تساهم بنسبة خطر عالية ممكن أن تؤدي إلى فشل المشروع إن لم تتم بشكل متعاون بين الجهات المختلفة. إن استخراج المعلومة من المستخدم و انتقالها إلى محللي النظام ومن ثم إدراكها من وجهة نظر المستخدمين وتحويلها إلى متطلبات للنظام عملية صعبة للغاية وذلك لاختلاف وجهات وآراء المستخدمين.

مرحلة الدراسة الأولية لتحليل الأنظمة هي عملية اجتماعية وإدارية أكثر من كونها تكنولوجية، تحتاج إلى تفاعل ديناميكي بين المشاركين المختصين بالدراسة (Stakeholders) للتفاوض للوصول لمتطلبات النظام التي تفي باحتياجات المشروع في حدود التكنولوجيات المتوفرة وكيف تكاملها مع إجراءات العمل. تدخل في التأثير على تلك الدراسة عوامل مختلفة مثل شخصية المشاركين، مصلحتهم ومدى استعدادهم من المشاركة، الوقت، مهارات الحوار، مهارات إدارة الاجتماع و الأدوات المستخدمة لتسهيل الحوار و توصيل الوجهات المختلفة، الثقة مابين المشاركين، سلطة المستخدمين في اتخاذ القرار، بالإضافة إلى عوامل عديدة أخرى.

إن الهدف من الدراسة تحديد العوامل الرئيسية التي تؤثر على مرحلة تحليل النظام لاستخراج المتطلبات في وزارة الدفاع، وتحديد مؤثرات و تأثيرات تلك العوامل للوصول إلى التعاون الأمثل بين الجهات المختلفة التي تساهم في إنجاح نظام ميكنة الحاسب الآلي.

الرجاء التفضل بتعبئة هذا الاستبيان التجريبي الذي سوف يساهم في الدراسة الرئيسية. إن لمشاركتكم دور مهم في هذه الدراسة التي سوف تؤثر على إدارة المشاريع المستقبلية للأنظمة الآلية في جهات مختلفة من الدولة.

شاكرين لكم حسن تعاونكم

ملاحظة:
الأشخاص الذين سوف يستخدمون النظام الآلي،أو سيؤثرون على تنفيذ النظام الآلي ، أو يتأثرون بعد تنفيذ النظام الآلي. يمكن تصنيفهم إلى أربع فئات: مستخدمي النظام، متخذي القرار، مديري الاجتماعات الخاصة باستخراج متطلبات النظام، و الجهات الخارجية. Stakeholder المقصود بكلمة

<table dir="rtl">
<tr><th colspan="9">أولاً: البيانات الشخصية</th></tr>
<tr><td>العمر(سنة)</td><td colspan="2">أقل من 30</td><td colspan="3">30-45</td><td colspan="3">أكبر من 45</td></tr>
<tr><td>الدور في المشروع</td><td colspan="2">مستخدم</td><td colspan="2">صانع قرار</td><td colspan="2">Facilitator</td><td colspan="2">Analyst</td></tr>
<tr><td>الجنسية</td><td colspan="4">كويتي</td><td colspan="4">غير كويتي</td></tr>
<tr><td>سنوات الخدمة(سنة)</td><td colspan="2">أقل من 3 سنوات</td><td colspan="3">ما بين 3 - 10 سنوات</td><td colspan="3">أكثر من 10 سنوات</td></tr>
<tr><td>الجهة الممثلة</td><td colspan="2">وزارة الدفاع</td><td colspan="3">الجهة المنفذة للنظام</td><td colspan="3">جهات خارجية</td></tr>
</table>

C3. Pilot Study Progress Report

الرجاء إبداء الرأي بخصوص العبارات المذكورة في العامود الأيمن باختيار الرقم المناسب حسب التوصيف الآتي:

1 أعارض بشدة
2 أعارض
3 لا أعلم
4 أوافق
5 أوافق بشدة

ثانياً: هذا الجزء خاص لجميع إدارات الوزارة					
Score					**Statement**
5	4	3	2	1	o All stakeholders identified تم تحديد جميع الأشخاص الذين سوف يستخدمون النظام الآلي،أو يؤثرون على تنفيذ النظام الآلي ، أو يتأثرون بعد تنفيذ النظام الآلي. يمكن تصنيف إلى أربع فئات: المستخدم، متخذي القرار، مديري الاجتماعات، و الجهات الخارجية.
5	4	3	2	1	o All stakeholders are aware of the change to be in progress تم إعداد المستخدمين و الجهات المعنية ب مسبقاً تقبل التغييرات الممكن حدوثها بعد تنفيذ المشروع
5	4	3	2	1	o A proper stakeholder representatives has been recognized تم اختيار أشخاص مناسبين لتمثيل الجهات المعنية
5	4	3	2	1	o Stakeholder representatives prepared with communicative skills تم تدريب ممثلي الجهات بمهارات الحوار
5	4	3	2	1	o User representatives hold the power to change requirements ممثل الجهة المعنية مفوض بتغيير متطلبات النظام
5	4	3	2	1	o Representatives are given the chance to state their opinion freely without being disturbed or ignored تم إعطاء ممثلي الجهات المعنية حرية التعبير عن متطلباتهم
5	4	3	2	1	o Representatives know their roles officially ممثل الجهة المعنية على دراية تامة بما يتطلبه دورهم في العمل
5	4	3	2	1	o Representatives have the interest to impose change in the project ممثل الجهة المعنية يخص المشروع باهتمامه الخاص
5	4	3	2	1	o Users have been cognitively been prepared to accept change تم تحضير المستخدمون ذهنياً لتقبل التغيير الذي سوف يحدث
5	4	3	2	1	o Users have been motivated to engage in the project تم تحفيز المستخدمين للمشاركة في المشروع

C3. Pilot Study Progress Report

ثانياً: هذا الجزء خاص لجميع إدارات الوزارة					
Goal					**Question**
5	4	3	2	1	o All users identified know their role specifications جميع المستخدمين على دراية تامة بالتوصيف الإداري الخاص بأدوارهم في العمل
5	4	3	2	1	o All departments communicate effectively, they base their requirements without knowledge of departments inter-related with their work يوجد تعاون مستمر ما بين الإدارات المتداخلة في العمل وقد أثرت هذه العلاقة على توصيف متطلبات العمل
5	4	3	2	1	o The department's objectives blend with other organization objectives and lead to a shared organization goal? عند التوصيف بمتطلبات النظام تم الأخذ بالاعتبار مزج أهداف كل من الإدارة مع أهداف الوزارة للوصول إلى رؤية موحدة
5	4	3	2	1	o Trust can be promoted between employees if they blend together in informal social gatherings and meeting يمكن تعزيز الثقة ما بين الموظفين بالقيام برحلات و اجتماعات غير رسمية لهم
5	4	3	2	1	o There is a document that clearly describes the specification of each role in the organization structure and it is publicly accessible to all employees? يوجد توصيف إداري واضح لكل الأدوار في الهيكل التنظيمي في متناول جميع الموظفين
5	4	3	2	1	o Employees are doing what they are supposed to be doing كل موظف يقوم بما يتطلب منه دوره كما هو مذكور في التوصيف الإداري
5	4	3	2	1	o The benefit of change (introducing new systems) been openly discussed with employees مزايا النظام الجديد تم شرحها لموظفي الوزارة بشكل حواري مفتوح
5	4	3	2	1	o Their worries had been addressed before committing to change قبل الالتزام بالنظام الجديد تمت طمأنت جميع الموظفين بالقضايا التي كانت موضع قلق لديهم
5	4	3	2	1	o Decision making rely on central positions? اتخاذ قرارات في الإدارة يعتمد على المركزية
5	4	3	2	1	o Employees given more empowerment will collaborate freely in requirement facilitation تحميل الموظفين سلطة أكبر يجعل تعاونهم أكبر إثناء جمع متطلبات النظام
5	4	3	2	1	o Employees are aware of how the work is done in other departments
5	4	3	2	1	o Their knowledge affect their requirement specification
5	4	3	2	1	o It let them achieve consensus faster

C3. Pilot Study Progress Report

ثالثاً: هذا الجزء خاص بالشركة المنفذة للنظام					
Goal					**Question**
5	4	3	2	1	o All stakeholders are identified
5	4	3	2	1	o All stakeholders are aware of the change to be in progress
5	4	3	2	1	o Proper user representatives have been recognized
5	4	3	2	1	o Representative acquire proper communicative skills
5	4	3	2	1	o Acquaintance between users and the analysis team is important to establish proper communication
5	4	3	2	1	o A specific process will be used to collect requirements
5	4	3	2	1	o This process has been used before in this organization
5	4	3	2	1	o The process excites the users interest to engage in dialogue
5	4	3	2	1	o A time span is specified for each group of users
5	4	3	2	1	o The analysis team is structurally balanced with all the essential resources
5	4	3	2	1	o The team members have the right qualifications
5	4	3	2	1	o Each member knows their role in the project
5	4	3	2	1	o Members work in harmony
5	4	3	2	1	o Members characteristics clash with each other
5	4	3	2	1	o They clash with other users or IT personal in the organization
5	4	3	2	1	o Procedures and tools used to facilitate requirements are adequate and do not need to be improved
5	4	3	2	1	o When people engage in conversation and start to develop an understanding then they become more willing to deeper their understanding
5	4	3	2	1	o A good meeting plan has bean designed to overcome the difficulties in the beginning of the conversation.
5	4	3	2	1	o Users perception of risk to their interests lowers their willingness to engage in the project
5	4	3	2	1	o Categories are predefined to facilitate conversation
5	4	3	2	1	o Users were motivated to put down the required effort to engage

C3. Pilot Study Progress Report

ثالثاً: هذا الجزء خاص بالشركة المنفذة للنظام					
Goal					Question
5	4	3	2	1	o Understanding the goals of the users enables the team to know more about the users needs
5	4	3	2	1	o It is important to know who is supposed to do what and when, using what information and resources
5	4	3	2	1	o Relationships and dependencies between users and departments impacts the plan of requirement facilitation
5	4	3	2	1	o Understanding what other team members are backgrounds and capabilities affects the task distribution
5	4	3	2	1	o If team members have affective and agreed upon rules for interacting with each other collaboration between them increases
5	4	3	2	1	o Mutual understanding is the key aspect of knowledge transfer between the user and the analyst
5	4	3	2	1	o Knowing the status of users, things and events of the world outside the team and projecting future events affects the teams facilitation process and meeting deadlines

رابعاً: هذا الجزء خاص بإدارة الحاسب الآلي					
Goal					Question
5	4	3	2	1	o All stakeholders are identified o Proper stakeholder representatives have been identified
5	4	3	2	1	o They have proper communicative skills?
5	4	3	2	1	o All stakeholders are aware of the change to be in progress after system implementation
5	4	3	2	1	o The change was initiated by the users
5	4	3	2	1	o The change was initiated by decision makers
5	4	3	2	1	o The change was initiated by outside agencies
5	4	3	2	1	o All stakeholders acquainted to each other formally
5	4	3	2	1	o IT management distribute its decision making o Employees have a sense of empowerment?
5	4	3	2	1	o IT invests in open dialogue with stakeholders before a new project is engaged o Software projects evolved from within needs of departments or from higher management vision
5	4	3	2	1	o The procedures and tools used to facilitate requirements have been discussed and found adequate
5	4	3	2	1	o The requirement analysis plan must be assessed in a weekly bases to check if the analysis team can still achieve it's goals

رابعاً: ملاحظات الرجاء ذكر العوامل الرئيسية في اعتقادك التي ممكن أن تساهم في تعاون الجميع للوصول على متطلبات
o

Pilot Study Findings

The objective of the pilot study was to evaluate the data collection tools (phases 1, 2 and 3); it was not meant in any way as an evaluation for the methodology. Some alterations are to be made with the structured interviews questions, participators feedback show that the questions were ambiguous and the researcher has to rephrase some of them. Never the less some interesting findings were obtained:

- Initial analysis of the pilot study emphasizes the role of facilitator in governmental projects.
- Findings have validated the base criteria identified from the literature. A prioritization of these criteria was obtained from focus groups with stakeholders involved as follow (starting from the highest priority):
  - Knowledge Sharing
  - Dialogue
  - Trust
  - Role
  - Empowerment
  - Interest

This prioritization is context specific to the organization under study.

Other context specific issues related to stakeholder collaboration were also identified, these included:

- Facilitator representative, it was found that the communication gap was less between system engagers and system analysts and the collaboration was present when the facilitator was from within the organization but not related to the problem. This finding is the opposite of other studies that recommend that the facilitator be from outside the organization. Never the less it was an important factor for KMOD.
- User readiness; some users were asked to join the meeting with out prior notice from their direct manager. They were found less willing to engage in the meeting and wanted to schedule another meeting.
- User reassurance regarding security measures of the system. Some users did not want to engage until they were reassured before meeting the analysis team.

- The number of system analyst meeting with the users also had an affect on their collaboration. An analysis team more than two made the users intimidated and less willing to engage.
- Planning and sticking to the schedule had an affect on altering the collaboration process.

These are only initial findings and need to be reevaluated with other empirical studies scheduled for June, September, October and November 2006 where the whole methodology will be evaluated on ongoing KMOD software projects.

Preliminary Meeting

Date **Time**	1 Feb. 2006 10:30am – 12:30pm	**Place**	IT Dept./MOD

Attendance

Name	Position	Represent
Eng. Tahany Al-Adwani	System Development Controller	MOD
Eng. Nabeel Zaki	Project Manager	Alkaldia Sol. Co.
Eng. Bareeq AlGhannam	Researcher	Sunderland univ.

Context:
In the office of Eng. Tahani, the three of us met in an informal way. I know Tahany for eight years (I worked with her for two years in the same department), so it was easy for her to open up and talk freely without restrictions. I related easily with the people she was referring to as I have worked with them as well and know how the situation was, other personals that she referred to were unknown to me thus I had to imagine their characteristics (although I will get a chance to meet with them at a later stage). The third person in the room was Khaldia Solutions company representative; he is one of four system developers and also the project manager of the financial system/payroll project. I have also met with him before last August 2005 and had a fruitful discussion about problems experienced with users and management of the client.

No tape or video recording was done, I relied on note taking. As a quality procedure a report will be sent to both parties for validation.

Purpose:
The purpose of the meeting was twofold: First, to get an overview of the systems being developed for MOD so that I can choose the proper case to study. Second, to get a feeling of the problems encountered with stakeholders, compare them with the base criteria developed so far and discover collaboration problems to aid the focus of the research.

Meeting Structure:
The meeting was informal and unstructured, but I had embedded questions that I needed answers to (stated in the purpose). So although the discussion was free and open, I was making a checklist to the base criteria and trying to discover potential collaboration problem areas to research so that I can encapsulate context specific criteria.

Note:
During our discussions, I was thinking of using a tool which I have researched before which is called a "pattern". It is used as a template to capture ethnographic instances in rapid ethnography by Lancaster University. If the pattern template is used the coding will be a lot faster since it is done while the researcher is doing the observation, also the validation can be done at the spot. No report has to be written. It will combine data collection, coding and validation. The researcher needs only to

analyze the data and reach the proper conclusions. Also I think it will help in developing the system dynamic collaboration model a lot faster. The reason I say this is because in system dynamics the researcher has to find "archetypes" that describe the system (which are patterns of system structure or behavior that occur again and again). The pattern template can be used to store these archetypes in a systematic manner. A collection of related patterns are called a pattern language which I think is parallel in properties to archetype systems. The archetype systems are a set of generic structure interconnected and reinforced by feedback and delays. A "pattern language" shares "archetype systems" the characteristics property of being generic, recursive and interconnected.

Systems in MOD:

There are several systems that I can study. The focus discussion of this meeting was the financial system/payroll project as it is the most recent and major one being developed by Alkaldia Sol. Co. and as Eng.Nabeel was its project manager as well as one of its main developers. The structure of MOD is composed of civil departments and military departments; each has its own hierarchal structure, management policies and financial procedures. The project in focus serves the financial and payroll of military personal.

Note:

I will be conducting another meeting with Eng. Jihan Khalaf (from MOD) who has detail information of all the other systems. I will also have access of documentations of these systems.

Project Name:	Financial System (Military Personal)
Start Date	1 Sep. 2000
End Date	25 May 2004
Status	working (still not signed off/ accepted by the users)
Developer	Alkaldia Sol. Co.

Team Structure
▪ 1 project manager and system analyzer ▪ 2 senior system developers ▪ 2 system developers ▪ Testing done by developers The team suffered changes during the project; this aspect needs to be discussed in detail as it has an effect on the stakeholder system.
Process
▪ SDLC was adapted. At some phases the need of a user's signature to proceed to the next phase was omitted. This was due to inherent problems related to the users of not wanting to be held responsible of missing requirements recognized at a later phase. The only signed agreement from the user is the initial requirement; all other phases the users agree verbally that the team met their needs but refuse to sign any documents of acceptance. The developer team decided to proceed with development even though they had no proof of the user agreement. There was no maintenance contract signed. All problems were handled per call.

Eng. Nabeel is from Egypt, he has a four year working experience as a system developer in Egypt (1998-2002) and also a four year working experience as a system developer in Kuwait (2002-now). He has dealt with all types of users and encountered many problems related to collaboration and resistance to change.

The meeting started with the interaction of both Eng.Nabeel and Eng.Tahany relating to the many problems inherent in the ministry that they think it has an affect on collaboration during system development. I done my own categorization of the problems which I will state them in categorized points now; I will then put them in a pattern structure after discussing a potential pattern template with my supervisory team. I will go back to both Eng.Tahany and Eng.Nabeel to capture the context of in which the problems occurred.

There are problems in the IT management (MOD):

- Bad infrastructure. Structure of employees is not balanced. Qualified management working with unqualified employees. Not enough low level employees with the right experience and qualification to handle large projects and support the developer company during the software development process. (Low salaries for civil employees not attracting experienced IT, even though MOD has the highest budget). The IT management is trying to solve that problem by employing IT personals on special yearly contracts of high salaries. (*I think this problem happened because of the sudden hierarchal expansion of the MOD IT department structure. It was a small department with qualified employees, after the hierarchal expansion all the old employees were given higher management roles which left the department with no employees. New employees were recruited, but they are fresh graduates and inexperienced*).
- Gab between the qualifications of the IT personal of MOD and the Software house.
- Central decision making, everything has to go back to one person. No empowerment to employees in the IT department.
- No shared knowledge. If one person is missing then no one knows how the work is done.
- In contracts, a development company is always chosen with the lowest offering price meeting the initial requirements.
- Working hours 7:00am – 2:00pm. Employees do not stay after work hours if the job required (which is always the case in a software development project). The reason is the structure of IT employees is dominant by females and no overtime policy is used.

There are problems in the users (MOD):

- Organizational culture of machines replacing people (knowledge replacement). The importance of dialogue is recognized here to resolve this problem.
- Constant change of requirements. All requirements were based on the needs and interests of the user as a person not on the needs and interests of the user filling a role in the organization. If at any point a person changes

jobs and a new employee fills his place, a new set of requirements are then in demand.

- No clear future vision of their requirements, this might be a result of the user qualification. And the same time over requirements are sometimes specified from users in higher management because the department has access budget.
- User representative dealing with the IT & software developers are considered unacceptable by other users of the system. It is difficult to ignore some users as they will present consistent problems through out development. There is no knowledge sharing and open dialogue, each user insisting on his way of doing the work. One example is in the financial department, a user was in vacation while the system requirements were being collected. He knew in advance of the dates of data collection but still had his days off with no mean of being contacted even though he was the best representative of the users. Thus requirements were collected by other employees. When he came back he refused the requirements collected and insisted on providing the requirements himself. He refused any dialogue and had refused any knowledge sharing with the other employees.
- Lack of trust between the users, IT department and the developer. They represent a constant threat to the user.
- Users refuse to sign the acceptance of any part of the system to ovoid any legal responsibility of the system not matching the requirements. A system has to be accepted and signed off by its users according to MOD procedures. This behavior shows lack of empowerment.

There are problems in the organization (MOD):

- The organizational structure is clear on paper only. When it came to knowing who is responsible for what the picture became very fuzzy. There is no written job description and specification of responsibilities. Roles are not specified.
- No coordination between departments. Each department has its own perspective without relating to a shared perspective which should be evolved from within the organizations vision. Maybe there is no clear vision to the employees.
- Low salaries.
- Low percentage of Kuwaiti citizen employees. Most Kuwaiti employees are fresh graduates and lack the work experience.
- The need for overriding procedures and policies.

There are problems in the IT management (Alkhaldiah Sol. Co.):

- Restriction to SDLC process for software development, no management direction of using agile process (this is the same with all software development companies in Kuwait)
- Personalities of team members. The company had a very qualified developer, he had a very good relation with the team members in his company, but he was banned from entering MOD because of his attitude with the MOD management during meeting. His team members had advised him not to talk during discussions with MOD, they suggested he should inform them of his needs and that they would do the discussion for him to avoid unnecessary fraction with MOD IT management.

There are problems in the Ministries Interrelation Structure of the Country:

- All the financial departments of all ministries in the state of Kuwait are under the Ministry of Finance.
- All budgets specified to ministries must be used by that ministry. Any access in the budget will not be added to the coming year budget. This has an affect in over specification of requirements from higher management. Access budget is returned to the Ministry of Finance. It is common knowledge that ministries indulge in unnecessary needs at the end of a financial year. Some IT departments buy equipment with out any specific need or state requirements that they will never use.

Conclusion

This preliminary meeting has touched upon all the base criteria in my stakeholder collaboration mode which are trust, knowledge sharing, roles, empowerment, interest and dialogue. The meeting has also stepped by other criteria context specific to the culture of MOD such as: qualification, personality, experience, shared vision, inter-department communication and central decision making. These criteria need to be examined more specifically relating them to specific instances during the software development process. Some of these criteria may be considered signs and manifestation of the base criteria. I think I need to follow three levels of validation to verify the context specific criteria. I need to relate each criterion to a specific instance within a context fallowed by a more structured interview in the form of a survey.

Preliminary Meeting

Date **Time**	14 Feb. 2006 10:30am – 11:00pm	**Place**	IT Dept./MOD

Attendance

Name	**Position**	**Represent**
Eng. Jihan Khalaf	Professional Training Controller	MOD
Eng. Bareeq AlGhannam	Researcher	Sunderland Univ.

Context:
In the office of Eng. Jihan, I was to meet with Eng.Jihan (As a result of my meeting in Feb. 1st 2006, I made arrangements with Eng. Tahani to meet with Eng.Jihan as she was involved with the initial requirement collection documentation of the MOD Automation Project). I was acquainted but never worked with Eng.Jihan before.

No tape or video recording was done, I relied on note taking. As a quality procedure a report will be sent to parties involved for validation.

Purpose:
The purpose of the meeting was to build an overview of the MOD Automation Project as she was part of the team that conducted the initial requirement study.

Meeting Structure:
The meeting was informal.

Meeting Discussion:
At first I gave Eng. Jihan a brief overview of my research. Then she started briefing me on the MOD Automation Project. The aim of the project was to automate all workflow within MOD, develop systems to serve each department (some systems already exist), and to automate and archive all incoming and outgoing documents. The preliminary investigation of the project produced requirement documentation in November 2003 in preparation to link MOD with the national e-government project. The MOD Automation project was put on the shelf and now the plan is to re-examine the requirements again. A new study is in order to validate the requirements and to collect new requirements. This action is necessary because the hierarchal structure of MOD was changed; new departments and sections were introduced to the structure which the call for new requirements and the amendment of the old. A brief documentation of the requirement was given to me at the meeting; a detailed document on a CD will be given to me at a later meeting. I was welcomed to attend coming meetings related to the project.

Note:
- *I need to critically evaluate the systems within the MOD Automation Project.*
- *Choose two systems as case studies.*

Conclusion
An overview of all MOD Automation project was established.

Preliminary Meeting

Date **Time**	14 Feb. 2006 11:15am – 11:45pm	**Place**	IT Dept./MOD

Attendance

Name	**Position**	**Represent**
Eng. Tahany Al-Adwani	System Development Controller	MOD
Mrs. Nawal Abdul-Samad	Assistant Director of ID Department	MOD
Eng. Bareeq AlGhannam	Researcher	Sunderland Univ.

Context:
In Mrs.Nawal's office, Eng. Tahani was also present.

No tape or video recording was done, I relied on note taking. As a quality procedure a report will be sent to parties involved for validation.

Purpose:
The purpose of the meeting was to request attendance of sessions that are to be held in the future regarding the MOD Automation Project.

Meeting Structure:
The meeting was informal.

Meeting Discussion:
My major concern was that I needed to attend as an observer all meetins that are to be held between the user, IT and software house. I informed them regarding the dates I will be out of Kuwait. Mrs.Nawal told me that in March the IT department is to be holding seminars to present the new MOD Automation Project to all the head of departments before any requirement collection is taken. An agenda of the event is underdevelopment. It was agreed that I Eng.Tahani will be taking notes of all accounts and the reaction of the participants while I am away.

Conclusion
Presentations will be given to head of departments as an introduction to the MOD Automation Project.

Preliminary Meeting

Date **Time**	18 Feb. 2006 10:30am – 11:00pm	**Place**	IT Dept./MOD

Attendance

Name	**Position**	**Represent**
Mr.Mahmoud Al-Jowaiser	System Development Director	MOD
Eng.Jihan Khalaf	Professional Training Controller	MOD
Eng. Bareeq AlGhannam	Researcher	Sunderland Univ.

Context:
In the office of Mr.Mahmoud, I was looking for Eng.Jihan (As a result of my meeting in Feb. 1st 2006 and Feb. 14th 2006, I made arrangements with Eng.Jihan to collect the CD that has detailed specifications of the requirements of the MOD Automation Project). I knew and worked with Mr.Mahmoud for seven years and I was acquainted but never worked with Eng.Jihan.

No tape or video recording was done, I relied on note taking. As a quality procedure a report will be sent to both parties for validation.

Purpose:
The purpose of the meeting was to collect the initial requirement study of the MOD Automation Project on a CD from Eng.Jihan.

Meeting Structure:
The meeting was informal and unplanned for.

Meeting Discussion:
At first I gave Mr.Mahmoud a brief overview of the research and the official steps that I followed to get the MOD agreement to conduct the study. For thirty minutes we were then discussing how the MOD is planning to reinvestigate the requirements already documented for the MOD Automation Project. A requirement document was produced for the project in November 2003 in preparation to link MOD with the national e-government project. The MOD Automation project was put on the shelf and now the plan is to re-examine the requirements again. A new study is in order to validate the requirements and to collect new requirements. This action is necessary because the hierarchal structure of MOD was changed; new departments and sections were introduced to the structure which calls for new requirements and the amendment of the old.

It was made clear to a lot of the problems in using software after installation was from non-Kuwaiti employees. (*I think the problem is from the feeling of non-security and of the machine replacing the human syndrome. According to the civic service bureau, in the public sector employment in Kuwait, a Kuwaiti citizen holding a job cannot be fired or degraded, he/she can be given different jobs or salary deduction if found unsatisfactory. Thus a feeling of security is within the Kuwaiti employee even if a machine replaces his/her role. On the other hand, non-Kuwaiti employees have yearly* *contracts that are evaluated according to the needs of each department. Thus a computer program replacing his role might let them lose their jobs*.)

The ID department has planned a procedure that involves the following steps:

1. Send each head of department in MOD the part in the requirement documentation that related to them (if it is available in the initial study).
2. Specify a deadline for each department to read their requirement documentation, discuss it with employees within the department.
3. Feedback is expected from each department with a representative to meet with IT and SW house employees.
4. A date is sent to schedule a meeting between the department representatives, IT and SW house employees.
5. Several group meetings will be conducted to negotiate the final requirement for each department.
6. A signature is required for final decision.

Suggestions:

Mr.Mahmoud has given me the following suggestions (*I think they are very useful*):

- Have all my data collection tools prepared.
- Get extra help from PAAET IT students if possible for the survey distribution and collection (after giving them proper training in using the tool).
- Prepare a brief documentation on my study to be distributed to the departments to be studied (emphasizing benefit returning to them) calling for their cooperation enclosed with the letter from the under secretary of MOD.
- Be in continuous contact with the IT department while I am away in the UK.

Note:

- *Dates taken from the MOD schedule for revisiting the departments will affect my case study schedule.*
- *I will make arrangements to participate with the requirement collection team.*
- *My data collection tools must be ready before end of March.*

Conclusion

This meeting has made me focus on developing a schedule for my data collection. My schedule will be influenced by the schedule developed by MOD IT for the software house to meet with representatives of each department. I also need to develop my own schedule to attend inter-department discussions.

Preliminary Meeting

Date **Time**	1 Feb. 2006 10:30am – 12:30pm	**Place**	IT Dept./MOD

Attendance

Name	**Position**	**Represent**
Eng. Tahany Al-Adwani	System Development Controller	MOD
Eng. Nabeel Zaki	Project Manager	Alkaldia Sol. Co.
Eng. Bareeq AlGhannam	Researcher	Sunderland univ.

Context:
In the office of Eng. Tahani, the three of us met in an informal way. I know Tahany for eight years (I worked with her for two years in the same department), so it was easy for her to open up and talk freely without restrictions. I related easily with the people she was referring to as I have worked with them as well and know how the situation was, other personals that she referred to were unknown to me thus I had to imagine their characteristics (although I will get a chance to meet with them at a latter stage). The third person in the room was Khaldia Solutions company representative; he is one of four system developers and also the project manager of the financial system/payroll project. I have also met with him before last August 2005 and had a fruitful discussion about problems experienced with users and management of the client.

No tape or video recording was done, I relied on note taking. As a quality procedure a report will be sent to both parties for validation.

Purpose:
The purpose of the meeting was twofold: First, to get an overview of the systems being developed for MOD so that I can choose the proper case to study. Second, to get a feeling of the problems encountered with stakeholders, compare them with the base criteria developed so far and discover collaboration problems to aid the focus of the research.

Meeting Structure:
The meeting was informal and unstructured, but I had embedded questions that I needed answers to (stated in the purpose). So although the discussion was free and open, I was making a checklist to the base criteria and trying to discover potential collaboration problem areas to research so that I can encapsulate context specific criteria.

Note:
During our discussions, I was thinking of using a tool which I have researched before which is called a "pattern". It is used as a template to capture ethnographic instances in rapid ethnography by Lancaster University. If the pattern template is used the coding will be a lot faster since it is done while the researcher is doing the observation, also the validation can be done at the spot. No report has to be written. It will combine data collection, coding and validation. The researcher needs only to

analyze the data and reach the proper conclusions. Also I think it will help in developing the system dynamic collaboration model a lot faster. The reason I say this is because in system dynamics the researcher has to find "archetypes" that describe the system (which are patterns of system structure or behavior that occur again and again). The pattern template can be used to store these archetypes in a systematic manner. A collection of related patterns are called a pattern language which I think is parallel in properties to archetype systems. The archetype systems are a set of generic structure interconnected and reinforced by feedback and delays. A "pattern language" shares "archetype systems" the characteristics property of being generic, recursive and interconnected.

Systems in MOD:
There are several systems that I can study. The focus discussion of this meeting was the financial system/payroll project as it is the most recent and major one being developed by Alkaldia Sol. Co. and as Eng.Nabeel was its project manager as well as one of its main developers. The structure of MOD is composed of civil departments and military departments; each has its own hierarchal structure, management policies and financial procedures. The project in focus serves the financial and payroll of military personal.

Note:
I will be conducting another meeting with Eng. Jihan Khalaf (from MOD) who has detail information of all the other systems. I will also have access of documentations of these systems.

Project Name:	Financial System (Military Personal)
Start Date	1 Sep. 2000
End Date	25 May 2004
Status	working (still not signed off/ accepted by the users)
Developer	Alkaldia Sol. Co.

Team Structure

- 1 project manager and system analyzer
- 2 senior system developers
- 2 system developers
- Testing done by developers

The team suffered changes during the project; this aspect needs to be discussed in detail as it has an effect on the stakeholder system.

Process

- SDLC was adapted. At some phases the need of a user's signature to proceed to the next phase was omitted. This was due to inherent problems related to the users of not wanting to be held responsible of missing requirements recognized at a later phase. The only signed agreement from the user is the initial requirement; all other phases the users agree verbally that the team met their needs but refuse to sign any documents of acceptance. The developer team decided to proceed with development even though they had no proof of the user agreement. There was no maintenance contract signed. All problems were handled per call.

Eng. Nabeel is from Egypt, he has a four year working experience as a system developer in Egypt (1998-2002) and also a four year working experience as a system developer in Kuwait (2002-now). He has dealt with all types of users and encountered many problems related to collaboration and resistance to change.

The meeting started with the interaction of both Eng.Nabeel and Eng.Tahany relating to the many problems inherent in the ministry that they think it has an affect on collaboration during system development. I done my own categorization of the problems which I will state them in categorized points now; I will then put them in a pattern structure after discussing a potential pattern template with my supervisory team. I will go back to both Eng.Tahany and Eng.Nabeel to capture the context of in which the problems occurred.

There are problems in the IT management (MOD):

- Bad infrastructure. Structure of employees is not balance. Not enough employees with the right experience and qualification to handle large projects and support the developer company during the software development process. (Low salaries for civil employees not attracting experienced IT, even though MOD has the highest budget). Most The IT management is trying to solve that problem by employing IT personals on special yearly contracts of high salaries.
- Central decision making, everything has to go back to one person. No empowerment to employees in the IT department.
- No shared knowledge. If one person is missing then no one knows how the work is done.
- A development company is always chosen with the lowest offering price meeting the initial requirements.
- Working hours 7:00am – 2:00pm. Employees do not stay after work hours if the job required (which is always the case in a software development project). The reason is the structure of IT employees is dominant by females and no overtime policy is used.
- Gab between the qualifications of the IT personal of MOD and the Software house.

There are problems in the users (MOD):

- Organizational culture of machines replacing people (knowledge replacement). The importance of dialogue is recognized here to resolve this problem.
- Constant change of requirements. All requirements were based on the needs and interests of the user as a person not on the needs and interests of the user filling a role in the organization. If at any point a person changes jobs and a new employee fills his place, a new set of requirements are then in demand.
- No future vision of their requirements, this might be a result of the user qualification. And the same time over requirements are sometimes specified from users in higher management because the department has access budget.

- User representative dealing with the IT & software developers are considered unacceptable by other users of the system. It is difficult to ignore some users as they will present consistent problems through out development. There is no knowledge sharing and open dialogue, each user insisting on his way of doing the work. One example is in the financial department, a user was in vacation while the system requirements were being collected. He knew in advance of the dates of data collection but still had his days off with no mean of being contacted even though he was the best representative of the users. Thus requirements were collected by other employees. When he came back he refused the requirements collected and insisted on providing the requirements himself. He refused any dialogue and had refused any knowledge sharing with the other employees.
- Lack of trust between the users, IT department and the developer. They represent a constant threat to the user.
- Users refuse to sign the acceptance of any part of the system to ovoid any legal responsibility of the system not matching the requirements. A system has to be accepted and signed off by its users according to MOD procedures. This behavior shows lack of empowerment.

There are problems in the organization (MOD):

- The organizational structure is clear on paper only. When it came to knowing who is responsible for what the picture became very fuzzy. There is no written job description and specification of responsibilities. Roles are not specified.
- No coordination between departments. I think that each department has its own perspective without relating to a shared perspective which should be evolved from within the organizations vision. Maybe there is no clear vision to the employees.
- Low salaries.
- Low percentage of Kuwaiti citizen employees. Most Kuwaiti employees are fresh graduates and lack the work experience.
- The need for overriding procedures and policies.

There are problems in the IT management (Alkhaldiah Sol. Co.):

- Restriction to SDLC process for software development, no management direction of using agile process (this is the same with all software development companies in Kuwait)
- Personalities of team members. The company had a very qualified developer, he had a very good relation with the team members in his company, but he was banned from entering MOD because of his attitude with the MOD management during meeting. His team members had advised him not to talk during discussions with MOD, they suggested he should inform them of his needs and that they would do the discussion for him to avoid unnecessary fraction with MOD IT management.

There are problems in the Ministries Interrelation Structure of the Country:

- All the financial departments of all ministries in the state of Kuwait are under the Ministry of Finance.
- All budgets specified to ministries must be used by that ministry. Any access in the budget will not be added to the coming year budget. This has

an affect in over specification of requirements from higher management. Access budget is returned to the Ministry of Finance. It is common knowledge that ministries indulge in unnecessary needs at the end of a financial year. Some IT departments buy equipment with out any specific need or state requirements that they will never use.

Conclusion

This preliminary meeting has touched upon all the base criteria in my stakeholder collaboration mode which are trust, knowledge sharing, roles, empowerment, interest and dialogue. The meeting has also stepped by many criteria context specific to the culture of MOD such as: qualification, personality, experience, shared vision, inter-department communication and central decision making. These criteria need to be examined more specifically relating them to specific instances during the software development process. Some of these criteria may be considered signs and manifestation of the base criteria. I think I need to follow three levels of validation to verify the context specific criteria. I need to relate each criterion to a specific instance within a context fallowed by a more structured interview in the form of a survey.

Appendix D

Case Study I Material

D1. Foreign Procurement (FP) Project Report (in the CD)

D2. FP Context Specific Collaboration Evaluation Form

10/1/2007

Foreign Procurement Project: - The KMOD Case Study

Background

The foreign procurement system is concerned in procuring and maintaining the availability of all the armed forces in the Kuwaiti Army (Land, Air, and Navy forces) and the independent committees and units demands. The foreign procurement system works in sync with two types of committees:

1. Committee concerned in projects under the annual budget.
2. Committee concerned in projects under the support budget.

Also, one of the tasks of the foreign procurement department to qualify the companies specialized in foreign procurement, follow up on their activities, and to implement the systems needed to filter and distinguish those companies.

The foreign procurement, through the foreign purchase department, is responsible for purchasing and supplying all spare parts and maintenance parts from foreign markets.

Through the shipping and insurance department, all shipments of spare parts and maintenance are executed for the military forces.

Finally, the foreign procurement department, through the military cases sub-department, is handling all the military cases signed with the American and British governments in the military field.

Data Collection

- Observation and interviews documented in personal log.
- Meeting reports documented
- Pattern Encapsulation (link to data in personal log)
- Two focus group sessions conducted

  Date 13th & 14th of November 2006
  Time 9:00am- 11:00am
  Place G1/ FP Meeting Room
  Participant (representatives of each stakeholder group, names in personal log)

The implementation of the methodology is meant to be used as a tool that could be used to construct reality of the collaboration process as perceived by the stakeholders involved. That is done by making the stakeholders aware of their actions by enforcing a standard that frames a way of thinking. From the interviews I have conducted with analysts in the field of requirement collection in Kuwait, awareness is a major issue that is affecting the collaboration of users.

The following description summarizes the methodology phases. As I mentioned before in my reports the methodology is generic, the phases are not in sequence, and at any point information obtained was used to mace necessary changes to the outcome. However, I started the methodology with the data gathering which is documented in phase 1.

Phase 1 Scope of the System

This is a preliminary investigation phase. The system was investigated to identify its goal, structure and roles:

System Goals

The Foreign Procurement Department has thee main goals for the system they want to develop:

1. The first goal of the foreign procurement system is to ease the mechanism of the business procedures executed in the sub-departments and divisions of the foreign procurement department. Also, to integrate those sub-departments and divisions using an automated system that enables the transfer of information between them using the available security level assigned for each user of the system

2. Integrate the foreign procurement system with other systems in the ministry like, financial, legal affairs, and general record systems. Using this integration, information between those systems will be easier and faster to transfer.

3. Construct a proper infrastructure for the foreign procurement department to implement the system. Some of the main requirements for such infrastructure are workstations for employees and adequate space for them, also to connect the workstations to the local area network of the ministry.

Coherent Structure

The requirement collection for the foreign procurement system involves the collaboration of several sub-systems serving different sub-departments and divisions.

Looking into these systems in a hieratical way will only increase the complexity, a VSM was used as a tool to represent the system holistically in a coherent structure.

1. System 1

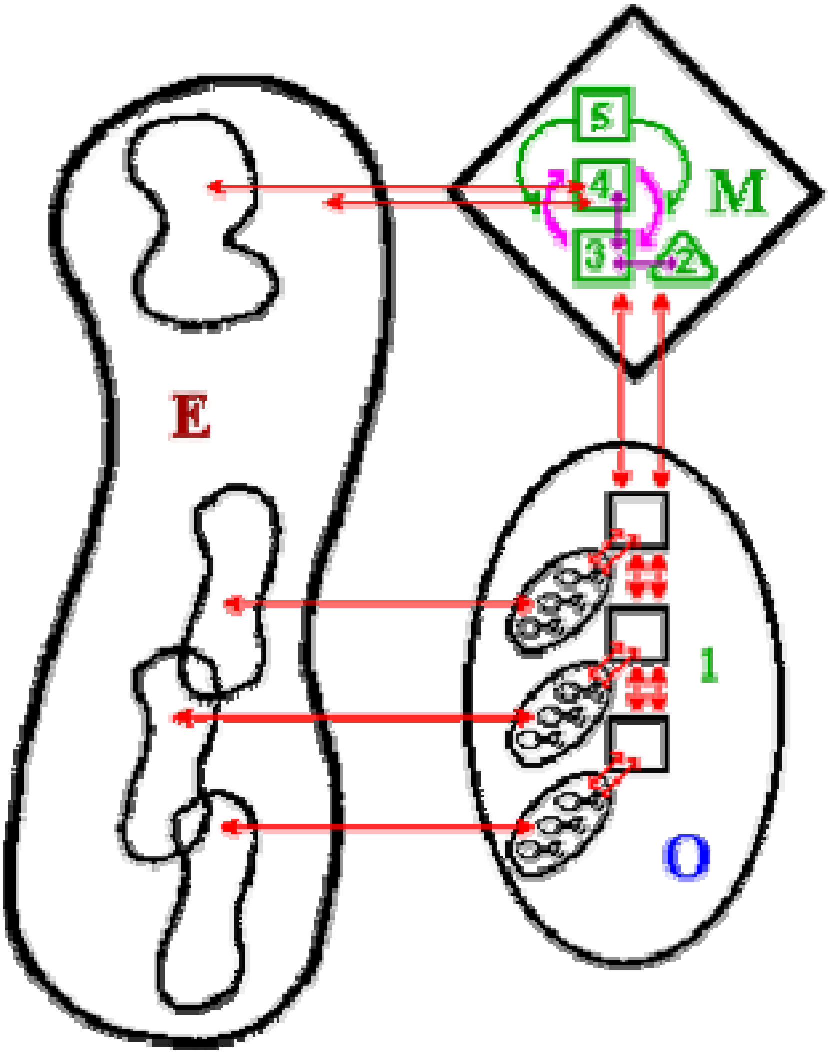
Operation:- The sub-modules are:
Incoming/Outgoing Mail System.
Foreign Contracts System.
Foreign Purchases System
Shipping and Insurance System.
Military Cases System

2. ***System 2***
Regulation & Conflict Resolution:-
The undersecretary of the sector is responsible for enforcing the regulations

3. ***System 3***
Day to day management: - The head of each division within the five sub-modules in the operation is responsible for the internal regulation, he acts as an audit

4. ***System 4***
Adaptation & Forward planning- This system is missing within the system. There is a planning committee on the level of the ministry but it is missing within the sector.

5. ***System 5***
Authority & Policy- The Controller of each division represents the authority



Foreign Procurement (F.P.) Stakeholders on pisoSIA Matrix

Engagers

Stakeholders	Stakeholder Attributes			Stakeholder Influence
	Power	Legitimacy	Urgency	
Secretary		X	X	Dependent
Accountant		X	X	Dependent
Shipping & Insurance Personal		X	X	Dependent
Foreign Contracts Personal		X	X	Dependent
Foreign Purchases Personal		X	X	Dependent
Correspondence Personal		X	X	Dependent
Military Cases Personal		X	X	Dependent
Shipping & Insurance Controller	X	X	X	Definitive
Foreign Contracts Controller	X	X	X	Definitive
Foreign Purchases Controller	X	X	X	Definitive
Correspondence Controller	X	X	X	Definitive
Military Cases Controller	X	X	X	Definitive
Manager	X	X	X	Definitive
Division Head	X	X	X	Definitive

Facilitator	Project Manager	X	X	X	Definitive
	SWH Analyst		X	X	Dependent
	KMOD SA Controller	X	X	X	Definitive
	KMOD SA		X	X	Dependent
	Technical Office P		X	X	Dependent
	Communication Officer		X	X	Dependent
	IT Undersecretary	X	X	X	Definitive
Outside Agencies	Ministry of Finance		X	X	Dependent
	Elfatwa Wil Tashree		X	X	Dependent
	Military Office (Embassy)		X	X	Dependent
	Companies		X	X	Dependent
	Foreign Armies		X	X	Dependent
	Educational Facilities		X	X	Dependent
	Accountancy Bureau		X	X	Dependent
Decision Makers	F.P. Undersecretary	X	X	X	Definitive
	F.P. Manager	X	X	X	Definitive
	MOD Undersecretary	X	X	X	Definitive
	Planning Sector		X		

At this level of analysis, the human boundary of the system has been specified. Roles have been identified and distributed into categories. People who may have an influence on the success of collaboration are identified in the matrix. A stakeholder that poses all three attributes should be given higher priority. As the project progresses, some stakeholders could be removed and others maybe added. This awareness is needed throughout the requirement collection phase. The project manager needs to be aware of those who will affect the progress of the project.

Phase 2 Understand the Social, Political and Cultural Issues

It was very important to understand the social, political and cultural issues that are going to affect the group. In a system thinking structure a focus group session of the stakeholders (not all the stakeholders attended) was conducted.

The purpose was to extract important factors affecting the collaboration of the group. I clearly define to them their roles as stakeholders in a software development process so that they can forward collaboration and communication problems.

- First, I start with a checklist that has the following constructs [knowledge sharing, interests, roles, trust, empowerment and dialogue]. As a facilitator I explained to them what I meant by the following constructs, this was done to stimulate the discussion [I found that after I explained the factors participants were more willing to participate and give their own perception].

  Knowledge Sharing: what mutual perception they share related to work?
  Interests: what makes them engrossed in participation?
  Roles: do they know what they are supposed to do or what they only do?
  Trust: are they given assurance and certainty to any threats?
  Empowerment: do they have the power to change a process?
  Dialogue: are they expressing their opinions freely?

- Then, I write down every construct or artifact that the group mentions. I ticked beside the construct or artifact every time a participator in the group talks about a story or incident in relevance to it. The following was obtained:

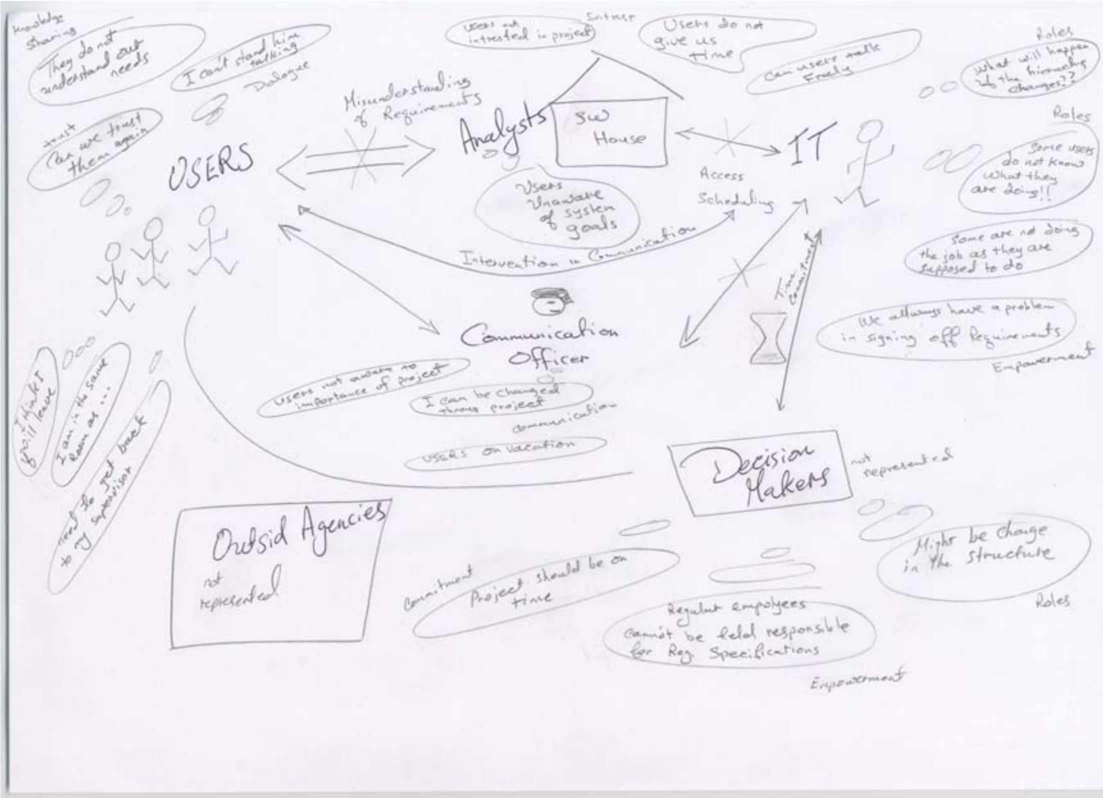
Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interests	✓
Roles	✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Dialogue	✓
Awareness	✓ ✓ ✓ ✓ ✓
Communication	✓ ✓ ✓ ✓ ✓ ✓
Commitment	✓ ✓ ✓ ✓ ✓ ✓ ✓

- At the end of all focus group meetings, I filtered the constructs and artifacts by picking the ones that were ticked three times or more (by the rule of three, they are considered patterns).

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Awareness	✓ ✓ ✓ ✓ ✓
Communication	✓ ✓ ✓ ✓ ✓ ✓
Commitment	✓ ✓ ✓ ✓ ✓ ✓ ✓

These findings were validated after I find corresponding patterns from the case study by linking these constructs to actual stories.

- I used SSM concept of rich text pictures to visualize the complexity related to the collaboration process between stakeholders while they were discussing the collaboration factors. I showed pisoSIA® stakeholder categories identified in the picture. I tried showing all related interrelationships that might be needed during the software development process making emphases on interests and influence (this was originally to be done mutually by the stakeholders, however I found that it is more convenient to be done the facilitator-which was me in this case study- because while the group was engrossed in discussion, I found it easy for me to translate what they are saying to pictures with interrelations). I then added unrepresented groups (outside agencies and decision makers) to the picture after the session was over, my interpretation of their worries from previous interview was then added.



As a facilitator in this project I find using rich pictures in the group session beneficial in making the problems in collaboration between stakeholders stand out in this project. However, as participators talk more and more I found it difficult for me to continue adding to the drawing. It became too crowded and may lose its essence.

- I went back to previously collected data and identified patterns. I then associated each pattern to a context. The following pattern template was used to document the incidents [vignettes]. (Some pattern template were used as data recording sheets, other patterns were extracted latter on from previous interviews.

Name
The name should reflect the situation at hand. How the construct was achieved or what artifact led to a specific construct.

Vignette Number: Case
Each pattern must have a number: Each pattern must be associated to a case.

Predecessor
Patterns that immediately leads this pattern.

Collaborative Arrangement
A description of the collaborative arrangement under study. It should include the people involved, the resources, number and type of communication medium employed and the basic activity.

Representation of activity
How the activity is represented. Plans and procedures of how activities relate to each other.

Ecological Arrangement
A description of the spatial characteristics. Abstract representation, plan view and information flow. Pictures could be used or sketches.

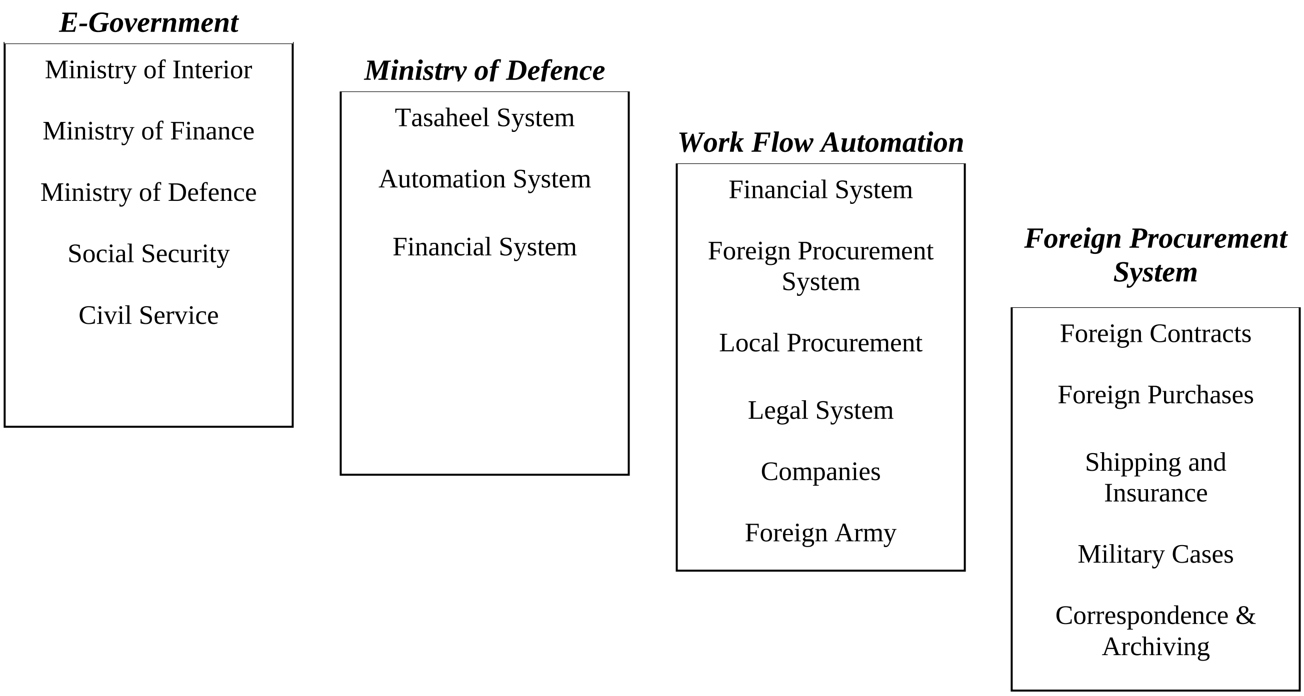
Collaboration Technique
A description of how and in what way the collaboration took place.

Population of Use
A description of the domain of user group.

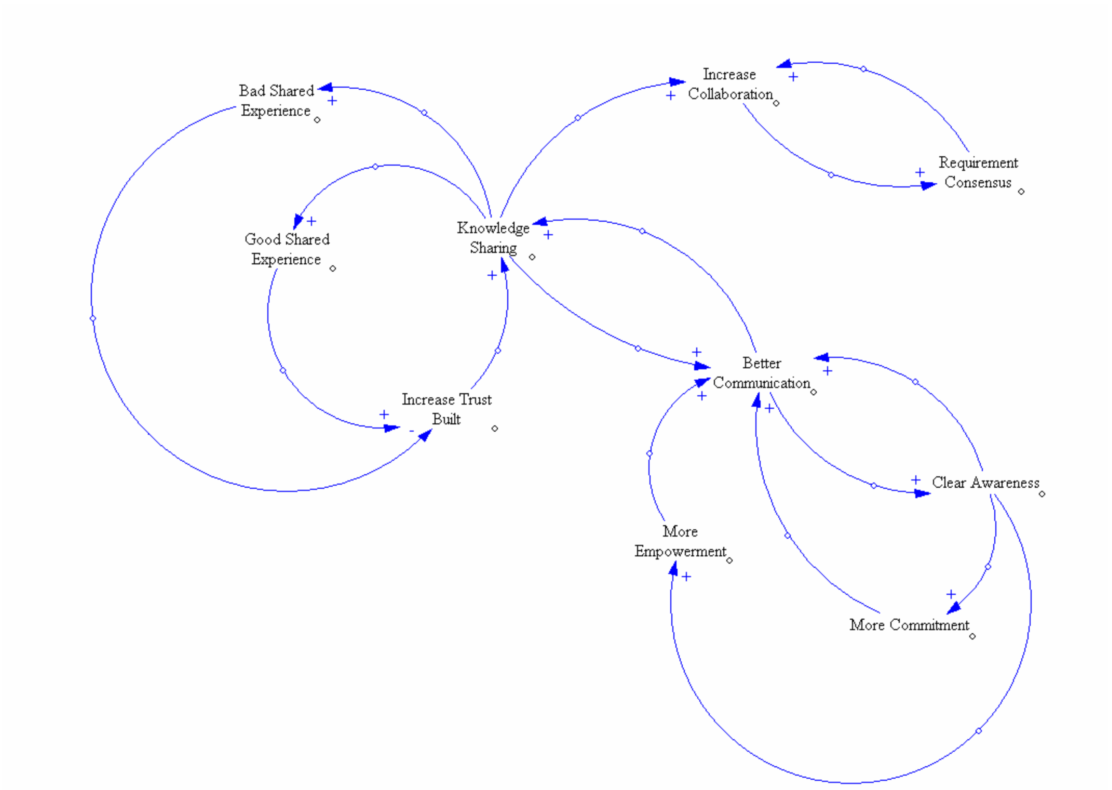
Predecessor
Patterns that are immediately caused by this pattern.

Phase 3 Conceptualize the complexity of Collaboration

From the data gathering it is seen that the problem is not simply a technical one. Social issues will affect the process of requirement specification. It is also not a problem that is contained within the ministry, I used VSM recursion concept to sketch the level of recursion in the organization. There are four major levels of recursion. The top level is Kuwait as a government and its direction into implementing an e-government platform. The Ministry of Defense forms the second level. The Ministry of Defense has several ongoing software systems, one of which is the Automation system that is level three. Level four shows the Foreign Procurement project within the Automation system that is the focus of this case study. At the end of this point, I identified the level where the problem needs to be in focus and diagnosed. The Foreign Procurement project needs to be diagnosed by considering the levels of recursion above and below it. It also needs to take into consideration the systems in the same level of recursion it lays. The Foreign Procurement system is highly integrated with other systems in the ministry like, financial and legal affairs which has potential problems in the way of implementation. As a project manager and facilitator, I need to focus on what matters by making control of variety. I need to attenuate the variety of the complexity of the situation by selecting what is relevant to stakeholder collaboration for each level of recursion such that the aim of the problem is fulfilled, and then amplify it by finding manifestations that can describe it. In this case study I looked at two problems: - the problem faced by the financial system in level three and the problem and the problem face by the Ministry of Deference as a structure in level one.(More details will be given as analysis will be performed)



- The system dynamics approach of feedback process is used to focus on complex problems which are responsible for the changes we experience over time. I formed a mental causal loop diagram using system dynamics convention. The loops developed represent a conceptual diagram of the encapsulated patterns showing cause and affect. Arrows tail indicates the cause (parent pattern) and the tail will indicate the affect (child pattern). If cause and affect are in the same direction then the arrow head is +ve (s for same), otherwise it is –ve (o for opposite). The loops developed should represent a conceptual diagram of the requirement analysis and how collaboration is established. At this stage all attenuated patterns in sub-stage two (phase two) must be included. Factors contributing to its cause are specifically identified and can be found from the pattern templates.



- The patterns encapsulated before act as a link between the CLD and the actual case study. They give reliability and confidence to the results of the CLD.

System Name	
Foreign Procurement	

Personal Information	
Name	
Position	
Years of experience	
At what stage where you involved?	
What was your role?	

The goal of this questionnaire is to validate the context specific factors affecting Stakeholder Collaboration within the requirement collection phase of the KMOD Automation project from the viewpoint of FP stakeholders.

This goal is achieved through the analysis of the following objectives:
Validate the encapsulated context specific constructs of collaboration

Construct
Knowledge Sharing
Trust
Empowerment
Awareness
Communication
Commitment

It is also required to establish a prioritization list of the factors.

Your completion of the questionnaire is highly appreciated and will affect the development of the approach.

	Strongly Agree	Agree	Neutral/ No Opinion	Disagree	Strongly disagree
A. Collaboration Constructs					
1. The correct perception of information transferred from the stakeholder to the analyst during requirement collection positively affects collaboration					
2. Trust developed between a system analyst and the users promotes the user to collaborate and talk freely without constraint					
3. Authorizing stakeholders of lower power to decide on matters regarding their daily tasks promotes the collaboration during requirement collection					
4. Stakeholders aware of the system goals, functionalities and limitations are easier to collaborate with					
5. Communication between stakeholders is key to collaboration					
6. Stakeholder feeling of commitment to the requirement collection team increases the collaboration between them					

B. Please list the construct starting from one indicating highest priority
Knowledge Sharing
Empowerment
Trust
Awareness
Commitment
Communication

C. Please indicate if there are other collaboration constructs that you think should be considered

Appendix E

Case Study II Material

E1. Information Technology (IT) Project Report (in the CD)

E2. IT Context Specific Collaboration Evaluation Form

5/12/2006

Information Technology Project: - The KMOD Case Study

Background

The Information Technology system is concerned in procuring and maintaining the availability of all the armed forces in the Kuwaiti Army (Land, Air, and Navy forces) and the independent committees and units demands. The foreign procurement system works in sync with two types of committees:

1. Committee concerned in projects under the annual budget.
2. Committee concerned in projects under the support budget.

Also, one of the tasks of the foreign procurement department to qualify the companies specialized in foreign procurement, follow up on their activities, and to implement the systems needed to filter and distinguish those companies.

The foreign procurement, through the foreign purchase department, is responsible for purchasing and supplying all spare parts and maintenance parts from foreign markets.

Through the shipping and insurance department, all shipments of spare parts and maintenance are executed for the military forces.

Finally, the foreign procurement department, through the military cases sub-department, is handling all the military cases signed with the American and British governments in the military field.

Data Collection

- Observation and interviews documented in personal log.
- Meeting reports documented
- Pattern Encapsulation (link to data in personal log)
- NCS Reports
- KMOD/IT Reports
- Two focus group sessions conducted
    - Date 4th & 5th of April 2006 (pilot study phase)
    - Time 10:00am- 12:00am
    - Place Sabhan/ IT Meeting Room
    - Participant (representatives of each stakeholder group, names in personal log)

Results from pilot study report was revisited and refined. The stakeholder matrix updated according to the current situation of people involved in the project.

The Information Technology (IT) Project is 0ne of the projects project selected from within the environment of KMOD as an example of a typical ministry department with expected high collaboration between stakeholders. The how and why it was chosen was described in detail in chapter Five. Originally the IT project was selected as a pilot study, chapter five show the first three stages briefly. In this chapter more elaboration will be given and the rest of the phases will be applied.

7.1. Phase I - Defining the System Boundary

The system boundaries are defined by the following steps:

7.1.1 Understand the System

Preliminary investigation of documents and early interviews with IT official gave an initial understanding of the system. Results from the pilot study in chapter five states that the IT department provides IT services to all KMOD departments and employees. Such services are divided into the following:

- Operations
- Technical Support
- Networks
- Document Processing
- System Development
- Qualification and Assessment
- IT Training

Although the IT department deals with all the other departments in the ministry through providing the IT services, never the less it has special relations with the following:

- Financial Department System
- Local Procurement System
- Administration and Personnel Department
- Training and Development Department

The IT Department has the following main goals for the system they want to develop:

- Ease the mechanism of sending and receiving calls from all departments regarding fixing problems and requesting new services.
- Integrate the Information Technology system with other systems in the ministry that are directly related, Financial, Local Procurement System , Administration and Personnel Department, and Training and Development Department

I used VSM recursion concept to sketch the level of recursion in the IT department. Figure 7.1 emphasizes the IT Automation System as embedded systems were there are four major levels of recursion shown.

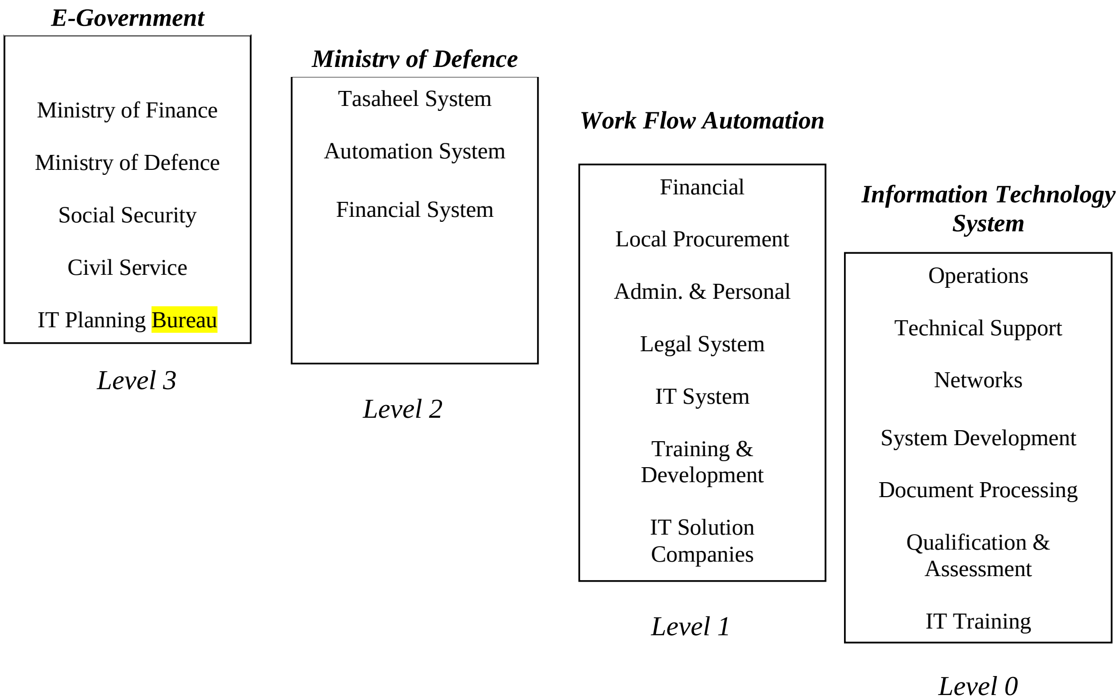


Figure 7.1 . The VMS recursion of the IT System

The top level which we will call level three is Kuwait E-government infrastructure, where our main interaction sites are the Ministry of Finance, Social Security, Civil Service and the IT Planning. It is most important to be in synch with the IT planning sectors because it directly deals with all the resolutions of the IT departments of all the public sector one of which the KMOD IT System.

The Information Technology (IT) project is the system in focus. It works in sync with other departments on the same recursion level: Financial, Local Procurement, Administration & Personal, Legal System, Training & Development, and IT Solution Companies from the outside environment. As in case study I requirement collection sessions are conducted individually for each project, I find that there is missing sessions that involve stakeholders from all the interrelated departments.

Level zero shows a finer granularity of the IT project which is the system in focus of this case study. It has several systems working simultaneously which are: Operations, Technical Support, Networks, System Development, Document Processing, Qualification & Assessment, and IT Training. Each system delivers complete services to the IT system which integrated represent the department goals.

Figure 7.2 shows another representation of the levels of recursion for the IT system.

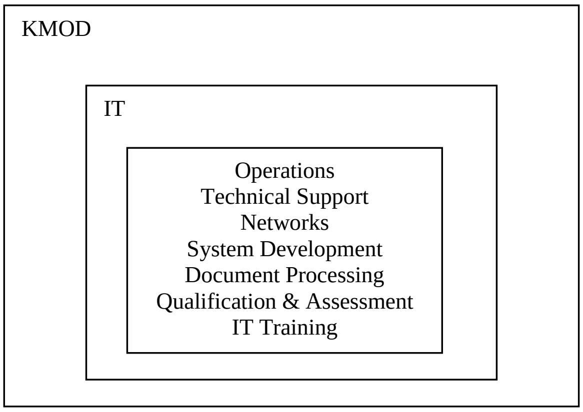


Figure 7.2. Another view of the recursion levels of the IT System

A holistic analysis is considered, IT project needs to be diagnosed by considering all the levels of recursion that affect it. Systems in the same level in which it needs to integrate with and levels above and below it that are affected or will affect it are considered. Recursion drawing as in Figures 7.1 and 7.2 give an instant realization of what is significant for a viable collaboration. From a cybernetic viewpoint, resources are allocated to the IT department at recursion level one. These resources are then reallocated by the IT management to either sub-department at recursion level zero. Sub-departments compete for these resources and threat the proper flow of information in the system. Careful consideration of how the resources are allocated insures the existence of the right information at the right place and therefore enforcing the viability of collaboration between the stakeholders within the requirement phase.

7.1.2 Structure the System Boundaries

VSM provides a structure to visualize the boundaries of the IT system as shown in Figure 7.3.

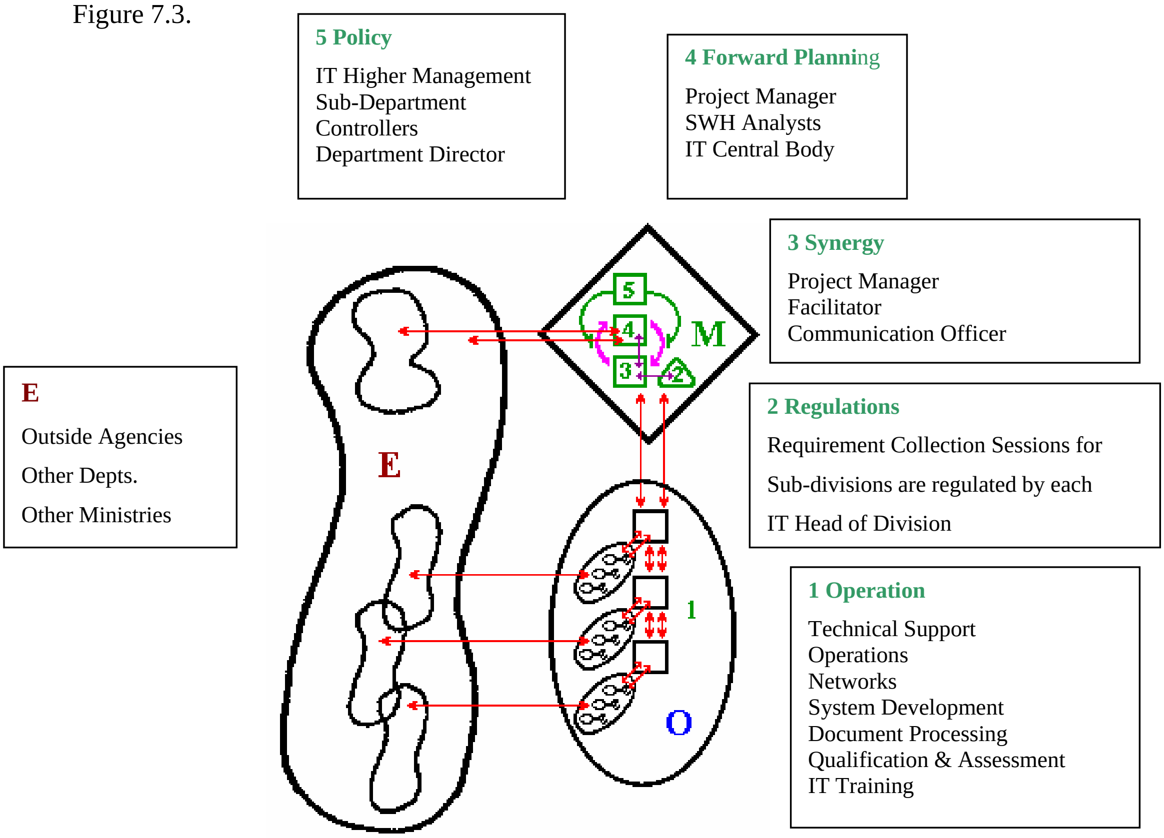


Figure 7.3. VMS Structure at Recursion Level 1 of the IT System

Figure 7.3 show that the requirement collection for the IT System involves the collaboration of several stakeholders serving different divisions as well as outside agencies in the environment; where specific appointment of the stakeholders shown are identified in the human boundary definition in the next step of this phase.

O represents Operation and it includes System1

System1:- Operation of Primary Activities

IT is currently organized into sub-departments, which constitute the System 1 and are completely autonomous:

- Technical Support
- Networks
- System Development
- Document Processing
- Qualification & Assessment
- IT Training

The integration of these seven sub-systems defines the IT System. Collaboration of stakeholders for these individual systems must be achieved by conducting requirement collection sessions between them with representatives from each. This was obvious and conducted accordingly in this project. However there should have been an intervention as lack of common requirement sessions that hold stakeholder representatives from different sub-departments is lacking at early stages of requirement collection as depicted in Phase Five.

M is the Metasystem and it includes Systems 2, 3, 4 and 5

System 2:- Regulation, Stability & Conflict Resolution

Internal regulation of each system 1 is insured by appointing a stakeholder in a position identified in the next step of human boundary definition.

System 3:- Synergy & Optimisation

As with the first case study general management meetings are conducted weekly on the level of divisions as well as on the level of sub-department. Awareness of the automation project being developed is high, however further implementation of the approach show that -as appointed earlier- lack of requirement session that involve cross departmental stakeholders in collaboration had a negative affect on the collected requirements.

System 4:- Adaptation & Forward planning-

The IT department is in communication with the Procedural Development but no actions were taken if procedures in the current system under development were to be reengineered in the future.

System 5:- Authority, Identity & Policy

A certain procedure was developed and followed throughout the project described in chapter five in the pilot study and was adhered to in the IT project which will be summarized below:

- The IT department director initiated an order to all the related IT sub-departments to analyze the old requirement documentation.
- A deadline was specified for each sub-department to read their requirement documentation and discuss it with employees within the department.
- Feedback was expected from each IT sub-department with a representative to meet with SW house employees.
- A date was sent to schedule a meeting between the department representatives SW house employees.
- Several group meetings were conducted to negotiate the final requirement for each department as well as observation.
- A signature given for final requirements.

In the coming steps of the approach, the VSM diagram of the Automation System (recursion level two) and VSM diagram of recursion level zero are presented with stakeholders mapped each in turn and stakeholders involved are carefully considered.

7.1.3 Define Human Boundaries

Seven sub-departments work under the IT department as shown if Figure 7.4, each responsible for procedures and executing tasks assigned to them, depending on the roles and responsibilities and the business procedures cycle.

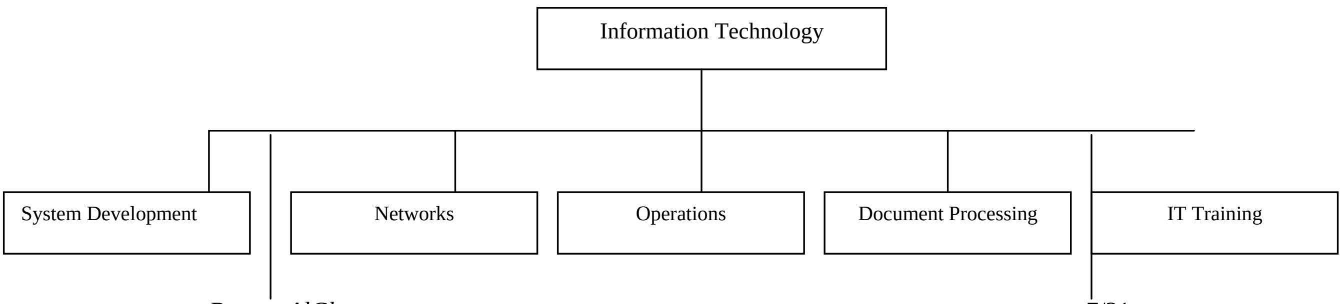


Figure 7.4. Hierarchy Structure of IT department

Table 7.1 shows the stakeholders involved which represent the human boundaries of the system according to the structure of the IT system. They are divided into four categories: the system engagers, facilitators, outside agencies and decision makers. In each category a number of users are identified according to the characteristics presented in the pisoSIA description in chapter three.

According to pisoSIA a stakeholder that poses all three attributes should be given higher priority. The project manager needs to be aware of those who will affect the progress of the project. Table 7.1 showing stakeholders identified through the use of the pisoSIA matrix.

The Central IT Body is categorized as both outside agency and decision maker at this particular time of investigation. The decision was reached because the authorization of this association was not fully configured it was initiated after the start of the project. I believe it should act as a decision maker in future projects.

Stakeholders	**Stakeholder Attributes**			**Stakeholder influence**
	Power	**Legitimacy**	**Urgency**	
IT Secretary		X	X	Dependent
Technical Support Personnel		X	X	Dependent
System Development Personnel		X	X	Dependent
Operations Personnel		X	X	Dependent
Networks Personnel		X	X	Dependent
Qualification & Assess. Personnel		X	X	Dependent
IT Training Personnel		X	X	Dependent
Document Processing Personnel		X	X	Dependent
Technical Support Head of Division		X	X	Dependent
System Development Head of Division		X	X	Dependent

System Engagers

	Operations Head of Division		X	X	Dependent
	Networks Head of Division		X	X	Dependent
	Qualification & Assess. Head of Division			X	Dependent
	IT Training Head of Division		X	X	Dependent
	Document Processing Head of Division		X	X	Dependent
	Technical Support Controller	X	X	X	Definitive
	System Development Controller	X	X	X	Definitive
	Operations Controller	X	X	X	Definitive
	Networks Controller	X	X	X	Definitive
	Document Processing Controller	X	X	X	Definitive
	Qualification & Assess. Controller	X	X	X	Definitive
	IT Training Controller	X	X	X	Definitive
	IT Manager	X	X	X	Definitive
Facilitator	Project Manager	X	X	X	Definitive
	SWH Analyst		X	X	Dependent
	KMOD SA Controller	X	X	X	Definitive
	KMOD SA		X	X	Dependent
	Technical Office Personal		X	X	Dependent
	Communication Officer		X	X	Dependent
Outside Agencies	Ministry of Finance		X	X	Dependent
	Legal Advice and Legislation		X	X	Dependent
	Developer Companies		X	X	Dependent
	Educational Facilities		X	X	Dependent
	Accountancy Bureau		X	X	Dependent
	Central IT Body	X	X		Discretionary
Decision Makers	IT Undersecretary	X	X	X	Definitive
	IT Manager	X	X	X	Definitive
	MOD Undersecretary	X	X	X	Definitive
	Planning Sector		X	X	Dependent
	IT Undersecretary	X	X	X	Definitive
	Procedural Development		X		Discretionary
	Central IT Body	X	X	X	Definitive

Table 7.1. Stakeholder Identification and Analysis Matrix of the IT System**.**

7.1.4 Visualize the System Boundaries

Stakeholders identified from the pisoSIA matrix are mapped into the IT structure defined by the VSM. This step visually defines the system boundaries; the evaluator must ensure that all Systems one through five of the VSM exists in the VSM structure and has stakeholders associated to perform them. The evaluator at a later phase needs also needs to check that these stakeholders are not over exhausted with multitasking.

Project Managers should be able to develop contingency plans that aim for internal optimization in stakeholder collaboration by analysing future changes in the organization, in the FP project many changes in the hierarchy of the department affected by the political status of the country has altered the level of collaboration the stakeholders were involved. Collecting requirements and knowing that expected changes will affect these requirements lowered the level of collaboration.

System 4 function is not evident during the procedures of the FP requirement collection. The communication was overlooked between the integral of two sectors before the start of this project which are the Technical Office and Procedural Development. Managers need to examine the environment in which they exist and to plan accordingly.

All communication channels shown in Figure 7.4 must also exist and having stakeholders to perform them. A deficiency in collaboration is immediately diagnosed and identified by completing the structure. Early warning signals are passed on to Phase Five to be documented as part of the intervention points in the planning strategy.

VSM analysis can be applied to this diagram to diagnose collaboration problems at a higher level of investigation. One level below the system in focus-which is Level Zero- can also be drawn, in the IT case, there will be five seven Level Zero diagrams**.**

Level two provides a higher level of recursion; this level enables to consider the Automation System in relevance to the other available systems in the ministry. There is no conflict between them, however there is no obvious internal regulator for the system at this level of recursion.

5
Decision Makers (exm. Sub-Department)
Controllers
Department Director

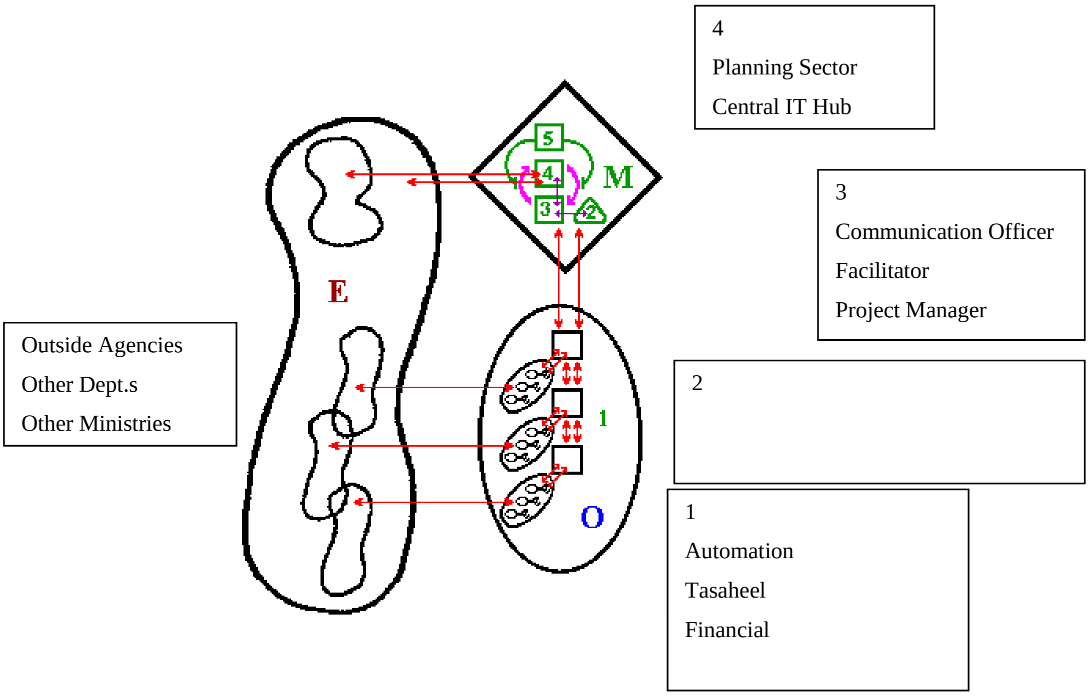


Figure 7.5. Human Boundaries Mapped to IT VSM (Recursion Level Two)

7.2. Phase 2: Collaboration Definition

It was very important to understand the social, political and cultural issues that are going to affect the group as seen in the previous analysis. In a system thinking structure a focus group session of the stakeholders (not all the stakeholders attended) was conducted. The purpose was to extract important factors affecting the collaboration of the group. I clearly define to them their roles as stakeholders in a software development process so that they can forward collaboration and communication problems.

7.2.1. Define the Collaboration Constructs

First, I started with a checklist that has the following constructs [knowledge sharing, interests, roles, trust, empowerment and dialogue]. As a facilitator I explained to them what I meant by the following constructs, this was done to stimulate the discussion [I found that after I explained the factors participants were more willing to participate and give their own perception].

Knowledge Sharing: what mutual perception they share related to work?

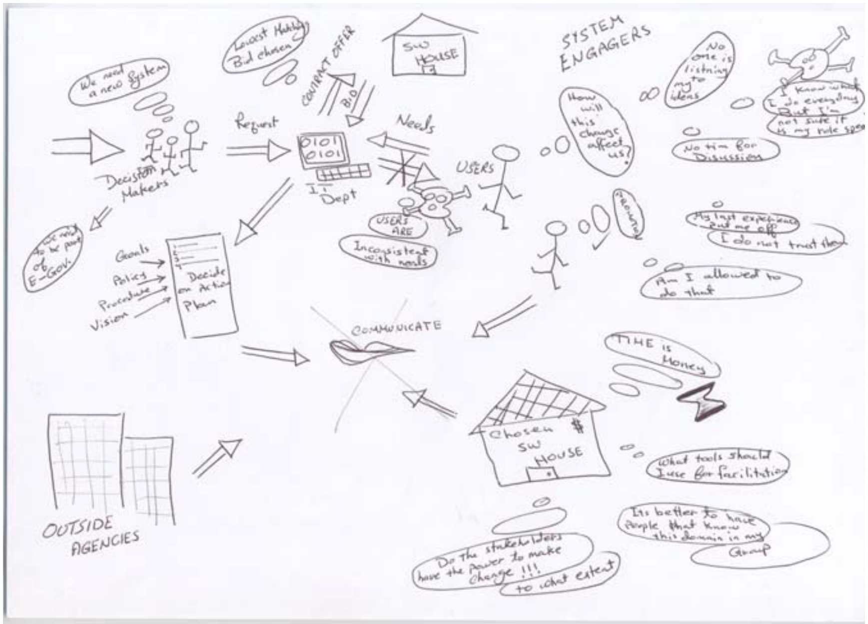
Interests: what makes them engrossed in participation?

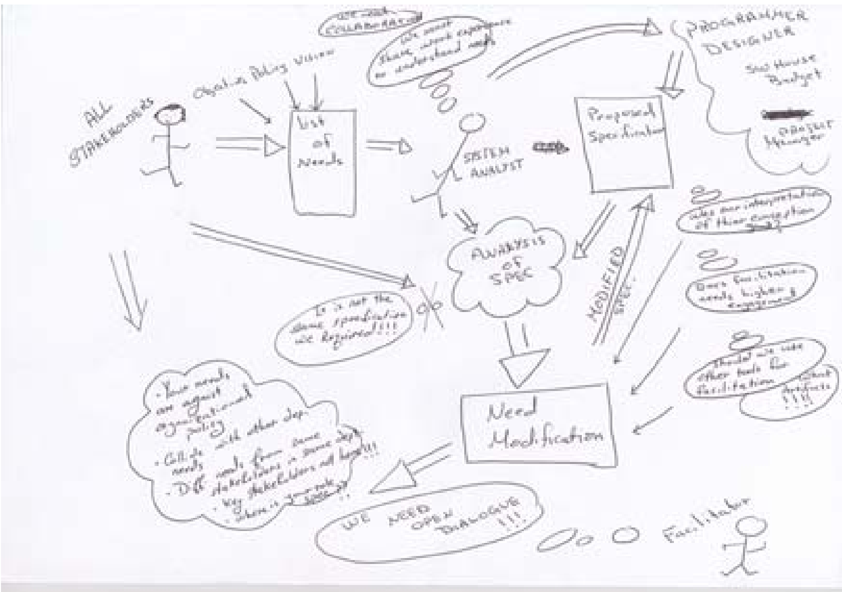
Roles: do they know what they are supposed to do or what they only do?

Trust: are they given assurance and certainty to any threats?

Empowerment: do they have the power to change a process?

Dialogue: are they expressing their opinions freely?





In association SSM concept of rich pictures was used to visualize the complexity related to the collaboration process between stakeholders while they were discussing the collaboration factors. I mapped pisoSIA® stakeholder categories identified in Figure 7.6. I tried showing all related interrelationships that might be needed during the software development process making emphases on interests and influence (originally this step was to be performed mutually by the stakeholders and the facilitator, however I found from early engagement in the pilot project that it is more convenient for the facilitator to engage in developing the rich pictures -which was me in this case study- because while the group was engrossed in discussion, I found it easy for me to translate what they are saying to pictures with interrelations without disturbing the focus of their discussion). I then added unrepresented groups (outside agencies and decision makers) to the picture after the session was over; the pictures were shown to participating stakeholders at the end of the session for validation of interpretation.

As a facilitator in this project I find using rich pictures in the group session beneficial in making the problems in collaboration between stakeholders stand out for the FP project. However, as participators talk more and more I found it difficult for me to continue adding to the drawing. It became too crowded and I thought that it may lose its essence if too much information is added.

The SSM pictures flashes out three major conflicts in the FP project designated by the big cross on the links between the pictures. The following section is a simple analysis that designates these issues.

There are obvious problems between the system analysts and users, requirements are repeatedly misunderstood and SW developed never performs what needs to be performed. This needs to be resolved by investing in dialogue.

Roles within the FP department are clearly specified; however staff members are not given the authority of signing off the specification of their own process tasks. Empowerment is definitely missing in FP; I believe that this is because there is some differences in performing certain tasks and that the current manager does not agree on, even though this is how they are doing their job.

Another conflict in collaboration arises between the IT staff and the FP communication officer. I noticed that this conflict happened during the FP project, at the beginning of the FP requirement collection phase the communication officer designated was fully committed and all relevant stakeholders were negotiated and schedules were compromised. At a later stage of requirement collection the communication officer was change due to associated social problems in the department. This change has affected collaboration as some stakeholders were not notified and were brought to requirement collection sessions without preparation as can be seen patterns in the appendix.

7.2.2. Filter & Prioritize the Collaboration Constructs

At this sub phase, I wrote down every construct that the group mentioned during their discussion of their potential collaboration. I ticked beside the construct or artifact every time a participator in the group talks about a story or incident in relevance to it. The following was obtained in Table 7.2:

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interests	✓ ✓ ✓
Roles	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓

Empowerment	✓ ✓ ✓
Dialogue	✓ ✓ ✓ ✓ ✓ ✓
Awareness	✓ ✓
Commitment	✓

Table 7.2. Collected Collaboration Constructs for the IT System

At the end of all focus group meetings, I filtered the constructs and artifacts by picking the ones that were ticked three times or more (by the rule of three that design patterns follow, these constructs are considered patterns) as shown in Table 7.3.

Construct	Frequency of Occurrence
Knowledge Sharing	✓ ✓ ✓ ✓
Interest	✓ ✓ ✓
Roles	✓ ✓ ✓ ✓
Trust	✓ ✓ ✓ ✓ ✓ ✓ ✓
Empowerment	✓ ✓ ✓
Dialogue	✓ ✓ ✓ ✓ ✓ ✓

Table 7.3. Filtered Collaboration Constructs for the IT System

I went back to previously collected data from interviews and meetings and identified patterns of collaboration between stakeholders. I then associated each pattern to a context either from previous data or by conducting new meetings. This step is a validation of findings step, collaboration patterns were validated after I find corresponding patterns from the case study by linking these constructs to actual stories.

Templates were used to document the incidents [vignettes] and are attached in the appendix.

7.2.3. Define the Collaboration Patterns

A prioritization of these constructs was obtained from focus groups with stakeholders involved as follows (starting from the highest priority): Knowledge Sharing, Awareness, Trust, Communication, Empowerment, and Commitment. This prioritization is context specific to the organization under study. Other context specific factors were also recognized, such as user readiness and user reassurance before meeting the analysis team. The number of systems analysts meeting with the users also had an affect on their collaboration. An analysis team of more than two made the users intimidated and less willing to engage. Planning and sticking to the schedule was also important to the collaboration process. An important factor affecting collaboration between stakeholders was the facilitator representative – although in the FP project the role was not specifically defined, however one of the KMOD IT members filled that role instinctively-. It was found that the communication gap was less between system engagers and systems analysts and the collaboration was most effective when the facilitator was from within the organization.

Figure 7.7 shows the template used for encapsulating the collaboration patterns. I went back to previously collected data and identified patterns. I then associated each pattern to a context. The following pattern template was used as a structured way to document the incidents [vignettes]. (Some pattern template were used as data recording sheets, other patterns were extracted latter on from previous interviews). These findings were validated after I found corresponding patterns from the case study by linking these constructs to actual stories.

Name
Requirement Consensus

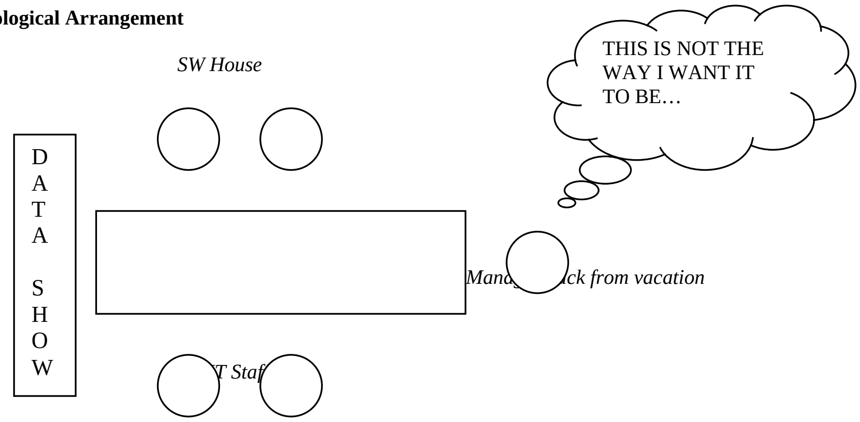
Vignette Number: 2
CASE: Foreign Procurement

Predecessor
Increase Collaboration

Collaborative Arrangement
The final phase of the requirement documentation, the manager missed out on the early phases. The IT staff & SW house are briefing him. Data show used, early version prototype used.

Representation of activity
The early version prototype used made collaboration worse, not working features made the manager upset. Collaboration was improved by intervention of IT staff explaining what will happen in the real software.

Ecological Arrangement



Collaboration Technique
The collaboration was achieved by a personal face to face discussion of how the software will appear. Better collaboration would have happened if a final version of the prototype was used.

Population of Use
IT staff

Successor
Increase Collaboration

Figure 7.7. A Collaboration Pattern Example

7.3. Phase III Conceptualizing the Complexity of Collaboration

A model is developed for the requirement collection process showing how collaboration is dynamically developed in the IT System. The model encompasses the major relationships that exist between stakeholders in the specific context of the IT project.

7.3.1. Draw inter-relationships of collaboration patterns

A basic collaboration model is presented in Figure 7.8 showing collaboration as a causal loop diagram (CLD) that leads to requirement consensus during the requirement collection phase of a the IT project.

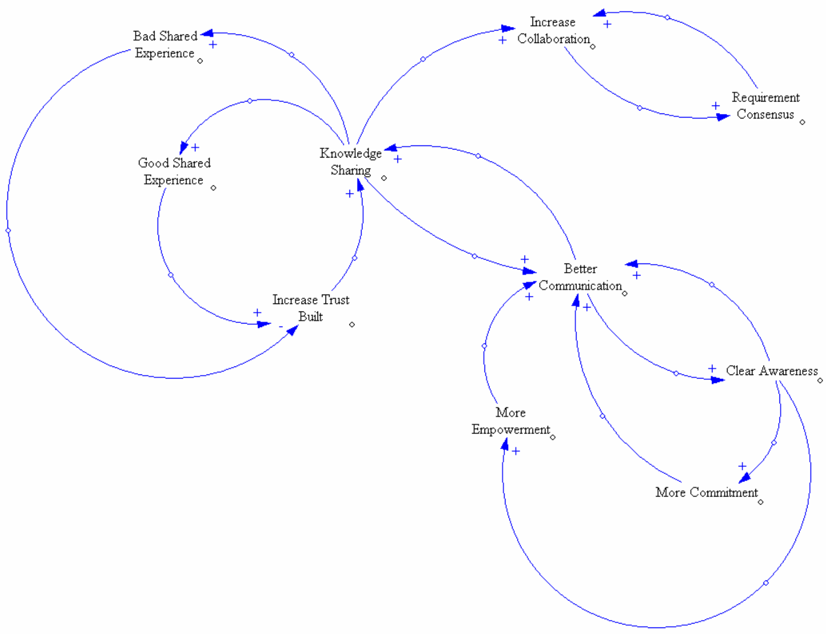


Figure 7.8. The Collaboration Model Overview of IT Requirement Collection

Major positive feedback loops of constructs lead to an increase in collaboration between the stakeholders, each in turn are affected by interrelated factors. The full interdependence of relationships between the factors is shown in Figure 7.8. The following is an analysis of these interrelations where long term scenarios are discussed:

This IT Collaboration model is validated by stakeholder perception. The patterns encapsulated before act as a link between the CLD and the actual case study. They give reliability and confidence to the results of the CLD. More confidence is given to the CLD by developing a questionnaire that has the CLD associated with written expressions that describe the diagram. This questionnaire was given to stakeholders to evaluate the model. The questionnaire was written as logical statements that describe a qualitative pattern of behavior that leads to collaboration. The questionnaire was presented to stakeholders by in groups and comments acted as feedback were changes were made accordingly and affected the final CLD given in Figure 7.8. Consistent stories from participant stakeholders suggest good correspondence of the IT model with their experience.

I noticed that trust was built up gradually as the meetings progressed throughout the requirement collection phase. It showed when at certain points through prototype presentations he agreed on certain aspects that were not clear and said that he had trust that they will be clear after the system is launched. He had the awareness that the users need to adapt to the software gradually, and was aware and willing to accept that the system might have certain deficiencies that the IT department will maintain.

7.3.2. Analyze Collaboration at Different Granularities

Initial analysis of the collaboration model in Figure 7.8 emphasizes the importance of knowledge sharing to increase collaboration in the IT project. It is the basic construct in the model that directly affects collaboration. Communication and trust both feed into knowledge sharing with positive loops.

Collaboration could be analyzed at different granularities in this phase, for example at the better communication level, going back to patterns encapsulated it is evident that bad communication was factor that hurdled collaboration at different situations before the requirement sessions in scheduling, during requirement collection session –either bad mediums are used and even the verbal accent of the users affected the analysts from engaging collaboratively-. Communication channels in Figure 7.4. Shown by bidirectional arrows need be active. Missing information within these channels is an indication to deficiencies that need to rectify it by sending warning signals need to be passed on to following phases. One such missing communication channel is the looking into the environment channel and propagating potential threats and changes back to the operational units which are the requirement collection sessions for each sub-division and how they might affect the current requirement collection process in the FP project. Analysis show that project managers should appoint resources to identify potential disturbances in the ministry and country, causal affects are important in such complicated situations.

The FP model could be used to analyze each requirement collection session individually. Requirement collection sessions for each sub-division can be analyzed to evaluate collaboration resulting different interpretations and impressions of between stakeholders represented.

7.4.1. Identify Collaboration Viability

Viability of collaboration in IT system needs to be ensured through the following:-

1. Management should be able to handle unexpected perturb during requirement collection.
2. Flow of information in the communication channels - bidirectional arrows - are available at the right time and in the right place.

According to VSM analysis, I checked the IT projected against the list of viable collaboration signs documented in the previous chapter and associated the analysis results in Table 7.4.

Signs of Viability	Analysis Results
Make sure that having stakeholders in multiple roles will not affect the system behavior. Human resources must be deployed efficiently over the VSM structure.	*Multiple roles were assigned and resources need to be relocated in the FP project*
Missing communication channels between stakeholders will affect the viability of collaboration between them.	*Many communication links missing in the project*
Primary operations in VSM System One must be atomic, higher level interference must be minimum and not interfering with the ability given to the lower level to handle variety.	*All primary operations are atomic*
Everyday activities in System Two must be met efficiently and deployed with resources.	*Efficient System Two*
Synergy and optimal performance must be achieved, System Three ensures such synergy.	*Lacking in the FP project as scheduling and communication are inefficient*
Looking at the future ensures planning for	*Lacking in the FP project*

disturbances that might affect collaboration. System four is in charge of these activities.	
System Five, ensures that policies are implemented according to goals identified achieves closure.	*Goals of FP automation need to be more clearly identified*

Table 7.4. IT Collaboration Viability Checklist

7.4.2. Analyze Short and Long Term Behavior

Major feedback loops for collaboration shown in Figure 7.8 are determined in the IT model in order to identify the factors that improve collaboration. We need to find answers to the next question "what contributes to each factor presented in the model?"

CLD behavioral analysis of the IT model shows that there are three major positive reinforcing loops of collaboration. These are desirable and ways of boosting should be considered. The project manager has to critically investigate short-term decisions on stakeholders' long-term collaboration performance. A good project manager needs to determine the major feedback loops that affect stakeholder collaboration and investigate ways of intervention to promote positive feedback. The major reinforcing feedback loops are shown in Figure 7.9.

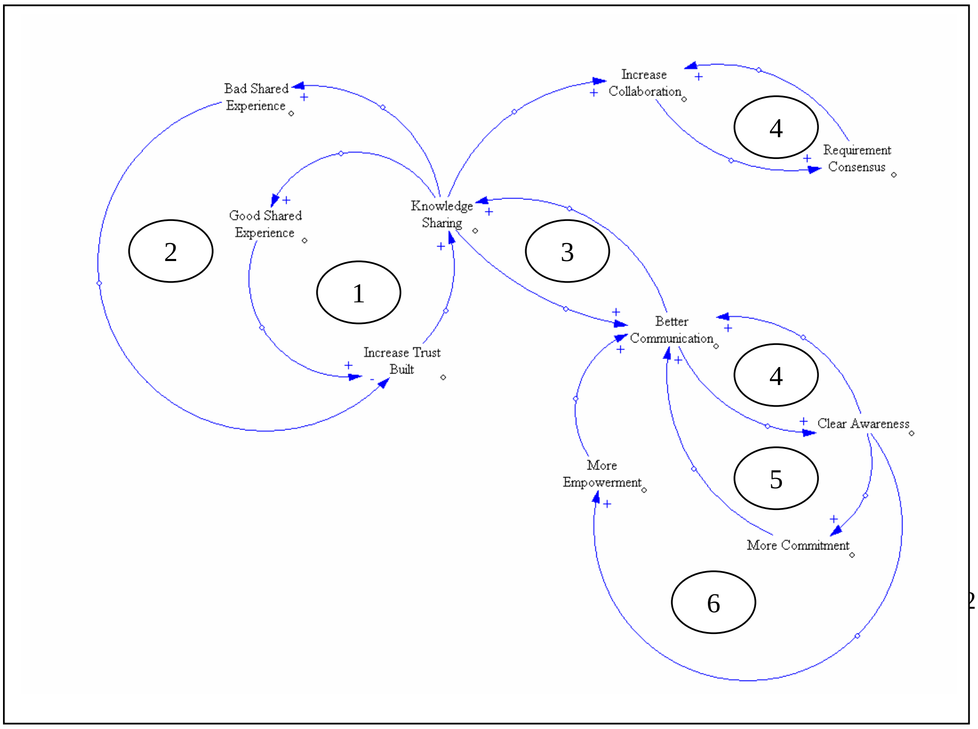


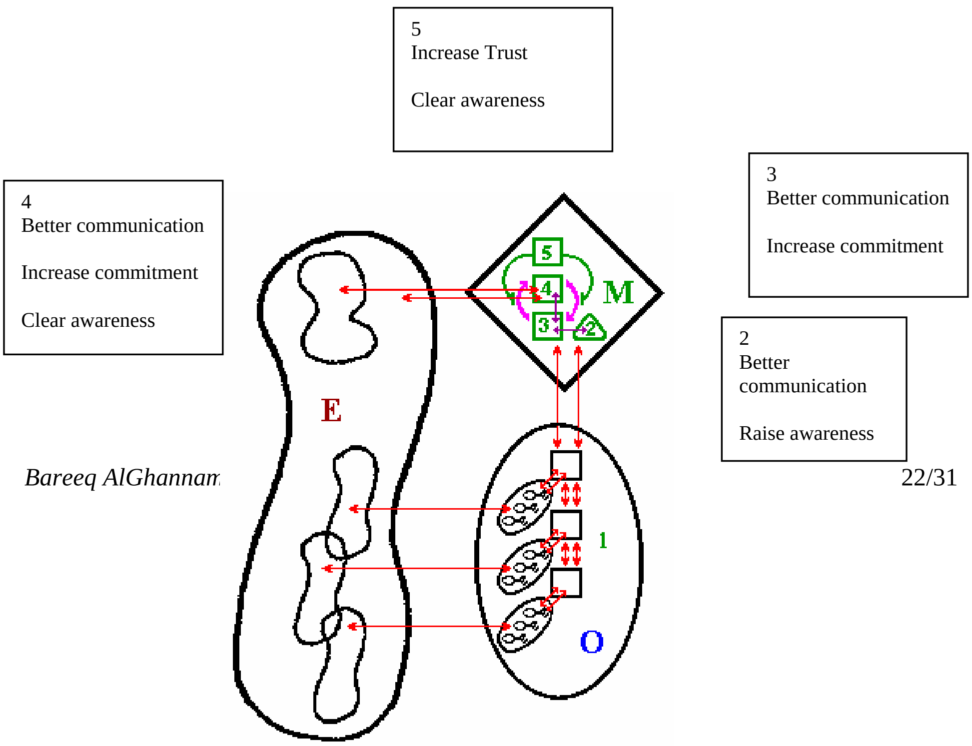
Figure 7.9. Reinforcing loops of the IT Model

As in the previous case study each reinforcing loop shown in Figure 7.9 is a point for analysis. The project manager needs to consider long term affects on the system. For example awareness is found partially missing in the FP project, users are not aware of the target vision, and goals are not specifically explained to potential users in the FP system. One pattern that hindered collaboration related to this issue is evident when the manager kept asking for requirements that are either covered by other current systems in the ministry or are not relevant to the objectives of the automation project. This pattern of behavior and how it affects collaboration during requirement collection was overseen and this specific approach was able to encapsulate and intensify its long term affect.

The other loops marked in Figure 7.9 also need to be analyzed to get an overall evaluation of the interrelated factors that affect collaboration. Results are visualized in the next sub-phase as the patterns are mapped onto the VSM structure.

7.4.3. Map Collaboration Patterns

Figure 7.10 show the patterns mapped onto the IT VSM.



1
Increase user empowerment

Raise awareness

Increase commitment

Increase trust

Increase empowerment

Figure 7.10. The Collaboration Patterns Mapped to the Model

Middle and higher management need to invest in the proper management course that promotes empowerment and leadership. Communication skills and facilitation skills must be gained as there is a need to assign facilitators to requirement collection group sessions. Scheduling and planning is essential and need to be investigated properly.

7.5. Phase V: Planning for Stakeholder Collaboration

This is a strategic planning phase developed from what has been uncovered and leaned in the previous phases.

7.5.1. Perturb Findings

Early warning signals are passed on from Phase Four to Phase Five to be documented as part of the intervention points in the planning strategy. The most obvious warning signals are the missing communication channels in the FP project and are propagated immediately to final analysis. Other deficiencies diagnosed are considered in the next sub-phase taking into account results obtained in Table 7.4.

7.5.2. Final Analysis

VSM analysis emphasizes the lack of resources assigned to communication links in the FP project. There are missing processes through out the requirement collection phase that insure proper delivery of information related to scheduling stakeholders meetings. This is evident in the lack of awareness in stakeholders during the meetings.

"Communication Officer", is a role supposed to be filled by a personal in the department that has both personal and professional communication skills that include scheduling, reasoning, courtesy, negotiation and social attractiveness. His job was to facilitate meetings between parties. In this particular case the communication officer was changed several times, this has caused a lack of synergy in the meetings. Some users were called for meetings without prior notice and some were not aware of the system scope and demanded requirement outside the system boundaries. Communication channels needs to be re-considered; more emphasis should be given to planning and scheduling. This continuous changing of roles between stakeholders is a major factor that negatively affected the flow of information between the channels. There is a pattern of communication officers changing throughout the FP requirement collection phase which has affected collaboration negatively by affecting the commitment factor. There is no specific person committed to the role of communication officer and there is no relation of commitment between stakeholders in FP with that changing figure.

A focus on what matters really matters to stakeholders must be identified by making control of variety by selecting what is relevant to stakeholder collaboration for each level of recursion, and then amplify it by finding manifestations that can describe it and thus be able to promote it. One such example is the facilitation better communication construct. There exist many manifestations that can define communication. The VSM is used to identify physically missing communication link, but what about the infinite factors that can contribute to better communication in the FP project? How can we limit these factors? According to cybernetics the project manager must find means to select the relevant factors that promote collaboration and then in turn amplify it to best use. Group sessions can be used for this matter to collect comments from stakeholders. Results from FP stakeholders show two emerging artifacts that manifest communication which are: the medium used during the sessions and the dialect. Sessions that had prototypes and data shows used in them show high participation from stakeholders while sessions with no such mediums are used show less participation. Now a project manager needs to amplify these two artifacts to promote collaboration.

An evident example is the tense atmosphere in the country, news of changes in ministry hierarchy is known to affect the structure of the ministry which will definitely have changes reflected in the requirements. In the FP project entire processes may be removed, the project manager should have the means that enable him/her to decide on appropriate action on what ever course of action that might occur.

System Two is relatively affective in FP. The head of each division is responsible for extracting requirement from potential users; requirements were being extracted from collaborating stakeholders and conflict was relatively avoided during the meetings for each System One sessions individually. However missing communication links has affected the availability of information to System 2 which in turn has affected the availability of information to operational units such as uninformed requirement collection sessions scheduled.

Knowledge sharing which involves the transfer of perception from one individual to the other is not evident enough in the FP project. The difference in dialect between the analysts and the users was an obstacle in communication which negatively affected collaboration.

Empowerment was not evident during the sessions with users system 2 in order to achieve stability in collaboration. It should be noted that the power of collaboration is optimised when the users agree to the requirements without having to go back to their supervisors.

Facilitation tools as a manifestation of better communication needs to be considered, their effectiveness and what needs to be changed to optimize requirement collection. This is the job of the facilitator, which is clearly undefined in the FP project; no one has been actually appointment to commit to that role. A committed facilitator will audit tools used in each meeting and will improvise creative ways to make the requirement collection easier and the transfer of knowledge between the system users faster. Throughout the project the only tools used were the requirement documentation and the prototype, on a laptop or presented through a data show. An auditing system is definitely missing, if the project manager is over tasked, a staff must be appointed to that important task.

Evaluation of the FP department culture calls for improving trust and empowerment as they will definitely lead to an enhancement to the collaboration in the requirement process. Higher management in this department are military personal. Some users did not want to engage before meeting the analysis team. This emphasizes the importance of trust and its positive affect on collaboration. Trust development in the system is associated with the trust in the analysis team and SW Developer Company. Some users did not want to engage before meeting the analysis team. This emphasizes the importance of trust and its positive affect on collaboration.

Clearly they are not performing the System Four activities properly: they are in touch with their environment, but are not planning at the sector level to adapt to future threats and opportunities. This was evident that in the process when the requirement collection was preceded even with the threat of having the business processes re-organized during the re-election of the National Assembly and the delegation of the new government. It was a matter of good luck that the same minister was appointed to KMOD, otherwise the hierarchy of the organization would have bean changed and requirements for changed departments would have been re-collected.
This system needs attention from higher management. There is a planning committee on the level of the ministry its interaction with the IT Undersecretary needs to be stimulated and it needs better communication with System Three to account for current threats.

On the level of meetings for requirement collection, the policy is indicated by the IT undersecretary (in the future the IT Controlling Body needs to contribute). Periodic meetings between controllers in the IT department and daily meeting between the software house analysis team and the Software Analysis sub-department in KMOD ensure a sufficient level of understanding and sharing the policy procedures. There is a sufficient amount of trust, knowledge sharing and empowerment within the department and the IT team that motivates a fair amount of collaboration.

There is a communication gap in the requirements collection process of the FP project. This communication gap is affecting the collaboration of stakeholders which was seen in the patterns collected.

User readiness for change and awareness; some users were asked to join the meeting with out prior notice from their direct manager. They were found less willing to engage in the meeting and wanted to schedule another meeting.

The above analysis indicates that collaboration between stakeholders in Recursion Level One is essential for achieving proper information transfer in the whole system. To do that requirement collection sessions must be conducted with relevant stakeholders involved from all the interrelated sectors, I find that missing in the implementation of this project as requirement collection sessions are conducted individually for each project –this is a warning sign that needs to be propagated to final analysis-.

At this level of application a subjective evaluation of stakeholder collaboration is developed through descriptive analysis. The evaluator can relatively decide on what level of collaboration is achieved by comparing to collaboration viability signs. The final sub-phase of intervention point development provides closure to the approach by identifying straight forward points.

7.5.3. Develop Intervention Points

Intervention points and recommendations are developed at this point for a viable requirement collection process in the IT project. Results from the previous sub-phases of the approach are propagated and the following intervention points are uncovered:

- Immediate action must be taken to investigate missing communication links in the FP VSM.
- Manifestations of artifacts need to be collected in order to identify the ones that directly increase user collaboration within FP.
- Awareness alerts must be heavily appointed to FP stakeholders. Goals and vision of the new system must be explained in more detail. Flyers and department news flashes could be employed. Seminars explaining how the new system would affect the daily process of the users in the FP department could be conducted. Actual users of new automated systems in other ministries could be called to recall their experience and how they managed change.
- Develop a strategy that promotes stakeholders to accept change in FP.

- Build a trusting environment emphasizing on security measures of the new system. Trust must be built gradually through relationships and shared experiences. The developer company can invite stakeholders to engage in the construction of a shared vision and understanding of the potential system. New participatory approaches in requirement collection must be looked at.
- Decide on an agreed upon number of system analyst meeting with the users
- Plan and stick to the schedule by develop affective scheduling contingency plans.
- Improve System Four activities which is planning by employing resources that look into the environment and detect specific situations that affect the collaboration of stakeholders and reporting back to the project manager to take the appropriate action.

These intervention points give us confidence that there is a base that promotes a collaborative culture within IT System stakeholders that accepts change with minimal conflict. This realization is expected as IT stakeholders deal with constant change to catch up with the world of technology. Trust among the stakeholders reasonably high, which defied the political disturbances in the system.

7.6. Assessment & Evaluation of Applied Approach

A questionnaire is used to evaluate the approach according to its objectives. As in the previous chapter the questionnaire was developed through the use of Goal Question Metrics (GQM), where questions are developed in correspondence to goals specified. The questionnaire is aimed to be completed by potential users of the approach – SW Project Managers, System Analysts and Facilitators -. In this case they are required to complete the questionnaire comparing their current experience in the IT project with what information is gained from the developed approach and how useful it would have been if the intervention points have been made use of through out the requirement collection phase of the IT project. Its usefulness in future SW projects for evaluation of stakeholder collaboration is also questioned. Their reflection of the intervention points produced from the approach is useful and can be used in determining how they think collaboration can be promoted. This evaluation is a subjective evaluation relative to the partitions perception and view points; no exact measurement is used as no exact measurement can exist due to the soft and complicated nature of the problem.

7.7.Conclusions

In this chapter the IT System is chosen as an example of a typical department in a public sector undergoing software development that had potential high collaboration among the stakeholders involved in the requirement collection process. The five phases of the approach is applied to evaluate the collaboration of stakeholders involved in the IT System.

A distinctive realization from the previous analysis is that although collaboration is highly expected in this specific system, urgent issues were elicited and collaboration intervention points are encapsulated from the analysis.

The phases in this approach are presented distinctively for presentation purpose. In real application a more holistic implementation is applied where the phases and results are intertwined.

As in the previous chapter the results of the approach are evaluated with the use of a questionnaire developed to analyse how well the approach achieved its objectives in handling the problem under focus and how close the results are according to the perspectives of system analysts and project managers involved in the IT project. Results show that

Comment: Still to be conducted in December 14th

System Name
Information Technology

Personal Information	
Name	
Position	
Years of experience	
At what stage where you involved?	
What was your role?	

The goal of this questionnaire is to validate the context specific factors affecting Stakeholder Collaboration within the requirement collection phase of the KMOD Automation project from the viewpoint of IT stakeholders.

This goal is achieved through the analysis of the following objectives:
Validate the encapsulated context specific constructs of collaboration

Construct
Knowledge Sharing
Trust
Empowerment
Awareness
Communication
Commitment

It is also required to establish a prioritization list of the factors.

Your completion of the questionnaire is highly appreciated and will affect the development of the approach.

	Strongly Agree	Agree	Neutral/ No Opinion	Disagree	Strongly disagree
A. Collaboration Constructs					
1. The correct perception of information transferred from the stakeholder to the analyst during requirement collection positively affects collaboration					
2. Trust developed between a system analyst and the users promotes the user to collaborate and talk freely without constraint					
3. Authorizing stakeholders of lower power to decide on matters regarding their daily tasks promotes the collaboration during requirement collection					
4. Stakeholders aware of the system goals, functionalities and limitations are easier to collaborate with					
5. Communication between stakeholders is key to collaboration					
6. Stakeholder feeling of commitment to the requirement collection team increases the collaboration between them					

B. Please list the construct starting from one indicating highest priority
Knowledge Sharing
Empowerment
Trust
Awareness
Commitment
Communication

C. Please indicate if there are other collaboration constructs that you think should be considered

Appendix F

Publication

AlGhannam, B. (2006). Poster: Evaluation of Stakeholder Collaboration within Software Development.

AlGhannam, B., Deeks, D. and Davison, J. (2006). Stakeholder Collaboration in System Development: Towards a Systemic Approach to Evaluation. In: *Proceedings of BIOPoM 2006 Conference.* London: University of Westminster.

2006

Evaluation of Stakeholder Collaboration within Software Development

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Abstract

A new systemic methodology is presented that evaluates the collaboration of stakeholders involved in a software development project. The methodology identified an initial set of criteria that the evaluator may use to initiate the collaboration model, other key constructs are generically added to the model from context specify encapsulation. The methodology is promising and future evaluation is undergoing.

1. Aim

Develop a systemic analysis of stakeholder collaboration within software development projects.

2. Significance

Many Software projects fail even after using tools that identify success and risk factors (Alter and Ginzberg, 1978; Gagnon, 2001).

This failure and the need to involve stakeholders in the development process calls for a better understanding of the collaborative interaction between groups involved in software development especially in the requirement engineering phase (Luna-Reyes, 2004).

However, there is no agreement on a general theory of collaboration (Wood and Gray, 1991).

A need for a systemic methodology rises to evaluate the collaboration of stakeholders in software development

3. Strategy

Theories developed from a combination of fields

Collaboration Theory

Stakeholder Theory

System Theory

By treating the collaborative activity between stakeholders as a system itself with feedback, we can take a systemic approach

Cybernetic →

System dynamics →

System thinking →

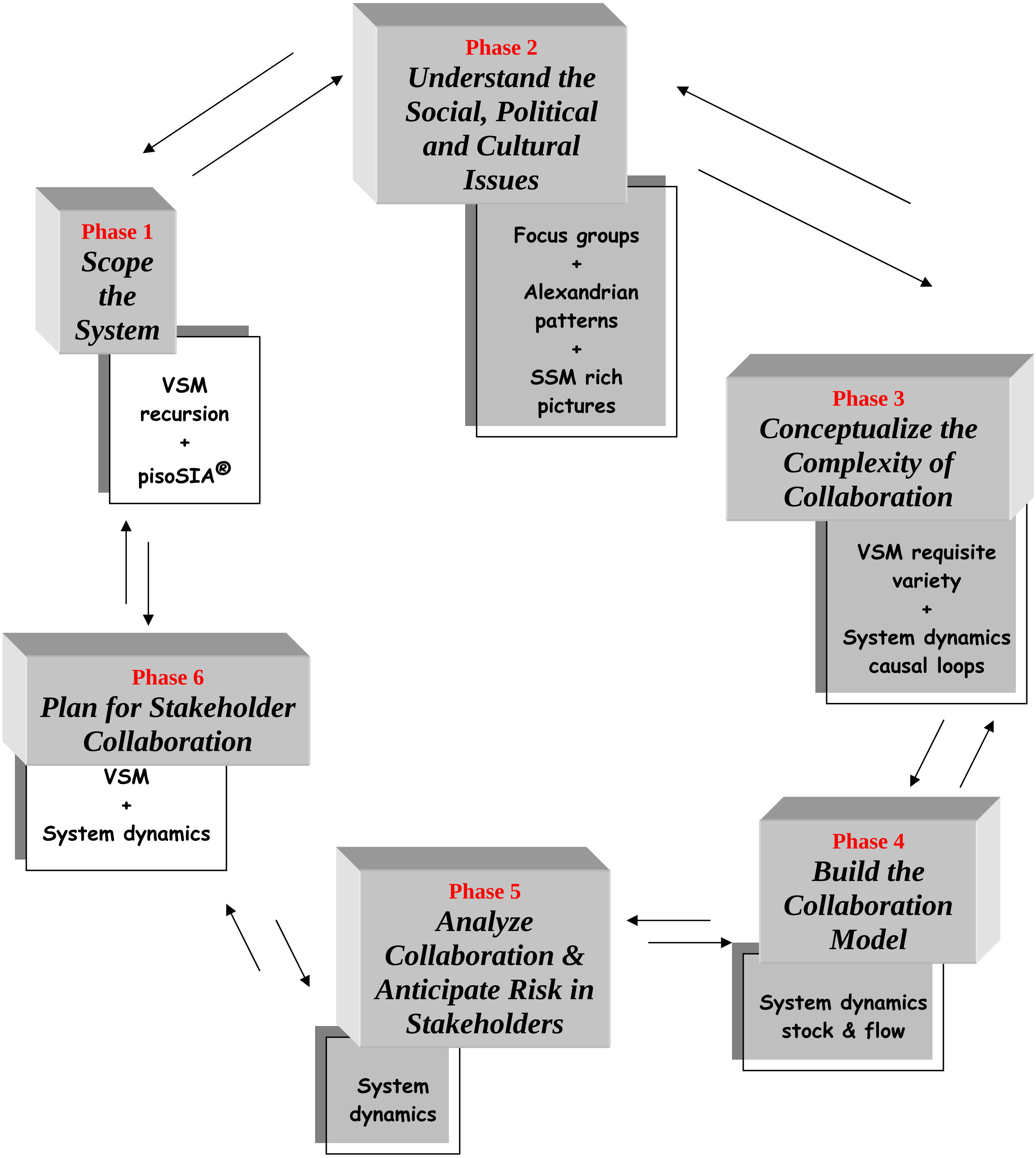
Stakeholder analysis →

Integrated Solution

Key Factors were identified as potential constructs that contributes to stakeholder collaboration within software development projects

- ***Knowledge Sharing***
- ***Roles***
- ***Interests***
- ***Trust***
- ***Empowerment***
- ***Dialogue***

4. The Proposed Methodology



4. Results

Figures 1& 2 are the causal diagrams obtained as the results of an iterative process between phases1 through three:

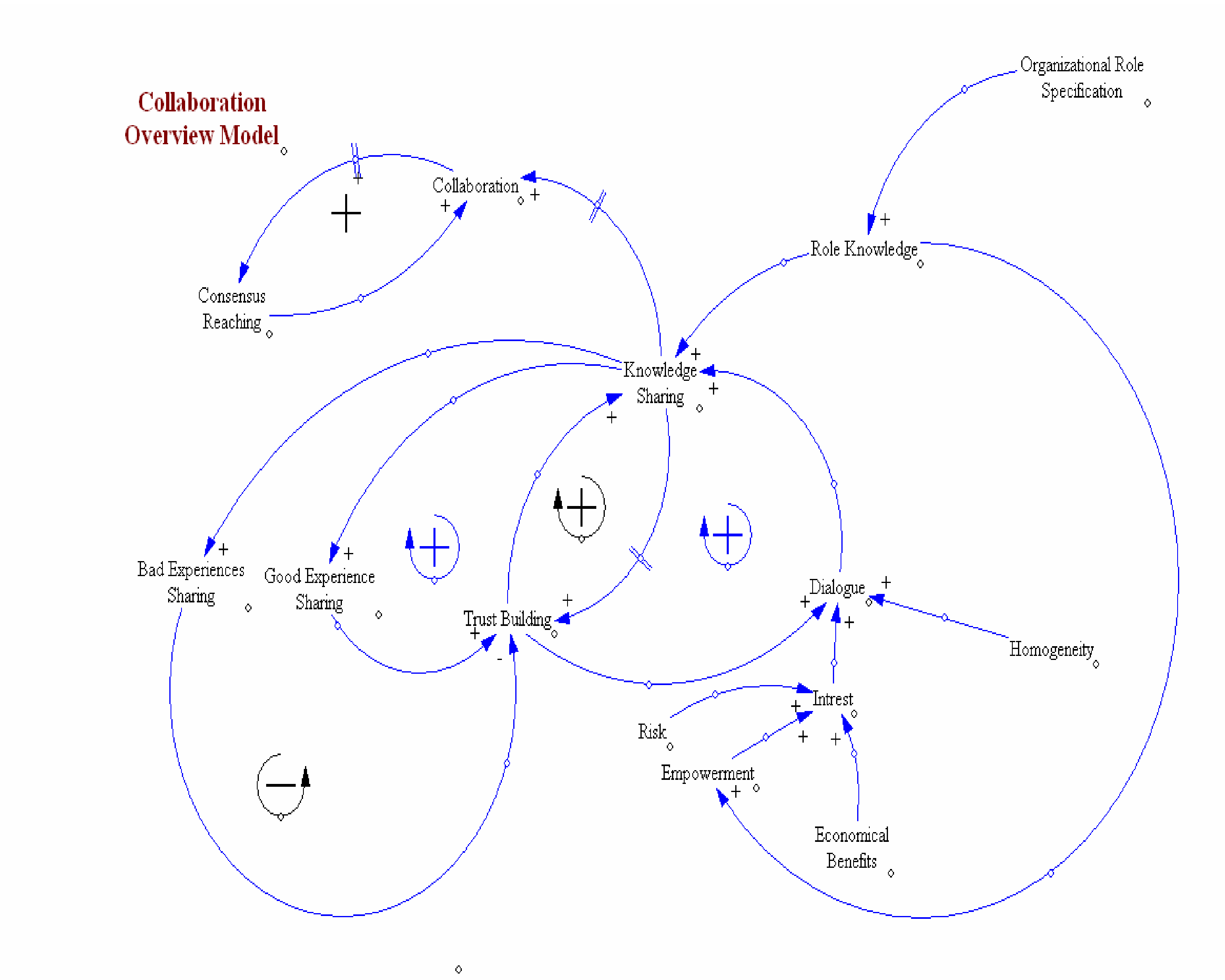


Figure1: The Collaboration Overview Model Overview

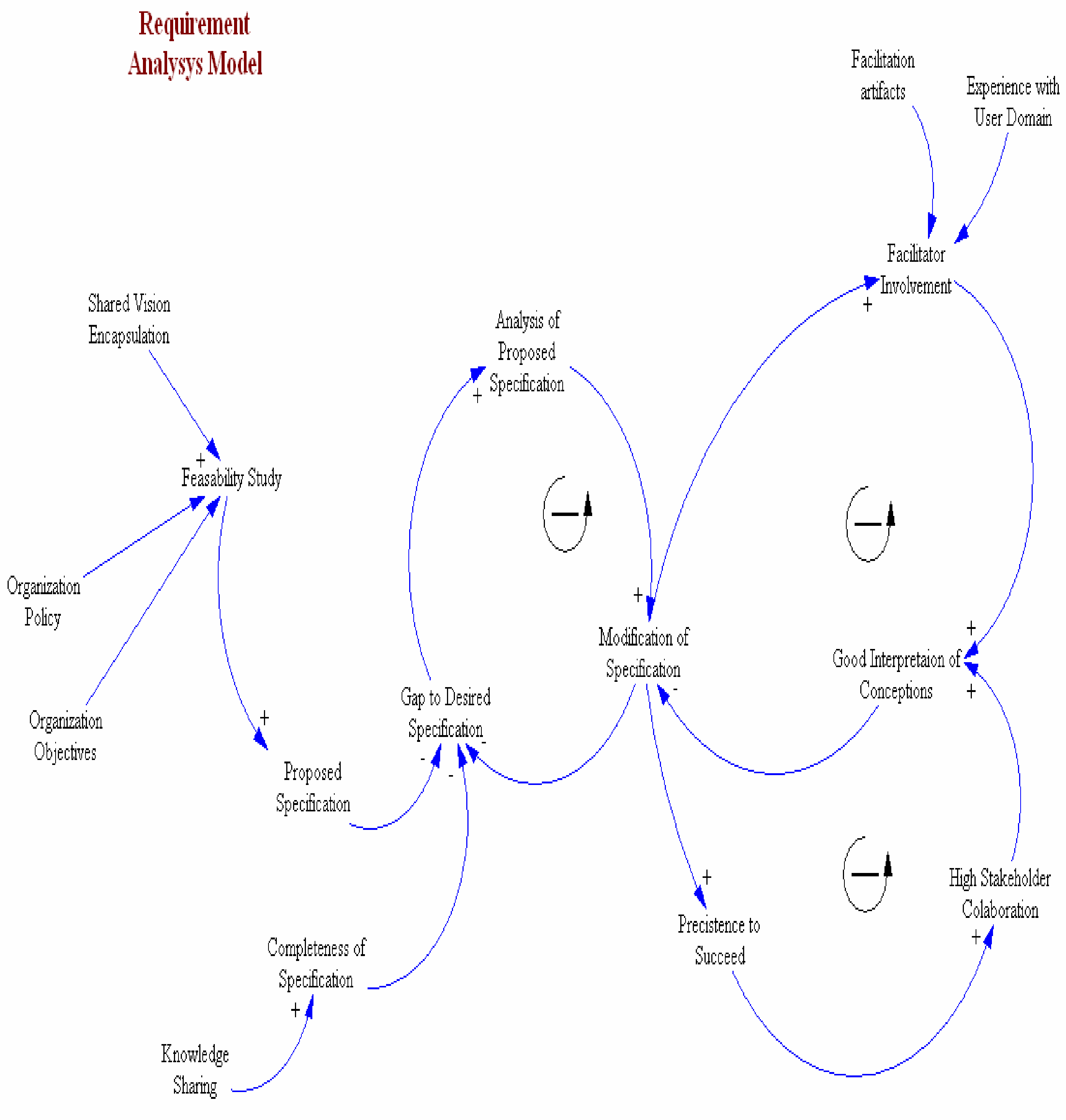


Figure 2: The Requirement Analysis Model Overview

5. Conclusion

A generic methodology shows potential in

→ Evaluating the collaborative nature of stakeholders

→ Identifying intervention points to maximize collaboration

→ Supporting acceptance of change in software projects

6. Future Prospect

The methodology will be evaluated on software development projects selected from the Ministry of Defense in the State of Kuwait.

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STAKEHOLDER COLLABORATION IN SYSTEM DEVELOPMENT: TOWARDS A SYSTEMIC APPROACH TO EVALUATION

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Abstract. *Elicitation of requirements for software projects and information systems is considered one of the risk factors that project managers have to deal with to reduce the probability of failure. Requirements analysis involves a series of activities that requires stakeholders to work collaboratively to achieve a shared goal which is the production of the requirement documentation. Collaboration evolves from a complex process of interlinked relationships between stakeholders. To evaluate this complexity, a new systemic methodology is under development. Results from the methodology will then form the basis for the development of a set of guidelines that project managers can use throughout the requirements analysis phase.*

Keywords. Collaboration, stakeholder analysis, software requirements analysis, systems thinking, systems design.

1. Introduction

The public sector in the state of Kuwait has expanded its use of technology over the last few years. This expansion was the result of the state's decision to promote the new trend of electronic office management that ensures better quality of outputs and services which is one of its basic objectives. Kuwait's Ministry of Defence (KMOD) is one of the main ministries in the State of Kuwait whose role is to provide high calibre services for the armed forces; which can be better provided by the implementation of such technology. There is always a risk that these technologies will fail; this risk is due to a combination of technical, social or political problems.

This paper proposes a new systemic approach to evaluating one of the key soft factors that affect software projects. It focuses on the evaluation of the collaborative nature between stakeholders involved in the project especially during the requirement collection phase. The developed methodology is used as a means to encapsulate vital aspects that maintain collaboration and thus identify intervention points that can contribute to stakeholder collaboration promotion. This new method is an integration of a combination of disciplines, stakeholder theory, collaboration theory and systems thinking. The authors contend that their proposed approach can give decision makers an insight into how collaborative a group of stakeholders may be, giving those decision makers the power to intervene to ensure maximum collaboration and thus increasing the project success factor.

The paper starts by emphasising the significance of the research and continues with a brief description of some existing methodologies for stakeholder evaluation. An outline of the new methodology is then presented, and conclusions drawn.

2. Significance of Research

Many software projects fail even after using tools that identify success and risk factors (Alter and Ginzberg, 1978; Luna-Reyes, 2004). This failure and the need to involve stakeholders in the development process calls for a better understanding of the collaborative interaction between groups involved in software development (Gottesdiener, 2003; Luna-Reyes, 2004). We believe that in software development the smooth transition from old to newly redesigned systems depends, in part, on the collaborative manner in which the stakeholders were involved while the software project was developed. This is especially important during the requirements collection phase, because it deals with stakeholders' perspectives and relationships at different levels of detail (Kotoyana and Sommerville, 1998). There is no agreement on a general theory of collaboration; nevertheless Wood and Gray (1991) have come up with a general definition that will be adopted in this research:

> *"Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain"*
>
> *(Wood and Gray, 1991).*

In order to understand collaboration, an insight must be gained into the interactions that occur between individuals (Jones, 2005). Social, cultural and political issues that influence interactions between stakeholders need to be examined (Hengest and De Vreede, 2004). The evaluation must be conducted using qualitative tools distributed over time because the social action of individual collaborations unfolds through time, affected by accumulated values (Black et. al 2002).

3. Stakeholder Collaboration in Existing Methodologies

Literature shows the need to involve stakeholders in the system development process (Luna-Reyes, 2004). This need is evident in the diverse methodologies available that emphasise stakeholder collaboration, such as Soft Systems Methodology (SSM) (Checkland and Scholes, 1990), Process Improvement for Strategic Objectives (PISO) (Deeks, 2002) and Strategic Options Development and Analysis (SODA) (Von Mullekom and Vennix, 2000). Other methodologies have embedded collaboration within their processes, such as Collaborative Business Engineering (CBE) (Hengest and De Vreede, 2004). None of the above methodologies go further into elaborating upon the collaborative relationship that unfolds between participating stakeholders.

Whilst there is a difference between co-operation and collaboration (Brown and Keast, 2003), Ramage (1999) presented a method to measure stakeholder co-operation that is worth noting. This was based upon evaluating the learning of the team. The development of this method drew upon a combination of disciplines including systems theory, stakeholder theory and learning theory. It presents a means to measure stakeholder co-operative interaction by the amount of learning shared between them. Another notable attempt was developed and tested in an intergovernmental information systems project by Luna-Reyes in 2004. It was called the dynamic theory of collaboration; it evaluates collaboration of stakeholders based on knowledge sharing and trust, using system dynamics as an analysis tool. It relied on grounded theory for its structure and evaluates collaboration by summing the participant's engagement, which was called “stocks of knowledge”. This need to measure collaboration was also highlighted in a Naval study concerning teamwork (Noble, 2004). This showed that knowledge between team members is the key to effective collaboration, emphasising a need for knowledge of the working environment as well as an evaluative knowledge for decision making.

4. A Need for a New Methodology

Existing methodologies cover a range of stakeholder collaboration aspects. There is common agreement that collaboration in systems design is looked upon as a learning process. The evaluation of collaboration is however subjective, often reflecting the analyst's own criteria from interpretation of the term ‘collaboration’, rather than the inputs of stakeholders. Current methods described in the literature for evaluating collaboration identify the involvement of multiple stakeholders, but fail to address the integration of these multiple views into shaping a systemic context specific evaluation of stakeholder collaboration. The need for a new systemic approach to evaluate stakeholder collaboration in software requirements analysis is raised based upon the following reasoning:

- An identification of exact stakeholders is required. The methodology must be precise enough to evaluate the collaboration process as well as identify potential risk from identified stakeholders.
- Collaboration is a complex problem consisting of dynamic interactions that are achieved through stakeholder inter-relationships.
- As this research deals with human factors in uncontrolled environments, it is clear that a replication is impossible. Simulation can be used to provide a controlled environment for the study to conduct our experiments.
- The methodology developed must be context specific, in order to consider constructs that shape the collaboration.
- It must be holistic, to include the entire picture.
- Constructs and artifacts that affect collaboration are not independent; they are interconnected and feed back into the process of collaboration which can perturb its environment.
- The new methodology must be able to emphasise that the collaboration process is dynamic and unfolds through time;
- Collaboration of stakeholders within a software development process is a social problem. It is vital to take account of the full implication of social, cultural and political issues for encapsulating context specific constructs.

5. The New Methodology

5.1. Introduction

This research approach is based on theories developed from a combination of fields: Collaboration Theory, Stakeholder Theory and System Theory. By treating the collaborative activity between stakeholders as a system itself with feedback, we can take a systemic approach. Tools in cybernetic, system dynamics, systems thinking and stakeholder analysis are used to provide an integrated solution of how to identify the key factors that are affecting collaboration on a specific group within a specific context.

5.2. Philosophical Foundation

The term "stakeholder" was "*first recorded in history in 1708 to mean a bet or deposit*" (Chevalier, 2001). It was a term that was originally used in organisational life and defined as *"any group or individual who can affect or is affected by the achievement of the organisations objectives*" (Freeman, 1984). It then naturally matured and unfolded to be used in information system, systems thinking and requirement engineering as well (Ramage, 1999). Stakeholder Analysis (SA) tools have been developed to identify and analyse specific stakeholders involved in the system design process such as pisoSIA (Davison et al, 2006).

Systems thinking approach is a way of understanding complex settings from a holistic perspective. This approach produces strikingly different results from traditional analysis especially when the system under study is multi-loop and dynamically complex. It gives the researcher the ability to see through the complexity of the structure (Forrester, 1971). Systems theory is supported by cybernetics and system dynamics. Both lead to evolutionary solutions for reoccurring problems. Theories from cybernetics, system dynamics and systems thinking give new insight to solving problems by introducing new ways of thinking. Many systemic tools are available; Soft System Methodology (SSM) (Checkland and Scholes, 1990) was specifically developed to analyse problems with social and political issues. The Viable System Model (VSM) (Beer, 1985) shows a different way for which organisations can be diagnosed to visualise the understanding of problems. System dynamics (Forrester, 1961) uses simulation to analyse causes of problems and ways of optimising solutions.

Using cybernetic tools different states of a complex system such as stakeholder collaboration can be evaluated such that internal states can be observed and controlled. Dong (2004) believes this provides a practical real time analysis of the team collaboration process, compared to discourse analysis and psychometric evaluation.

5.3. Methodology Outline

From the literature, a set of base criteria were identified as potential variables that conceptualise the formation of stakeholder collaboration within a software development process, which are:

- Knowledge Sharing
- Roles
- Interests
- Trust
- Empowerment
- Dialogue

A generic iterative methodology is being developed. At any point the evaluator can return to any previous phase and make changes as new understandings are discovered.

- Phase 1: Defining the system scope; this is a preliminary investigation phase that makes use of both VSM (Beer, 1985) and pisoSIA (Davison et al., 2006).
- Phase 2: Understanding the social, political and cultural Issues. Focus groups of identified stakeholders use a combination of two tools: Alexandrian patterns (Alexander, 1977) and SSM (Checkland, 1990) rich pictures to visualise the collaboration process between stakeholders and encapsulate the key constructs that are influencing it.
- Phase 3: Conceptualising the complexity of collaboration by employing system dynamics (Forrester, 1961) to draw the problem in focus in the form of a mental causal loop diagram.
- Phase 4: Building the collaboration model based on the results of the agreed upon mental models using stocks and flows (Forrester, 1961).
- Phase 5: Evaluating the collaboration by simulation of the model.
- Phase 6: Anticipating risk in stakeholders by analyzing the dominating loops to indicate which stakeholder group is causing highest risk to the collaboration process.
- Phase 7: Planning for stakeholder collaboration by investigating preset conditions and making use of VSM concepts of requisite variety (Beer, 1985).

6. Pilot Study

The methodology was piloted in the environment of the Ministry of Defence (MOD) of the State of Kuwait. A preliminary investigation was conducted in December 2005, where phases 1, 2 and 3 were undertaken by the first author. In April 2006 this researcher returned to KMOD and acted as an observer, and results from phases 1, 2 and 3 were revaluated. Due to the methodology’s iterative nature, earlier results were modified and a second iteration of the models was developed as shown in Figures 1 and 2.

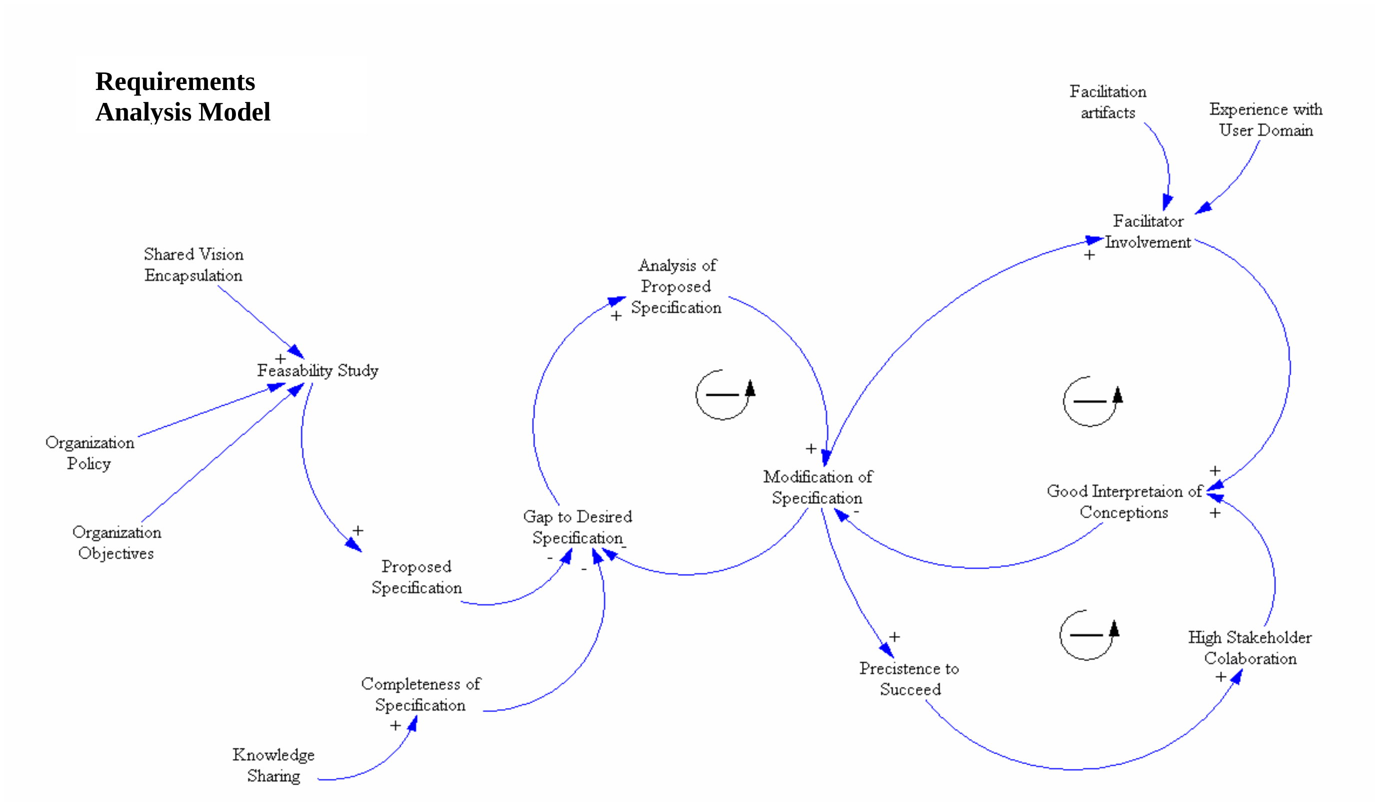

Figure 1. The Requirements Analysis Model Overview

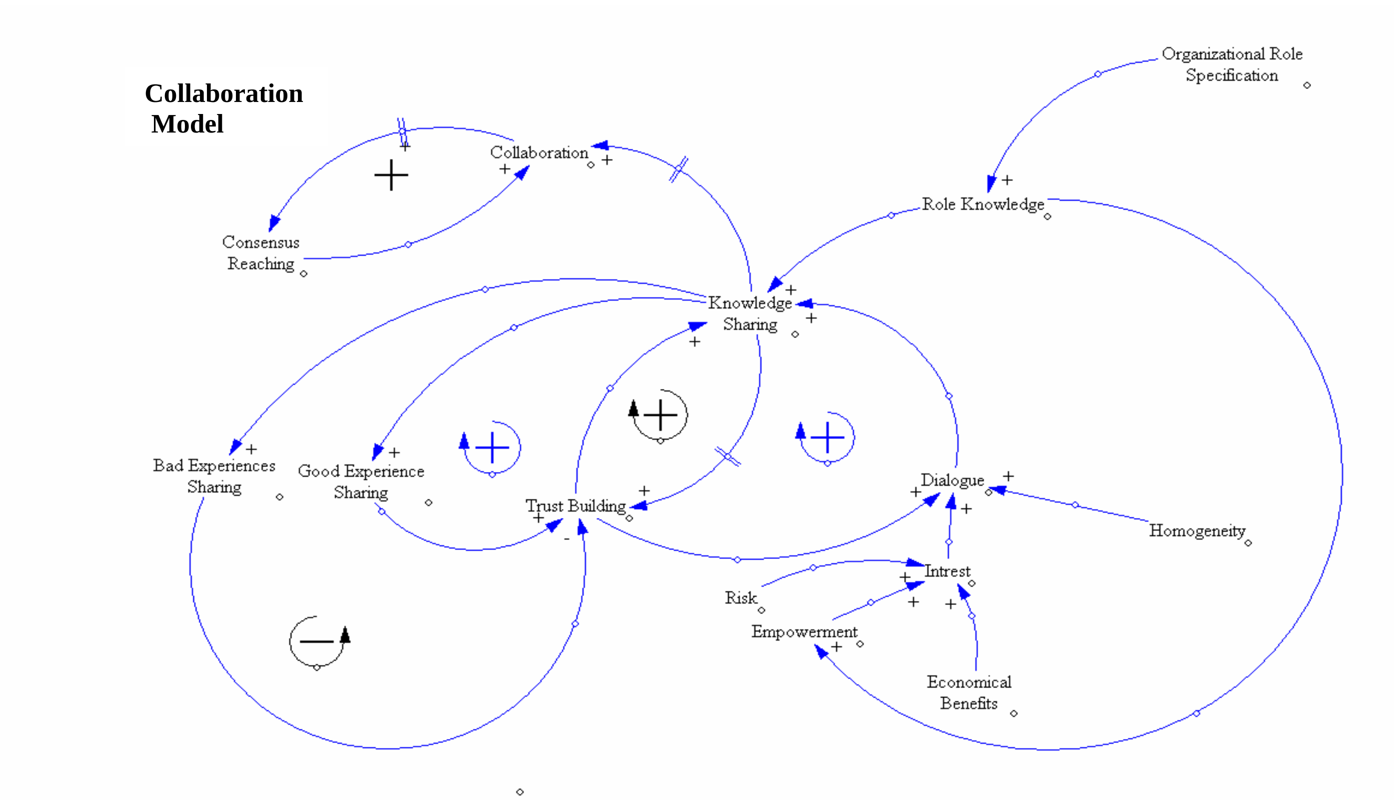

Figure 2. The Collaboration Model Overview

The objective of the pilot study was to evaluate the data collection tools (phases 1, 2 and 3); it was not meant in any way as an evaluation for the methodology. Some alterations are to be made to the structured interview questions; participator feedbacks show that the questions were ambiguous and the researcher has to rephrase some of them. Nevertheless some interesting findings were obtained. Initial analysis of the pilot study emphasises the role of facilitator in governmental projects. Findings have validated the base criteria identified from the literature. A prioritisation of these criteria was obtained from focus groups with stakeholders involved as follows (starting from the highest priority): Knowledge Sharing, Dialogue, Trust, Role, Empowerment, and Interest. This prioritisation is context specific to the organisation under study. Other context specific criteria were also identified; the most important one being the facilitator representative. It was found that the communication gap was less between system engagers and systems analysts and the collaboration was most effective when the facilitator was from within the organisation but not related to the problem. This finding is the opposite of other studies that recommend that the facilitator be from outside the organisation (van Mullekom and Vennix, 2006). Other context specific factors were also recognized, such as user readiness and user reassurance before meeting the analysis team. The number of systems analysts meeting with the users also had an affect on their collaboration. An analysis team of more than two made the users intimidated and less willing to engage. Planning and sticking to the schedule was also important to the collaboration process. These initial findings need to be reevaluated with other empirical studies scheduled for September 2006, when the whole methodology will be evaluated within ongoing KMOD software projects.

7. Conclusion

The proposed approach is a generic methodology that shows potential in evaluating the collaborative nature of stakeholders, identifying intervention points to maximize collaboration and promoting acceptance to change in software projects. The approach is planned to be context specific and to be integrated with any software development process or business process reengineering. Ongoing validation is in progress on software development projects in KMOD. Further findings will alter the existing methodology and contribute to the final models.

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Stakeholder Collaboration within Software Development: Towards a Systemic Approach to Evaluation

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29th June 2006

Introduction

Aim

A new systemic methodology for evaluating stakeholder collaboration.

Outline

Significance

Current Methodologies

Need for a new methodology

Strategy/ Tactics

The proposed methodology

Conclusion

Significance?

Software projects often fail even after using tools that identify success and risk factors (Alter and Ginzberg, 1978; Gagnon, 2001)

Need to involve stakeholders in the development process engineering phase (Luna-Reyes, 2004)

Calls for a better understanding of the collaborative interaction between groups involved in software development especially in the requirement
(Gottesdiener, 2003Luna-Reyes, 2004)

However, there is no agreement on a general theory of collaboration (Wood and Gray, 1991)

Current Methodologies

Evaluating Stakeholder Co-operation (Ramage,1999)

Shared learning between
Systems Theory, Stakeholder Theory and Learning Theory

The dynamic theory of collaboration (Luna-Reyes, 2004)

Knowledge sharing and Trust
Participant's engagement “stocks of knowledge”
System dynamics

A Need for a New Methodology

- Identify stakeholders
- Holistic
- Social Problem
- Complexity
- Dynamic
- Context Specific
- Uncontrolled Environment
- Inter-linked Relationships
- Feedback

Strategy

Theories developed from a combination of field

- Collaboration Theory
- Stakeholder Theory
- System Theory
  - System Thinking
  - Cybernetics
  - System Dynamics

•Holistic perspective
•New ways of thinking
•New insight to solving problems

Systemic Approach

Tactics

Integrated Solution

Combination of Tools

Stakeholder Analysis

System Thinking

Cybernetic

System Dynamics

Design Patterns

(pisoSIA®)
(Davison et al., 2006)

Human Boundaries

SSM rich pictures
(Checkland, 1981)

Social, Political and Cultural Issues

VSM
Recursion & Requisite Variety
(Beer, 1981)

- Diagnose System
- Complexity
- Variety

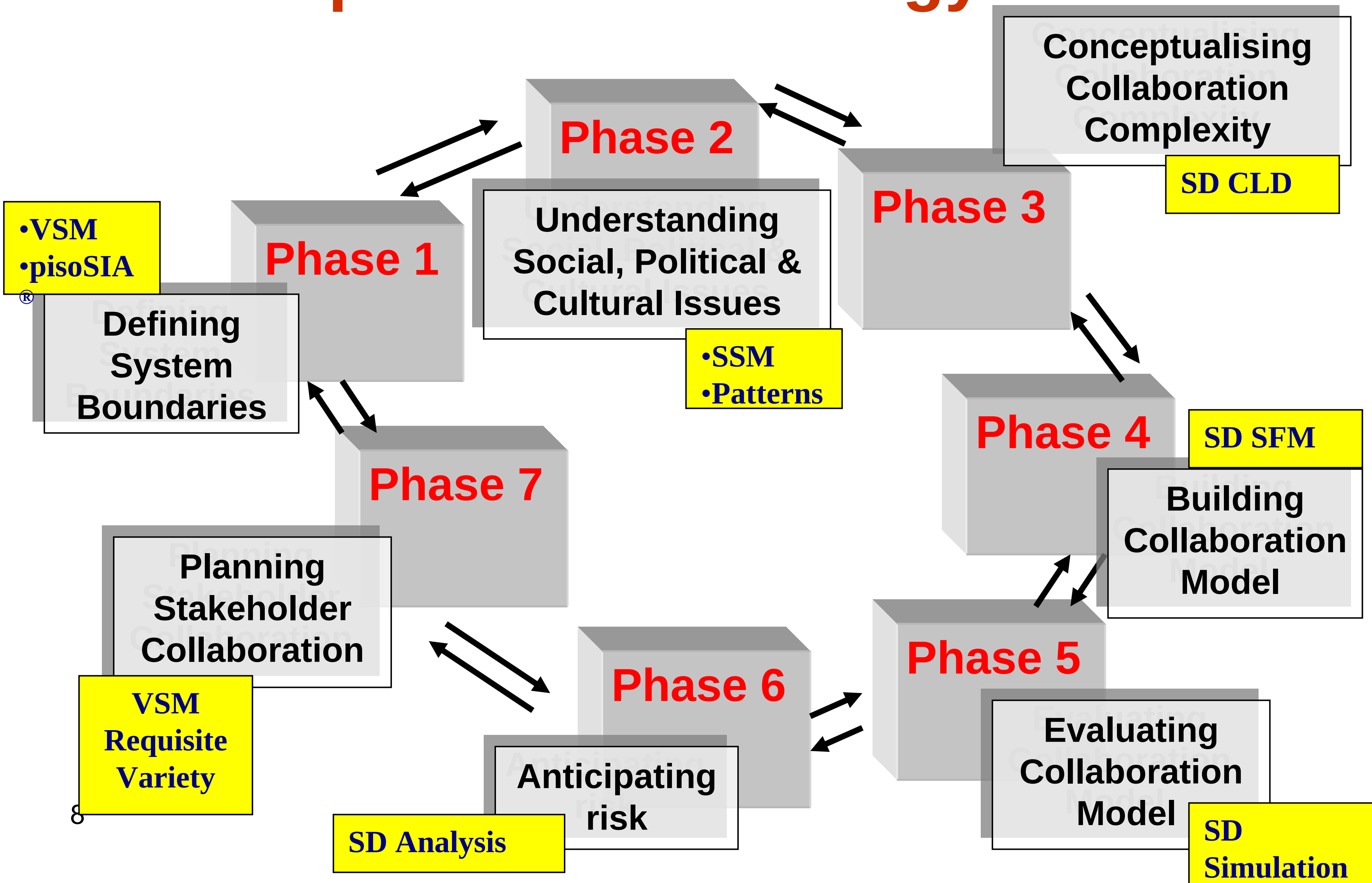
SD
(Forrester, 1961)

- Mental Model
- Stock & Flow
- Simulation

Pattern Language
(Alexander, 1977)

- Collaboration Pattern

The Proposed Methodology



Methodology Implementation

STATE OF KUWAIT
MINISTRY OF DEFENCE

دولــــة الكـــويـــت
وزارة الدفـــــــــاع

E-Government

Preliminary Investigation

December 2005

Pilot

April 2006

Actual Study

September 2006

Methodology Implementation Cont.

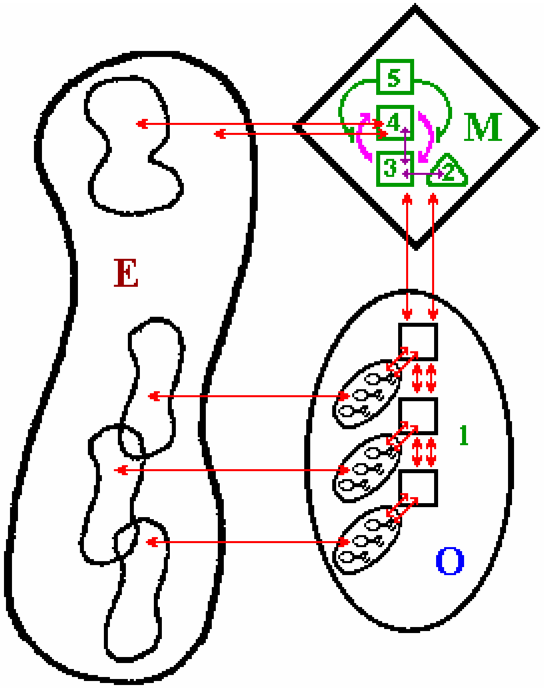
pisoSIA@

Groups

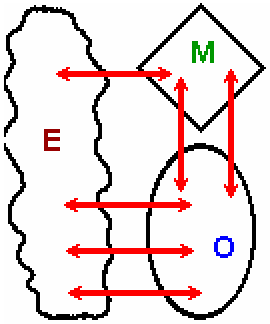
Attributes

Influence

recursion



VSM

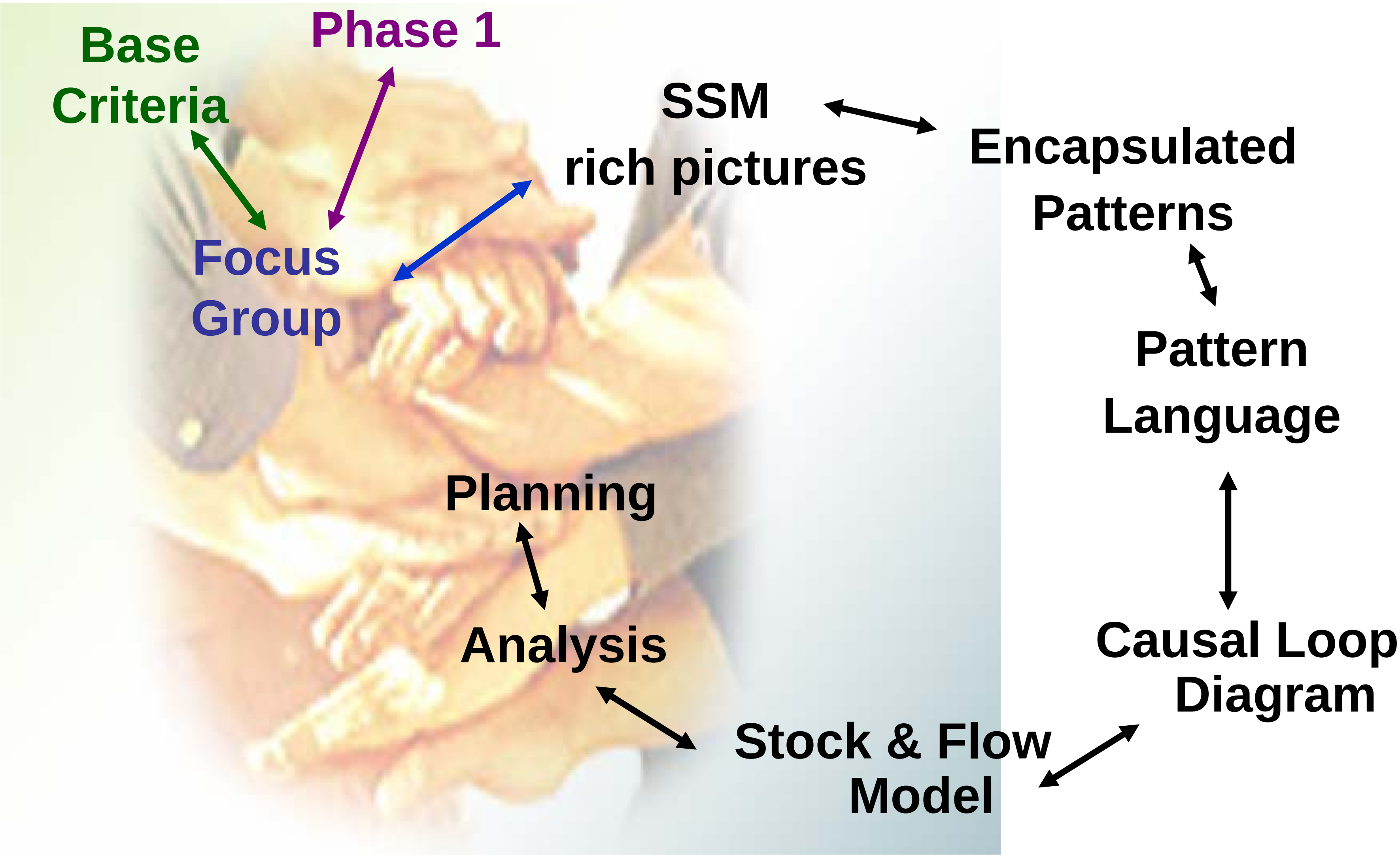


- E Environment
- O Operation
- M Metasystem

http://www.bogacki.co.uk/C7TER_fig_1.htm

http://www.greybox.uklinux.net/vsmg_2.2/0cybeyes.html

Methodology Implementation Cont.



Base Criteria

Key Factors identified as potential constructs that may contribute to stakeholder collaboration within software development projects

- Knowledge Sharing
- Role
- Interest
- Trust
- Empowerment
- Dialogue

Literature

Experience

Interviews

The Collaboration Model

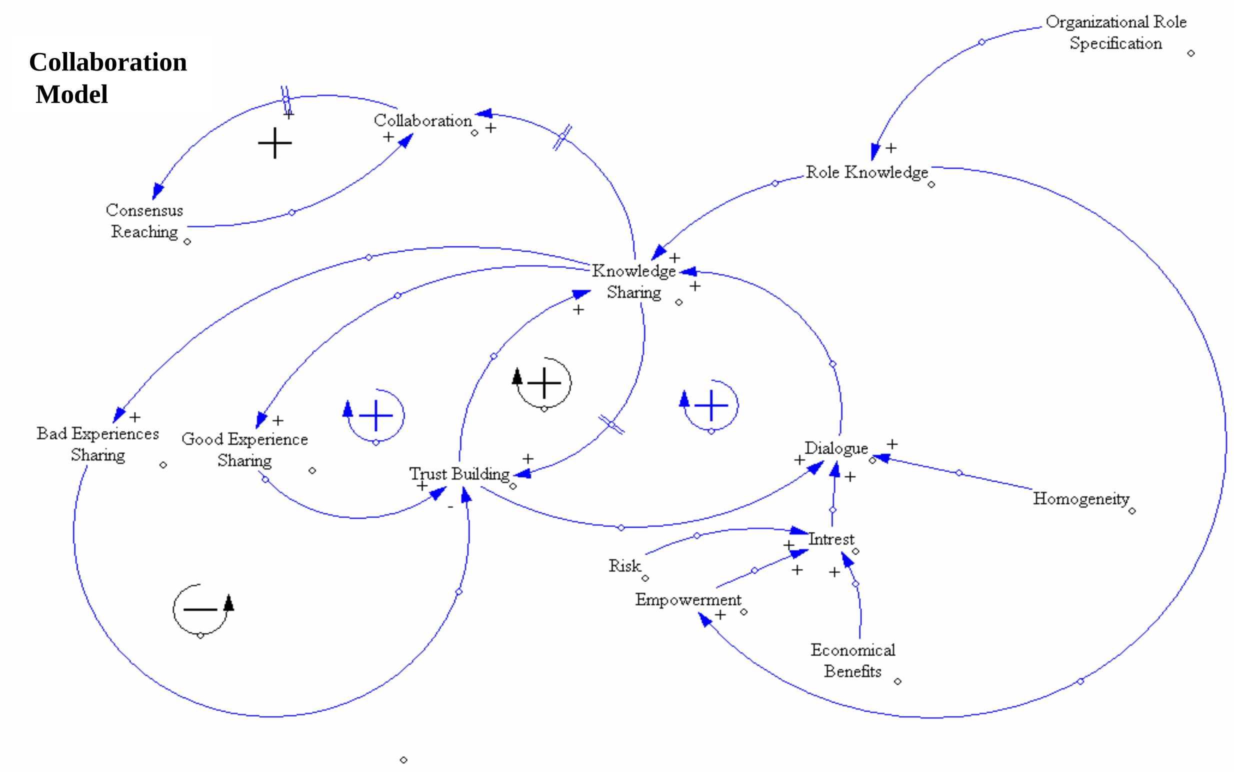


Figure 1

Conclusion

Systemic methodology

- Initial set of criteria, others generically added
- Context specific encapsulation..

Shows potential in

- Collaboration Evaluation
- Intervention points Identification
- Acceptance of change support

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The Requirement Analysis Model

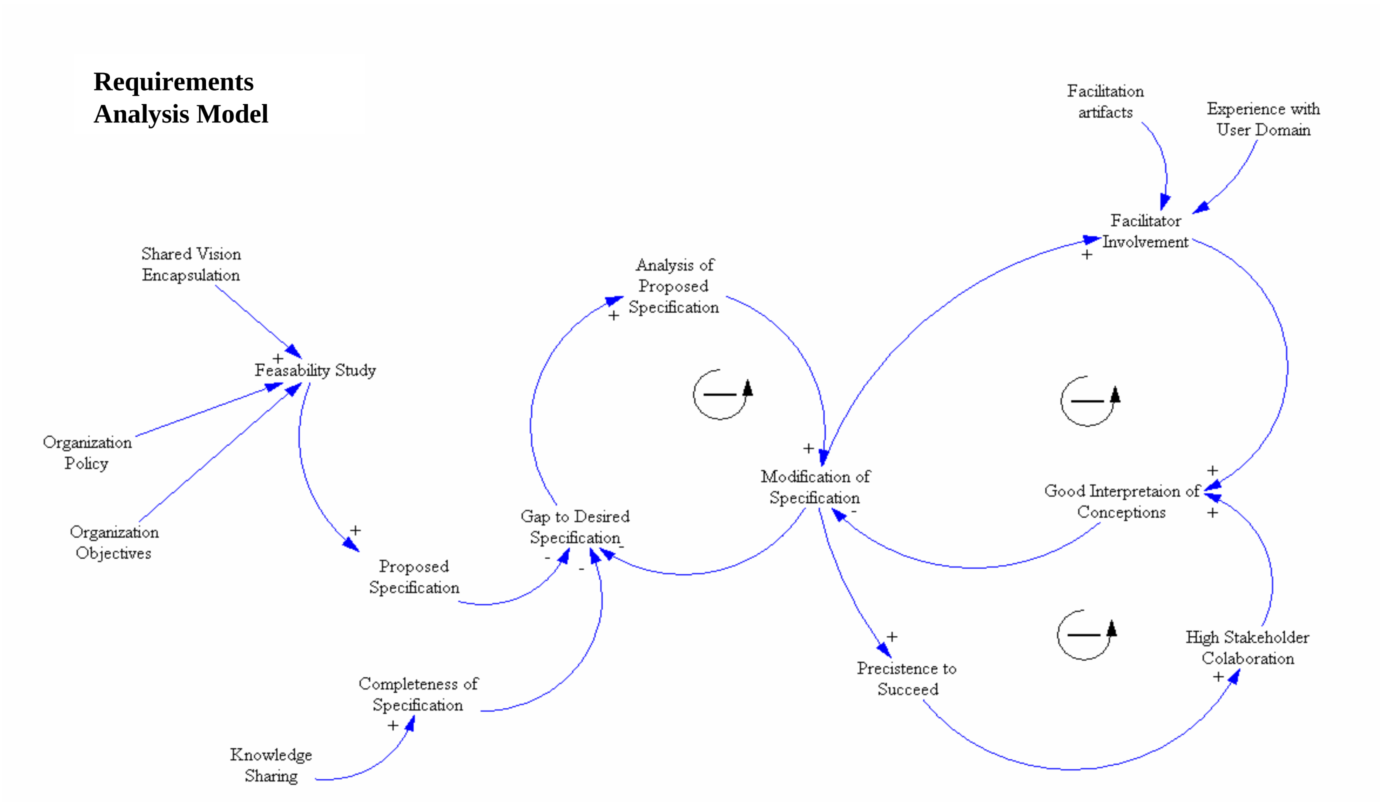

Figure 2