On Improving the Understanding of Software Requirements by Clients

By

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Preface

The research work reported in this thesis was carried out in the Department of Information Technology, Faculty of Accounting and Informatics, Durban University of Technology, South Africa, under the supervision of Prof Theo Andrew and Prof Doncho Petkov.

The framework for improving clients understanding of software requirements proposed in this thesis was presented as work in progress at the 23rd European Conference on Information Systems held in Münster, Germany, 26-29 May 2015.

The field work where the framework was applied was carried out in July to September 2015 for the pilot study and February to June 2016 for the main study.

This thesis represents original work by the author and has not otherwise been submitted in any form for any degree or diploma at any University. Where use has been made of the work of others it is duly acknowledged in the text.

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Abstract

Motivated by the literature regarding the need for further research on client participation in software development, a systemic framework for the understanding of client requirements in Information System development projects is developed. This systemic framework is particularly relevant for project contexts characterized by diversity of stakeholder values and complexity.

To address this complexity, research led to the selection of methods from three systems methodologies and the conclusion for the need to mix them in the process of requirements understanding by clients. The mixing of methods from various methodologies is justified through the principles of Critical Systems Practice, and the process of their use is guided by Action Design Research.

In spite of the strong research tradition associated with Soft Systems Methodology and the growing interest in the Work System Method, the level of use of these by practitioners is not high because complex project situations require harnessing of the strengths of more than one methodology. The proposed framework also includes a third system methodology Critical Systems Heuristics. This study demonstrated how the meta-methodology Critical Systems Practice is applied in justifying the selection and the mix of methods from the above three methodologies in the proposed framework.

The principles of design science were applied, where the framework is the design artifact that is developed. Action Research was used to guide evaluation of the framework in the pilot study. The framework was applied in a pilot study to the understanding of the management of a Wellness Centre which operates within the Kenneth Gardens Housing Estate, through action research. As a result of the pilot study some modifications were made to the framework and the process of its implementation. The modified framework was applied in a further main study concerning the management of the Kenneth Gardens Housing Estate which has a broader context than the pilot study.

The contribution of this research to the field of Information Systems is both theoretical and practical. One theoretical contribution is provision of a framework for clearer understanding of software requirements by clients. The second theoretical contribution is that Action Design Research is enhanced by adding proper justification for the methods included in the framework through the application of Critical Systems Thinking and Critical Systems Practice. The practical contribution is through the demonstration of Action Design Research being applied to a real-world problem in both the pilot and the main study.

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Table of Abbreviations

Abbreviation	Description
ADR	Action Design Research
AST	Applied Systems Thinking
BIE	Building, Intervention and Evaluation
CATWOE	Customers, Actors, Transformation process, World view (Weltanschauung) Environmental constraints
CSH	Critical Systems Heuristics
CSP	Critical Systems Practice
CST	Critical Systems Thinking
DS	Design Science
DSR	Design Science Research
DUT	Durban University of Technology
ECIS	European Conference on Information Systems
IEEE	Institute of Electrical and Electronic Engineers
IS	Information System/s
ISD	Information System Development
IT	Information Technology
MBA	Masters in Business Administration
MSIS	Masters in Information Systems
NPO	Non-Profit Organization
PAR	Participatory Action Research
PR	Proportional Representation
RE	Requirements Engineering
SA&D	Systems Analysis and Design
SE	Software Engineering
SOSM	System of Systems Methodologies
SSM	Soft Systems Methodology
STS	Social Technical Systems
TSI	Total Systems Intervention
UFC	Urban Futures Centre
WS	Work System
WSM	Work System Method
WSS	Work System Snapshot
WST	Work System Theory

Chapter 1: Introduction

1.1 Background to the problem

Information Technology project success rates show a need for improvement (Eeleens and Verhoef, 2010; Standish Group, 2013). According to Whitaker (2010), problems of project failure are attributed to requirements being incomplete, inaccurate, inconsistent, or missing. Building better software is still a challenge that needs to be faced (Highsmith, 2013). Highsmith (2013) goes on to observe that the approach to software development projects needs to change in order to address this challenge, and proposes Adaptive Software Development as a means to this end. Ahimbisibwe, Cavana and Daellenbach (2015) note that the lack of software development project success is a problem that requires further investigation and propose that more careful attention needs to be paid to matching the project type to the software development approach. Their approach to identifying the project type is through finding the most critical success factors for a project and then using this to choose the most appropriate software development approach. Another approach to bring about improvement in software development projects is to improve user-developer communication particularly in large scale Information Technology projects (Abelein and Paech, 2012, 2015).

The problems in software development include high costs, timelines not met and inferior quality of the final product. These problems with information systems (IS) have been in existence for many years, and yet there has been a lack of successful research leading to significant improvement of the process of software development.

Alter and Browne (2005: 981) state: “The relative dearth of SA&D research is even more surprising given the widely accepted belief that errors, omissions, and other difficulties in determining IS requirements are a primary cause of IS project failure and disappointment”.

The same authors highlight that the IS design process involves more than the technical aspects of an IS; it also encompasses human participants both in the IS as

well as in the business processes that are supported by the IS. In conclusion they identify six issues (Alter and Browne, 2005: 996) that require research in information system development. Two of the issues they identify are among the motivations for this study:

- Importance of information for decision making; and
- Attention to personalities, organizational politics, and culture.

User participation in the information system development (ISD) process has often been hypothesized as being a contributor toward systems success, and yet the poor success rates reflect that these problems appear to be ongoing.

McKeen, Guimaraes and Wetherbe (1994) found that user participation and user involvement are used interchangeably in the literature. User participation can be 'token participation' where although all users have an opportunity to provide input (usually via questionnaires or semi structured interviews) their input has no consequence on the project. Also, the questions can be approached from the designers' point of view rather than from the users' point of view. This would result in a technical bias being introduced from the very beginning stages of an ISD project.

Cavaye (1995) identifies the need for the process of participation to be clearly defined, as well as investigating the possible links between participation and system success.

In a recent review by Hirschheim and Klein (2012) on the history of IS, they show that user involvement has been studied in relation to IS for forty years already. In the early years of IS (1960s and 1970s) the impact of an information system on the work environment was perceived in the context of the social system supporting the technical system, they used the term 'social-technical-system' (STS) to emphasize that social and technical issues need to be considered when designing an IS (Hirschheim and Klein, 2012). The emergence of 'participative design' in the 1980s is a further extension of STS where the importance of user participation in the system design is emphasized. This reflection shows that user involvement and participation received considerable attention in the early years of IS research. They

conclude also that while STS research had mixed empirical results, it was clear that user involvement and participation were important in the ISD process. This leads to the possibility that the problem with user participation is related to the quality of user participation. This research proposes a framework for improved client understanding of software requirements that would assist in the formulation of client requirements for an ISD project.

The problem of how to effectively involve users in the ISD process so as to reap the benefits of their involvement was brought again to the attention of the IS community by a thought provoking paper by Markus and Mao (2004). These authors call for rich participation by clients in software projects, stating:

> … it is not the mere fact or quantity of participation that matters, but also the quality of participation. In particular, we describe participation activities in terms of participants' behavioral experiences (the types and richness of participation activities) and in terms of the design choices made by change agents (the method or techniques and conditions of participation) (Markus and Mao, 2004: 536).

They further point out that rich participation is encouraged by using analysis techniques that are appropriate for users with non-specialist information technology (IT) knowledge, by choosing analysis techniques that capture socio-technical requirements in addition to functional requirements, and in using a "facilitation" approach rather than a "technical expert" approach to participation. Participation needs to be such that the influence of the users' participation is reflected in the resulting ISD project and its implementation.

Further extension of the ideas of Markus and Mao (2004) is provided by Alter (2009b) who calls for "project collaboration" rather than "user participation". Alter uses the term "project collaboration" as a way to clarify the extent to which users should be involved, and the need for a comprehensive consideration of all aspects of the project rather than just the technical issues.

Given this need for meaningful participation, the issue of client participation and formulation of requirements becomes especially complicated for projects involving multiple stakeholders holding diverse interests which then contribute to the complexity of the project. Typically, the outcomes of such IT projects involve changes in the business process and work practices of organizations (Alter and Browne, 2005). In such projects the clients often have a vague idea about their perceptions of the requirements and as a result these need to be defined through a careful interaction between the developers and the clients. The need to carefully address the social construction of software requirements by those involved in requirements engineering (RE) is demonstrated by this comment from Holstrom and Sawyer (2011: 44):

> The RE community appears to have continued to focus on the artifact, and thus failed to exploit the potential value of social constructivist approaches, which are highlighted by our findings. There seems to be a clear need for more of a social process perspective, and awareness of the need for multiple perspectives of IS requirements.

Complex situations involve necessary organizational learning and the application of methods that support such learning. Organizational learning has been promoted through systems thinking as well as other methods. According to Mora *et al.* (2007: 1) the IS discipline

> … has been driven by a dual research perspective: technical (design engineering oriented) or social (behavioural focused). This duality of man-made non-living (hardware, software, data, and procedures) and living systems (human beings, teams, organizations, and societies), the multiple interrelationships among these elements, and the socio-cultural-economic-politic and physical-natural environment, make IS a complex field of enquiry.

Hence, the authors motivate that the systems approach is most likely to complement the technical analysis of a problem. The systems approach describes the general properties of a system as: "wholeness, purposefulness, emergence, organization, hierarchical order, interconnectedness, competence, information based

controllability, progressive mechanization, and centralization." (Mora *et al.*, 2007: 3). Midgley (2011: 5) states two assumptions that are fundamental to most (if not all) systems approaches: everything in the universe is directly or indirectly connected to everything else, and that our understandings in any situation are inevitably limited. To address the limitation of our understanding of a project situation a multiple perspective framework that combines the strengths of methods from different systems methodologies is proposed. Systems thinking as applied to information systems promotes organizational learning and recognizes the complexity of the social, cultural, and power dynamics within which an information system is required to function (Jackson, 2003, 2006). Recognizing and working within this social context is key to soft systems thinking.

Petkov *et al.* (2008a) in their article titled Information systems, software engineering, and systems thinking: challenges and opportunities trace past research on the application of the system`s approach to ISD and outline areas of further research that could be undertaken. The focus of this study relates to these points listed by Petkov *et al.* (2008a: 75):

- ...to foster a common language for all stakeholders in software development.
- *Build methods and tools to facilitate the communication process between software developers, customers, and supporting multiple perspective* (sic) representations of problem situations...

This thesis attempts to address these issues, proposing a framework for improved understanding of very complex project contexts that are characterized with significant changes in the business processes related to them.

1.1 Goals of the research

The goal of this research is to develop a systemic framework for better understanding of clients' requirements for an information system development project.

In this thesis clients include the owners of the system, those that could stop the project at any stage. It is noted that in IEEE Std. 830-1998 the IEEE Recommended Practice for Software Requirements Specifications the term customer is used for what is termed the client in this thesis.

It is the clients in collaboration with the developers that ultimately specify the requirements for an information system. The systemic framework proposed in this research is designed to bring clients to a clearer understanding of requirements through broader consultation with all stakeholders. The application of the framework assists in this broader consultation and the ideas used within the framework assist the clients to understand the requirements. The framework provides for rich participation by all stakeholders as described by Markus and Mao (2004) and for project collaboration as called for by Alter (2009b). The client participates in the implementation of the framework and through the interaction with a broader base of all stakeholders, is lead to a better understanding of requirements.

The following sub-goals were pursued in formulating a framework for enhancing client understanding of requirements in complex information technology interventions:

- Analyse the historical evolution and current state of user involvement in ISD projects in the light of difficulties associated with client requirements elicitation.
- Investigate the characteristics of software project contexts in general and the types of ISD project contexts in which the proposed framework could effectively be applied.
- Investigate relevant work in the field of systems thinking that can inform better understanding of software requirements by clients.
- Apply the principles of Critical Systems Practice (CSP) (Jackson, 2003) in drawing together a multimethodology framework for better understanding of software requirements by clients that incorporates methods from different systems methodologies within systems thinking.

- Justify the process of implementation of the proposed framework in a project on the basis of Action Design Research (ADR) (Sein *et al.*, 2011), a recently proposed meta-approach to design science that integrates Design Science (Hevner *et al.*, 2004) with Action Research.
- Apply the framework in a pilot study and a broader main study regarding a real-world problem and thus demonstrate validation of the framework and its application to the problem of client understanding of requirements.
- Provide reflection on the results from both the pilot and the main study.

1.2 Scope and delimitations of the research

The previous section defined that the main goal or aim of this project is to design and implement a holistic framework for improved understanding of software requirements by clients. A framework is designed with a specific purpose, and is often depicted in a graphic that shows the interaction between related concepts. A framework is a meta model for assisting methodology users (Jayaratna, 1994).

In this case the framework aims to bring individuals to an improved understanding in formulating software requirements. A framework is designed to apply to specific project contexts where software requirements are difficult to define at the start of the project because of their complexity. This complexity is due to the involvement of multiple stakeholders with diverse interests, significant size of the IT projects and where the IT projects are likely to cause changes in the business processes as a result of their implementation. Thus, the proposed framework needs to be applicable to these types of complex project contexts.

The framework developed in this study concerns the very early steps in the planning and analysis stages in the systems development life cycle of a complex ISD project. In such cases, the clear formulation of a client's requirements is usually too difficult at the outset of the project (in contrast IEEE Standard 1233-1998 provides the assumption that the requirements have to be defined at the beginning of the project). As a result of the application of the framework, better understanding of the business architecture and information architecture (these are discussed further in chapter 4)

related to a particular software development problem. The interaction between clients, developers and other stakeholders while using the framework facilitates the emergence of understanding. It will be demonstrated that the understanding gained through the application of the framework can lead to a formulation of a Work System Snapshot (WSS) (see Alter, 2006) and an improved common understanding by clients and developers of both the business architecture (Zachman, 1987; Ulrich and Kuehn, 2015), and information architecture (Brancheau, Schuster and March, 1989; Evernden and Evernden, 2003) associated with the project. The above results are of practical value to software developers as they can be used for the subsequent formulation of use cases as was shown by Alter and Bolloju (2016). The development of actual use cases is outside the scope of this project.

The validation of the framework is demonstrated through its application in both a pilot and a main study to a municipal owned housing estate in Durban, South Africa.

1.3 Research methodology

This research begins with an analysis of the literature regarding user involvement in ISD projects, identifying key issues in the literature that reveal the need for further research, as well as possible ways in which an improvement in understanding of requirements for ISD projects could be achieved. This is followed by the conclusion that the application of systems thinking to requirements analysis and analysis of potential systems methodologies could be relevant to improvement of the understanding of client requirements.

This project includes theoretical creative research as defined by Melville and Goddard (1996), "Theoretical creative research is about the discovery or creation of new models, theorems, algorithms, etc.". What Melville and Goddard (1996) referred to as theoretical creative research, has more recently been referred to as a form of design science (Hevner *et al.*, 2004). Design science in the field of IS as promoted by Hevner *et al.* (2004) was a reaction to the preoccupation of IS practitioners in the 1990s with empirical research on how systems are used and by the desire to address the development of IS. Hence design science "seeks to extend the boundaries of human and organizational capabilities by creating new and

innovative artifacts" (Hevner *et al.*, 2004: 75). The artifact may include software, frameworks, formal logic and mathematical proofs as well as descriptions in natural language. Design science (where design is both a noun and a verb) includes both process and product. The analysis in Chapters 2 and 3 shows the relevance of systems thinking for software requirements analysis. The general approach in this study is a combination of design science and systems thinking. In essence, the framework is developed following an original combination of ideas from more recent developments in systems thinking and in design science as will be shown below.

The choice of systemic methods used in the framework is achieved through applying the principles of Critical Systems Practice, a systems thinking meta-methodology proposed by Jackson (2003). It is an extension of Critical Systems Thinking (CST) (see Jackson, 2003: 306) now simplified to three commitments:

- *Critical awareness.* Critical awareness is demonstrated in the choice of certain methods from different systems methodologies as required by the context of the problem for which the framework is created.
- *Pluralism.* Theoretical awareness and recognition of the social implications within the context of a systemic intervention such as an ISD project.
- *Improvement.* In this case improvement of the client understanding of software requirements.

Since the process of applying CSP as proposed by Jackson (2003) is quite general, it was necessary to explore a more recent development in the field of design science in information systems called Action Design Research (Sein *et al.*, 2011). Action Design Research suggests an integration of ideas from design science and action research which fits well with the complexity of the type of project contexts for which the proposed framework is being developed. The alignment of the description of ADR and the objectives in this study can clearly be seen in the following extract: "ADR reaches into the very core of IS: *designing* IT artifacts while allowing for their *emergence* in an organizational context, and seeking utility in the *ensemble* they represent" (Sein *et al.*, 2011: 53 italics in original text).

The essence of emergence of better understanding of client requirements is explored through the interactions of the results of applying the methods in the framework that were chosen using CSP.

Action Design Research suggests a crisper definition of a process for implementing design science research in information systems than does CSP. It however does not explicitly embrace the richness of the available systems methodologies (which makes ADR different from CSP) though it implies some form of organizational learning being promoted by the action research element within it. It can be noted that ADR is similar to CSP in one aspect in that they are both implemented as action research interventions (Jackson, 2003; Sein *et al.*, 2011). The understanding of the problem situation and of client requirements emerges as a result of applying the framework. The stages of ADR facilitate the learning associated with the social construction of client requirements that needs to take place in the implementation of the framework. Hence the application of the framework will be guided by the process of ADR (see Sein *et al.*, 2011) as will be shown in Chapters 4 and 5.

From an ontological point of view this research is about mixing of methods from different methodologies from different paradigms in the same intervention. Thus Soft Systems Methodology (SSM) is based in an idealist interpretive philosophy, while Work System Theory (WST) is based on a realist philosophy. Critical Systems Heuristics (CSH) is based on the philosophy of practical reason and rational argument. Critical Systems Practice (see Jackson, 2003) recognizes on the one hand the specific strengths of the original paradigm of each method involved in the proposed framework and on the other hand the ability of one to provide results that can be used as inputs to another method. For example rich pictures and CATWOE analysis (where CATWOE describes Customers, Actors, Transformation process, World view (Weltanschauung)) can be informed by WSS in WST, or the AS-IS or OUGHT-TO questions in CSH. The issue of paradigm incommensurability (see Jackson, 2003) might be seen as a critique of open research but for the purposes of this thesis the argument against it as provided in Jackson (2003) and the analysis on the topic by Petkov *et al.* (2006) is accepted. Hence it is considered to be outside of

the scope of the research in this thesis as it requires a separate detailed research on its own.

Marshall and Rossman (2006) identify several types of research for the purpose of a study when designing qualitative research:

- Exploratory (investigate little understood phenomena, identify important variables, and generate hypotheses for further research).
- Explanatory (explain plausible causal networks influencing the phenomenon, explain the forces causing it).
- Descriptive (document the phenomenon of interest).
- Predictive (predict the outcomes of the phenomenon).

The work performed in this study is qualitative in nature but falls within the design science research perspective which has the following characteristics (extracted from Vaishnavi and Kuechler, 2004: 23):

- Ontology: Multiple, contextually situated alternative world-states. Socio-technologically enabled.
- Epistemology: Knowing through making objectively constrained construction within a context.
- Methodology: Developmental.
- Axiology (what is of value): creation, progress, improvement, understanding.

The research reported here includes exploratory and explanatory steps (see the first two purposes in Table 1 on the features of the research steps) and design science steps (as reported in Chapters 4 and 5 of this thesis). Table 1 summarises the text of this subsection by outlining the purpose of issues investigated in each chapter, the corresponding research questions that are explored, the research methods applied and the evidence collection used in the research. Further justifications of the philosophical foundations of the research are included where needed in Chapters 3, 4 and 5 in relation to their content.

Table 1: **Features of the research steps in this project**

Purpose of the study	**Research Question**	**Research Method**	**Evidence collection**
To investigate past research on user involvement in IS development (Exploratory) presented in Chapter 2.	What are the representative papers published regarding user participation in ISD requirements over the past 30 years? How have the main ideas on user participation in ISD projects evolved over the years?	Literature Review Assessment of established theoretical frameworks	Published research Existing body of knowledge in IS development
To explain what type of systems thinking is relevant for improving client participation in IS development (Explanatory) presented in Chapter 3.	What type of systems approach is relevant for the problem? Why is interpretive systems' thinking appropriate for the problem of concern? What are the features of the selected systems methodologies that could contribute to better understanding of the problem? What approach to use for mixing methods from different systems methodologies?	Assessment of established theory in systems thinking Literature review based on critical awareness of the strengths of systems methodologies following CSP Literature review based on the principles of improvement and methodological pluralism in CSP	Published research Existing body of knowledge in systems thinking
To design a framework for improved understanding of software requirements by clients (Design science research) presented in Chapter 4.	Why is Action Design Research a suitable process model for development and application of the framework? What methods to include in the proposed framework? What is the appropriate action design learning cycle for applying the framework?	Assessment of Action Design Research Development of the artifact (the framework) Development of the action design learning cycle	Existing body of knowledge on ADR and CSP
To demonstrate the relevance and the application of the framework (Design science research) presented in Chapter 5.	What approach to use for validation of the framework? Is the framework valid? (Implement the framework in order to validate the framework) What corrections of the learning cycle are needed, and how the framework should be adjusted as a result of the pilot implementation of the framework?	Assessment of the existing body of knowledge on soft design science evaluation Action Design Research intervention .	Existing body of knowledge on Design Science Output generated using the framework

1.4 Contribution to the field of Information Systems

The theoretical and practical contribution of this research is the development of a suitable framework for promoting organizational learning by clients and developers about software requirements in a project situation characterised by diversity of stakeholder values and significant complexity.

The proposed systemic framework is an interventionist approach justified by the principles of CSP and guided by the process of ADR. The benefits of the framework are a result of the mixing of several simple methods originating from different systems methodologies that includes exploiting the results from each method as an input to other methods in the framework. From a practical point of view, it can be noted that the chosen methods from SSM (see Checkland, 1999), WST (see Alter, 2014) and CSH (see Ulrich, 2005; Ulrich and Reynolds, 2010) are simpler to use than the whole methodologies to which they belong. The framework of their combined use provides a better way to promote organizational learning in the emergence of the formulated elements of software requirements. The framework considers the systemic or "ensemble view of the IT artifact" (Orlikowski and Iacono, 2001; Sein *et al.*, 2011) embedded within a complex social environment and encompassing the interactions between the technology and the people using the technology, as well as the social and cultural perspectives of the people concerned.

To the best knowledge of the author the combination of methods as proposed in this systemic framework has not been used before in the formulation of business architecture and information architecture as part of generating software requirements by clients and developers in an ISD project.

The main theoretical contribution of this thesis is the integration of the ideas of CSP and ADR in the formulation of the framework and the suggested process for its implementation as will be shown in Chapters 4 and 5.

The practical contribution of this research is in the development of a framework that generates greater engagement of clients with software developers for improved formulation of elements of the business and information and WSSs which are to be

used in further formulation of software requirements in an ISD project. There is also a practical contribution in the demonstration of the application of CSP and ADR in a real-world problem.

1.6 Overview of the thesis

The remaining chapters in this thesis are structured as follows:

Chapter 2 is an analysis of the literature considering the brief history of user involvement in ISD projects. On the basis of this history of research and the development of thinking regarding user involvement, a way forward for this study is identified. The importance of project contexts and the complexities of multiple and diverse stakeholders are analysed with reference to user involvement. Resulting from this chapter are the objectives for the framework to be developed, and the motivation of a need for a new approach to ISD project requirements and user involvement. This chapter ends with the conclusion that systems thinking can play a role in addressing the problems identified.

Chapter 3 is an in depth analysis of systems thinking in relation to user understanding of requirements. Several systems methodologies were chosen on the basis of their previous use in the field of ISD (e.g. SSM as per Checkland, 1999; WST as per Alter, 2014; CSH as per Ulrich, 2005; Ulrich and Reynolds, 2010). The historical development of each methodology and its use in practice is traced. Also identified is the possible contribution that each methodology could make towards the problem of client understanding of ISD project requirements. This chapter motivates the mixing of methods from the different methodologies using the principles of CSP (see Jackson, 2003). Chapter 3 lays the theoretical foundation for the framework to facilitate client understanding of requirements for ISD projects developed in the next chapter.

Chapter 4 presents a proposed framework that promotes client understanding of requirements for ISD projects. The principles of CSP are used in selecting methods from different systems methodologies, and drawing them together in a single

framework. The application of the framework follows the process of ADR. The proposed validation of the framework is briefly outlined.

Chapter 5 presents the theory supporting the validation of the framework considering the types of evaluation that are currently described in design science research (see Venable, Pries-Heje and Baskerville, 2012, 2014) and on validation in soft systems thinking (see Checkland, 1995). For this framework, a real-world situation that reflects the complexity identified for this research was found to exist in the Kenneth Gardens Housing Estate. The framework was applied in a pilot study that considered one element of Kenneth Gardens, the Health Centre that is run by a non-profit organization (NPO). Resulting from the findings and experience gained in the pilot study some small modifications to the framework were proposed. Further practical evaluation was then pursued through applying the framework to a far larger problem, for the understanding of the management of the Kenneth Gardens Housing Estate as a whole, resulting in formulating the WSS as well as the business architecture and information architecture that would better support the management of Kenneth Gardens.

Chapter 6 reflects on the results of this study. This chapter reflects on the goals of this research, and how they have been achieved. The theoretical and practical contribution made by this thesis to the field of IS is described. Possible areas for future research resulting from this study are proposed.

Chapter 2: Analysis of the Current State of Client Understanding of Requirements in ISD Projects

2.1 Introduction

In this chapter a detailed study of existing literature on factors related to client understanding of requirements for IS development projects will be conducted. The factors identified will guide a search for existing approaches that could possibly assist in bringing clearer understanding of requirements by clients for an ISD project.

The process followed in this chapter is firstly to analyse current IS project success rates with a view to establishing if project success is a problem that requires further investigation. This is followed by an analysis of the literature on user participation and its impact on IS development projects. The key ideas on user participation over the past 30 years are identified in a historical review. Areas for future research as identified by these authors and that are significant for this study are noted.

Arising from this overview, the importance of project contexts and consideration of the part that project context plays in client understanding of requirements in IS development projects is elucidated. An analysis of who the stakeholders are for an IS development project and the implications of many stakeholders on ISD project requirements specification is discussed. The implications of the factors identified and areas for future research described by previous authors are then used in the justification of the need for a new approach to ISD project requirements and user involvement.

The libraries databases ABI/INFORM, JSTOR, ProQuest, Springerlink and the Association for Computer Machinery (ACM) digital library as well as Google Scholar and Scopus were searched in locating significant papers for this literature review.

2.2 The overall success of IS development projects

The overall success or failure of IS development projects is reported on by the Standish group. Although these reports are released over set periods of time, the 1994 report became known as the Standish groups CHAOS report (Standish Group, 1995) as this report highlighted the poor state of IT projects and their related success rates. The first report produced in 1994 described the percentage of successful projects (on-time, on-budget and with required functionality) as 16%, with 31% being described as failed (cancelled before completion), and 53% as challenged (project completed but with one or all of the following problems: over budget, over time, functionality restricted or not completed as originally planned).

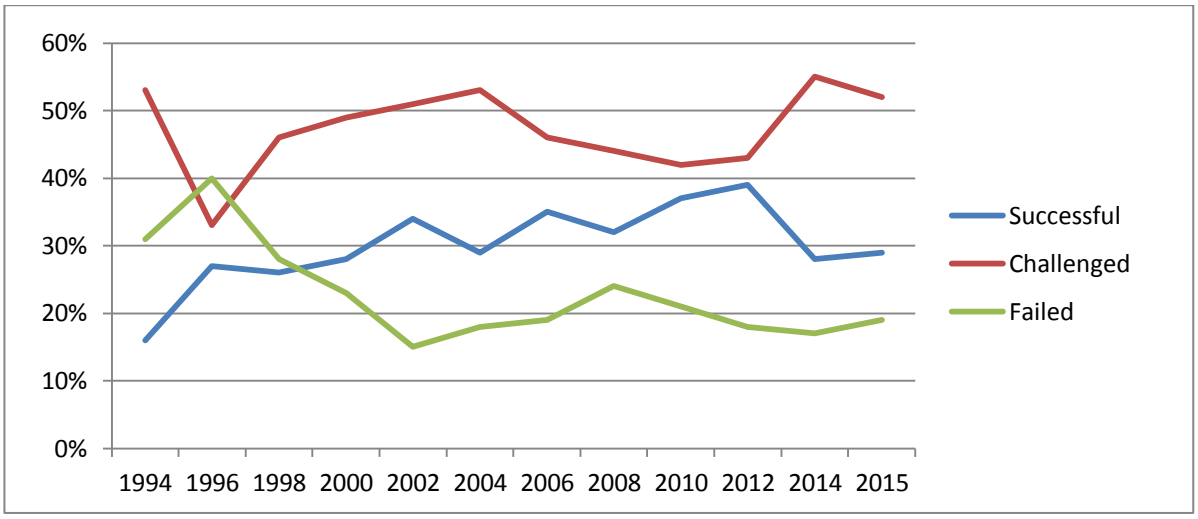


Figure 1: Comparison of The Standish Groups percentages for successful, challenged and failed projects over the period 1994 to 2015

Source: Adapted from Dominguez (2009), Standish Group (2013), InfoQ (2015)

Over the years the Standish group has published statistics (generally every two years) regarding the success rate of IT projects (Dominguez, 2009). The Standish Group reports that in 2015 the percentage successful projects were 29% challenged 52% and failed 19% (InfoQ, 2015). Figure 1 shows how the percentages for successful, challenged and failed projects have changed over the years. The percentage figures are taken from Dominguez (2009), The Standish Group (2013) and InfoQ (2015).

Looking at this graph, the numbers of successful IT projects are gradually increasing but the number of challenged projects is over 50% and still higher than the successful projects. After showing a decrease up to 2002, failed IT projects showed an increase from 2002 to 2008, and again in 2015. Although there was some improvement in challenged projects from 2012, the rate decreased again in 2015. There needs to be a concerted effort to reduce the number of challenged and failed projects, which in total still exceeds the number of successful projects.

The Standish group has attempted to identify factors that contribute to the success of an IT project and the factors that contribute to the possible failure of an IT project (Carroll, 2013). Executive support and user involvement consistently appear as the two most significant factors that contribute to an IT project's success. Even though there has been some criticism regarding how these statistics have been gathered by the Standish Group (Eeleens and Verhoef, 2010; Carroll, 2013), the figures, even if skewed, identify a need for concern regarding IT project success. These concerns have also been raised by other authors. According to Jones (2008: 55) "software projects are plagued by long schedules, major cost overruns, problems with software quality and poor user satisfaction". Whitaker (2010) describes the problems of project failure pointing out that often these problems are attributed to requirements being incomplete, inaccurate, inconsistent or missing. This suggests that IT project success rates need to be improved and that identification of system requirements is an area of concern.

The cost of failure of large scale IS projects in the European Union is reported as being in the region of 142 billion Euros in 2004, with only one in eight ISD projects being regarded as truly successful (McManus and Wood-Harper, 2007). A post mortem examination of failed IS projects revealed that it is the people and the process aspect of an IS project that are most likely to cause project failure (Kappelman, McKeeman and Zhang, 2006). The rate of IS project success can be increased by reducing the impact of interpersonal conflicts and requirements uncertainty (Liu *et al.*, 2011). Interpersonal conflicts and requirements uncertainty are inevitable as a result of user participation in projects and their interaction with the developers. Better managed user participation in the ISD process has often been

hypothesized as being a solution to these problems, and a contributor towards systems success, and yet these problems appear to still be ongoing. The way in which user participation takes place within ISD projects therefore needs further investigation. This is particularly relevant for large multidisciplinary projects like the development of embedded software systems for motor vehicles (see Champion, 2016).

2.3 User participation in ISD projects

The research questions considered during this review of the literature are:

- What are the representative papers published regarding user participation in ISD requirements over the past 30 years?
- How have the main ideas on user participation in ISD projects evolved over the years?

The call for user participation in requirements elicitation and ISD has been a topic of ongoing research for many years. The research however has not led to a coherent body of knowledge, as a number of different approaches and areas of foci have been used. The following representative papers on user participation describe this ongoing research.

In an empirical study that focused on managers and their involvement within the development of Management Information Systems (MIS), a correlation between a-priori involvement and appreciation and use was established. The purpose of the study was to establish if a manager's involvement prior to the development and implementation of the IS had a relationship with their appreciation and use of the system (Swanson, 1974). In this study, the managers were considered as the users, and a positive relationship between involvement and use was demonstrated. There is however a call for more research on developing the measures of involvement.

A review of 22 empirical studies between 1972 and 1981 that focused on the relationship between user involvement and system success was conducted by Ives and Olson (1984). They were unable to demonstrate a relationship between user

involvement and system success. This was attributed to severe methodological and measurement problems. Two key areas where measurement takes place are:

- The measurement of user involvement; and
- The measurement of success.

Both of these have a broad range of interpretations in the studies reviewed. User involvement, although used as a common term, incorporated many different types of involvement that could range from 'symbolic involvement' to 'involvement by strong control'. The outcomes of user involvement demonstrated a narrow focus which "ignores the important underlying cognitive and motivational characteristics of individuals affected by the changes" (Ives and Olson, 1984: 590). They further conclude:

> Not only has empirical research been unable to foresee when and what types of user involvement are appropriate, it has not convincingly demonstrated that user involvement contributes to system success. Until higher quality, theory-based research strategies are employed intuition, experience, and unsubstantiated prescriptions remain the practitioners' best guide to determine appropriate levels of user involvement. (Ives and Olson, 1984: 601)

A later study, considering the next ten years, reviewed 23 empirical studies on user participation and system success between 1981 and 1992, showed that conflicting results were still being produced, with 43% of the studies reporting positive results and 57% giving mixed or negative results (Lei, 1994). Lei identified that the inappropriate use of the factor analysis approach was a contributor towards the inconclusive results and proposed that process factor analysis should be used. The following statement highlights the complexity of human interaction and measuring human interaction in the ISD process: "user participation and its effects on the perceived quality of information systems is clearly a human interactive process, also dependent to human subjective perception. It appears to be problematic to conceptualize such complex and dynamic human interactive processes into a simple and static factor measurement" (Lei, 1994: 299).

Hirschheim and Newman (1991) go so far as to discuss user involvement and the anticipated benefits as one of the 'myths' of ISD. They argue that the underlying cause for this problem is that the ISD process is largely a social process which is usually ignored and a very narrow view of the ISD process is used for most projects.

This raises a further question regarding the way in which the users participate in an ISD project. This needs to be defined in order to determine if the predicted results of user satisfaction are achieved. McKeen, Guimaraes and Wetherbe (1994) found that user participation and user involvement are used interchangeably in the literature. They described 'user involvement' to be the more encompassing term that requires an individual's psychological involvement whereas 'user participation' indicates behavioural involvement. User participation can be token participation where although all users have an opportunity to provide input (usually via questionnaires or semi structured interviews), their input has no consequence on the project. Also the questions can be posed to users in such a way that they focus on the technical features of the system, the approach being from the designers' point of view rather than from the users' point of view.

Barki and Hartwick (1989) call for a separation of user participation and user involvement where the role and importance of participation and involvement can be described separately. They further note that user involvement influences user attitudes which are subsequently translated into user behaviour, and that this should be analysed for the field of IS. Barki and Hartwick (1989: 61) define involvement as "a subjective psychological state, reflecting the importance and personal relevance of an object or event". Participation therefore becomes involvement when the IS becomes personally relevant to the person or user involved. A further study separated participation and involvement as distinct constructs and considered measuring the influences between participation and involvement (Hartwick and Barki, 1994). Despite this work regarding user participation and user involvement and these authors describing a need for both types of interaction for the field of IS, subsequent studies still show that there is a lack of distinction in the use of these terms.

In a review of 28 empirical studies that investigated user participation, the range in interpretations are discussed, and describe 'user participation' and 'user involvement', where user involvement is the more encompassing term that includes hands-on as well as psychological involvement in ISD (Harris and Weistroffer, 2009). This demonstrates that there are still problems regarding user involvement, and the use of this term in the literature.

These distinctions between user involvement and user participation are significant, and require further investigation. Over the past 30 years there has been a range of types of involvement termed 'user participation' and 'user involvement'. To facilitate user involvement that is meaningful it is necessary to consider the human interaction in the ISD process, and the complexity that this interaction brings. The need to more effectively consider the social process in user involvement requires further investigation (Hirschheim and Newman, 1991; Lei, 1994).

A study which focused on the interaction between users and systems analysts (developers) showed that a major source of errors for ISD projects is attributed to ineffectual interaction between users and analysts (Salaway, 1987). This study included both qualitative and quantitative data analysis. From this research it is recommended that new processes that positively affect the interaction behaviour between users and developers at the very beginning stages for an ISD project need to be investigated by both researchers and practitioners so that errors as a result of poor communication are not built into the system. Better communication at this early stage in an ISD project would greatly improve efforts regarding ISD projects and their success. As stated in the paper's conclusion "Until a methodology can be created that facilitates the generation of valid information to be systematically translated into the system design construction, current IS development methodologies, no matter how elegant, will faithfully weave communication errors into their documents, designs and systems." (Salaway, 1987: 263).

Although it is often recognised that users of an IT system should be invited to have input to the change process, this requires more than just the verbal support of

managers. A lack of commitment by managers is described by Howcroft and Light (2010: 132) as follows:

> During our initial meetings with the project team, while there was an acknowledgement that users should have a voice in the change process, in practice little concrete effort was put into encouraging participation. A focus day with end-users was scheduled on a number of occasions, but this never materialized as managers deemed the staff to be too busy. One supervisor commented, "*We'd love to get people involved, but we just don't have the time".*

There needs to be more than a verbal commitment from managers, where they see the value of the time invested in getting 'the people involved'.

The process of participation needs to be clearly defined, so as to assess the links between participation and system success (Cavaye, 1995). Wieringa (1996) describes the following classifications regarding types of participation:

- Consultative participation where key users are regularly consulted.
- Representative participation where representatives of user groups are consulted.
- Consensus participation where consultation is undertaken with all users on all aspects of the system, and consensus is continuously sought.

According to Wieringa (1996: 106), "The demand on the time and energy of users increases from consultative to consensus participation, and the role of the developer changes from active participant making proposals for change to that of facilitator of the change process". Although consensus building has been identified in the literature as a key part of requirements for an ISD project, there needs to be some mechanism that assists in bringing this about.

Hunton and Beeler (1997) in their longitudinal field experiment, show that the benefits of user participation need to be generated by giving the users "instrumental voice" (i.e. influence) during system design, as well as job design.

Following these calls for a different type of participation, the type of participation required in ISD projects was further analysed by Markus and Mao (2004). These authors extensively analyse participation in ISD projects, the relationship between user participation and system success, and in so doing elaborate on the concept of participation. They identify the following possible benefits of participation:

- Buy-in. The psychological benefit of participation leads participants to adopt and use the new system.
- System Quality. The participation in ISD activities leads to system quality, as developers are given the correct information they need to develop a system.
- Emergent interactions. Due to participation, quality relationships develop between developers and users thereby improving project success.

Each of these above benefits is questioned, and analysed in terms of the following three perspectives:

- Unresolved issues. When does participation fail to bring this benefit? As well as, when does the benefit occur without active participation?
- Changing contexts. The context for IS development has changed from the initial traditional approach. Some elements of the changing contexts are more stakeholders, and also the different measures that are used to evaluate IS development projects. These changing contexts for ISD projects impact on each of the above three possible benefits.
- Implications for IS participation theory and research.

Using these perspectives Markus and Mao (2004) raise a number of issues that require further investigation and research with regards to what they term "IS participation theory". Items requiring further investigation in IS participation theory as suggested by Markus and Mao are quoted below:

- "We define system *implementation* success as a high quality process of preparing the target user community for use of the system (often called 'change management') and/or a high quality 'change' outcome, namely that the intended users (regardless of whether they participated in development)

adopt the system, use it as expected, and/or use it with the desired effects. (Markus and Mao, 2004: 525)

- "In many 'IS' projects today, it is difficult to differentiate the system from other aspects of an IT-based business intervention, such as process redesign, physical layouts of the workplace, changes in job design and compensation, or development of IT infrastructure... where solution refers to a package of IT plus complementary changes. (Markus and Mao, 2004: 526)
- "The literature has not really explored the implications of who the participants are relative to the population of affected stakeholders (Markus and Mao, 2004: 527).
- "Participation by affected stakeholders does not just happen. Someone has to provide, design, and execute participation opportunities for stakeholders; and how well he or she performs those activities is likely to make a difference in participation outcomes. (Markus and Mao, 2004: 530)
- "the quality of participation activities is likely to be related to participant experience and solution success, we believe it is important to differentiate theoretically among participation activities in terms of their richness, that is the extent to which participant are likely to experience them as personally meaningful and consequential (ability to have an influence)." (Markus and Mao, 2004: 532)

Arising from their analysis they discuss different participation activities related to different outcomes. The type of participation activities need to take into consideration the outcomes that are expected. Solution development participation leads to the outcome of solution quality. Solution implementation participation leads to the outcome of acceptance and use. Project management participation will lead to the expected outcome of project success measured in terms of project management. However, where the expected outcome involves the identification and possible resolution of conflict, then all three types of participation (solution development, solution implementation, project management) are advocated as necessary i.e. rich participation. This involves meaningful stakeholder participation in systems development, working iteratively with the problem, as opposed to thin participation

which could be for example, each stakeholder completing a requirements questionnaire. The time and commitment required for rich participation will be much higher than thin participation. For this facilitation to take place there needs to be commitment on stakeholder availability, and sufficient resources available.

Participation therefore needs to be such that the influence of the users' participation is reflected in the resulting ISD project and its implementation. Following this deep analysis of participation and the need for rich participation (Markus and Mao, 2004), Alter (2009b) calls for "project collaboration" rather than "user participation". Alter describes project collaboration as a way to clarify the extent to which users should be involved, and covers all aspects of the project rather than just the technical issues. In response to the call by Markus and Mao (2004) for a more detailed investigation of participation Alter extends this to project collaboration which "explicitly focuses on work system projects rather than projects whose main goal is the development and implementation of software/hardware configurations" (Alter, 2009b: 12). Project collaboration as a metaphor clarifies the depth of participation in that it is not a token activity but involves a working together and joint intellectual effort where all values and possibilities are brought to the table while working on a project. Collaboration implies a deep interaction between the technical experts or software engineers and the users to the extent that they are 'equally yoked' or have an equal influence on ISD. This call by Alter (2009b) for project collaboration highlights the emphasis on the business process that the ISD project is to support (the work system) and a high level of interaction is illustrated by the term 'collaboration'. The question that can be raised however is how is collaboration brought about?

Alter (2009b) proposes that using the Work System Method (WSM) will provide the necessary project collaboration. As will be shown in the next chapter, the potential of the Work System Method is recognized but for more complex problem contexts it may not be enough. Considering the points raised by Markus and Mao (2004) however, there needs to be a way of encouraging participation and to analyse who should be involved (a broad stakeholder base). The benefits that should occur include buy-in, system quality and emergent interactions between developers and users. To emerge with these benefits there is a need for something more than the

WSM so as to support a common learning process for developers and stakeholders in the ISD project. This research needs to consider these questions and a way forward to bring about 'rich participation' and thereby the benefits of an ISD project that becomes an effective part of the business process.

The point made by Alter (2009b) regarding the users and technical experts being 'equally yoked' is reflected by other authors that refer to coproduction, and the creation of common knowledge. In a study considering the relationship between users and IT professionals, users are considered as knowledge co-producers in information system development projects (Hsu *et al.*, 2012). In this study data was collected from 260 IS professionals, and the entire development process for IS development projects considered. The results from this study point towards the importance of common knowledge created between developer and user and the positive influence this has on project success. With regards to the requirements phase, the data shows that

> common knowledge has a positive impact on requirements determination, which results in better project performance. The impact of common knowledge on requirement determination is contingent on the user-IS relationship... the user-IS relationship is critical for requirement determination when common knowledge is low... the significant and positive result suggests that project performance is a function of the extent to which users and developers can integrate their own knowledge to develop new knowledge. (Hsu *et al.*, 2012: 34)

Ways therefore need to be sought that facilitate the creation of new knowledge, which becomes common knowledge between users and IS developers. The analysis of knowledge management in the systems development life cycle is a separate large research problem (relevant aspects of it are investigated in Konda, 2008) which is however outside the scope of this project. The generation of the new knowledge should take place through interaction between users and IS developers. Coproduction therefore effectively describes the depth of participation that is called for by Alter (2009b) when describing project collaboration.

A comprehensive model demonstrating that three types of social capital (cognitive, relational and structural) influence user coproduction in ISD projects is presented in a further study (Hsu *et al.*, 2013). The relationship between user coproduction and project outcomes are hypothesized. The hypotheses were tested through an empirical survey conducted in Taiwan. The data showed that "user coproduction can lead to higher project performance, better system quality, and higher levels of user satisfaction.... illustrating that users engaged in the coproduction process can indeed increase value. Effective coproduction leads to higher system quality and greater user satisfaction" (Hsu *et al.*, 2013: 83).

Beranek, Klein and Jiang (2014) investigated the elements of coproduction for software projects that lead to project success. The coproduction elements evaluated were communication, responsibility tolerance, accommodation, advocacy, governance and dedication. The authors found that although users are involved in coproduction, emphasis is often still placed on system development related activities rather than the relationship between users and developer (working relationships, emotional ties). According to Beranek, Klein and Jiang (2014) it is in considering the physical, cognitive and emotional energies that it is possible to develop the "intense engagement" that supports project success (Beranek, Klein and Jiang, 2014). They further state:

> pre-project partnering techniques should be applied to promote the intangibles of teamwork, ownership, and morale. Pre-project partnering includes team building activities and establishment of conflict resolution procedures before work on the project commences. This approach to considering both practice before and during the development activities is essential in motivating the users to join in the activities needed for successful development. (Beranek, Klein and Jiang, 2014: 15)

A recent review by Hirschheim and Klein (2012) on the history of the field of IS shows how user involvement has been studied in relation to information systems over the past forty years In the early years of IS (1960s and 1970s) in an attempt to understand the impact of an IS on the work environment, it was found that the social

system supported the technical system, therefore they used the term "social-technical-system" (STS) to emphasise that social and technical issues need to be considered when designing an information system (Hirschheim and Klein, 2012: 199). The emergence of "participative design" in the 1980s is a further extension of STS where the importance of user participation in the system design is emphasized. With regard to participative design researchers studied how user participation during the systems development process led to a successful system implementation. While this research had mixed empirical results, it was clear that user involvement and participation are important in the systems development process. This research also tried to identify factors that increase involvement and participation and argued that by increasing involvement and participation, users will be more likely to accept and be satisfied with the system. (Hirschheim and Klein, 2012: 206)

This reflection shows that while user involvement and participation received considerable attention in the early years of IS research, there is still a need to move forward in this area. This need is further demonstrated in the review of the literature presented in this section on user involvement.

A systems development method that directly addressed user participation in order to achieve project success is agile development. Agile software development addresses the problem of user participation by involving the client in the software development team (Boehm, 2006b; Cockburn, 2006; Sommerville, 2011). Agile methods have proven to support the development of the software product where the ISD project works within fairly well understood business practice, and clearly defined boundaries. It was however found that when there are a number of clients or user groups and each is concerned with different aspects of the system, there is a high risk in running such a project as an agile project (Ramesh, Cao and Baskerville, 2010). It was advocated that for this type of project, client consensus or compromise needs to be achieved before the project even starts, which does not fit with the agile approach.

The above considerations lead to the conclusion that the type of user participation required is influenced by the project context. For projects where the problem description is sufficiently well defined ~~known~~ at the beginning and there is not a

large group of diverse stakeholders, agile development may be sufficient but for complex projects with many stakeholders there is a need for a new approach to involving the users.

This research takes its lead from the work of Markus and Mao (2004) and Alter (2009b). To facilitate project success, there is a need to develop approaches that encourage user-developer collaboration and which release the potential of clients to formulate better their requirements for ISD projects. The context within which the ISD project will be used bears influence, and needs to be understood. This indicates that the type of user participation required is influenced by the project context. The implication of different project contexts and the corresponding user involvement required for different project contexts is significant. The next section illustrates how different contexts exist for ISD projects, and considers the implications of such contexts.

2.4 The implications of project contexts on the development approach to information systems projects

It has been established that the project context needs to be considered in order to determine the best approach to an ISD project. Most ISD methodologies are often presented as applying to any project context. This has been highlighted by Avison and Fitzgerald (2003: 81):

> Methodologies are often not contingent on the type or size of a project, nor upon the technology environment and organizational context. A methodology is often said to be one-dimensional, that is, it adopts only one approach to the development of projects that may well not address a particular organization's underlying issues or problems. Few recognize or address the critically important social, political, and organizational dimensions of development. A methodology may be inflexible, not allowing changes to requirements during development. Most methodologies make a number of simplifying yet invalid assumptions (such as a stable environment, a well-documented business strategy, users knowledgeable about their own requirements, or that a

consensus of requirements can be achieved). Rarely do such conditions exist in practice.

Although this describes a number of problems, it is clear that the context of the system needs to be considered when deciding on an approach to an ISD project.

The characteristics of the possible range of project contexts for ISD and their characteristics is described by Jackson (2003: 19) as follows:

> Simple systems can be characterized as having few subsystems that are involved in only a small number of highly structured interactions. They tend not to change much over time, being relatively unaffected by the independent actions of their parts or by environmental influences. Extremely complex systems, at the other end of the spectrum, can be characterized as having a large number of subsystems that are involved in many more loosely structured interactions, the outcome of which is not predetermined. Such systems adapt and evolve over time as they are affected by their own purposeful parts and by turbulent environments in which they exist.

This broad range of contexts points towards the need for different approaches for each context.

The complexities in requirements apply to specific problem contexts therefore there will be different processes that are better suited to each context. Bustard and Keenan (2005) proposed four types of context. The four contexts are classified as A, B, C and D and are described in Table 2. In each case the circumstance of the individual project needs to be evaluated, and a software development process selected that matches the individual project. The current study involves the D-Type context which involves a focus on the environment in a context where long term goals and the problem itself are unclear.

Table 2: Four project contexts as defined by Bustard and Keenan (2005)

Type	Context	Description
A	Software Focus, Immediate Needs	The focus is on the software changes. The target environment is well understood and has no significant influence on the software. The partial understanding of the environment is identified by the authors as a weakness of this approach.
B	Environmental Focus, Immediate Needs	This corresponds to the traditional top down approach where the whole system (environment) is examined first and then broken down into smaller parts (subsystems). The problem is solved without much consideration for long term or future development.
C	Software Focus, Long-Term Goal	This includes a long-term vision of what the software should be (or become), in other words how the software system should evolve in a stable environment.
D	Environment Focus, Long-term Goal	This involves firstly a long-term vision of the environment in which the system will be used. This type is needed • when the context for development needs to be understood and there is some uncertainty about future needs, for example when the nature of the problem is unclear • when the business process needs to be re-engineered • when existing technology may need to be replaced

Using different dimensions, Alter and Browne (2005) also describe possible problem contexts for systems analysis and design (SA&D) projects, giving six different business process views of SA&D. They focus on two dimensions that need to be evaluated for each project:

- To evaluate the amount of social versus technical issues regarding the project.
- To identify what needs to change, the technology or the work practice including the scope (low to high) of changes required in work practices.

Listed below are the six SA&D project contexts identified by Alter and Browne (2005: 984):

1. SA&D for software or hardware maintenance.
2. SA&D projects for software or hardware upgrades that lie at an intermediate position between focusing on work practices and focusing on technology, although the primary focus is still on the technology.

3. SA&D for monitoring and patching existing work practices via process improvement and Six Sigma with a focus more on work practices than on technology.
4. SA&D for the creation or major modification of IT-enabled work systems that may involve the creation of new software.
5. SA&D for the creation or major modification of IT-enabled work systems that may involve the configuration and installation of commercial application software.
6. SA&D for organizational change or reengineering that brings the most direct focus on work practices.

The two dimensions are further presented in a diagram that maps the six different SA&D contexts within the two dimensions of emphasis on the technical versus social and the second dimension of degree of changes in work practices. It is shown that requirements complexity relates to the context of the problem and how different methods would be suited to different problem contexts.

Alter and Browne (2005) also point to methods that have been developed that focus on organizational analysis, sociotechnical analysis, and change management. These methods include ETHICS (Effective Technical and Human Implementation of Computer Systems) (Mumford, 2006), soft system methodology (Checkland and Scholes, 1990), Multiview (Avison and Fitzgerald, 1998) and the Work System Method (Alter, 2006).

This research therefore agrees that different project contexts require different approaches and looks specifically to type D projects (Bustard and Keenan, 2005) which are projects that have more social than technical issues, and require a high degree of change in work practices (Alter and Browne, 2005), which is their project context 6. Alter and Browne (2005) describe different research directions for each of the six contexts. The research direction for context 6 states: “better links between the sociotechnical and organizational analysis and programming requirements could increase effectiveness of the entire effort” (Alter and Browne, 2005: 994). The possible change in work practices needs to take place in order to support the new

technology or modified information system. The system analysis and design effort needs to identify the required changes in work practices, through consultation with those involved. The acceptance and understanding of changes in work practices support further the systems analysis and design of the technological system. The new or modified work practices will support the new technological system. This is the type of complexity that is considered in this research.

The complexity of ISD projects and the need for a different approach in order to address this complexity is clearly highlighted in a recent article in Communications of the ACM by Sommerville *et al.* (2012). The authors state that the reductionist approach which is used in making a project manageable by breaking the project down into smaller parts that are easier to deal with does not work when dealing with large messy and complex problems. They further argue that it is the reductionist view that has resulted in many project failures. For example, the reductionist view is that "the problem is definable, and system boundaries are clear" but they point out that "the nature of 'wicked problems' is that the 'problem' is constantly changing, depending on the perceptions and status of stakeholders. As stakeholder positions change, the boundaries are likewise redefined" (Sommerville *et al.*, 2012: 74). The authors are of the view that in order to deal with complexity the environment including the people involved and business processes needs to be taken into consideration.

The users, or the people forming part of the environment, are the stakeholders. In large "messy" or "wicked problems" the stakeholders could include anyone affected by the system which can include political groups, trade unions, government laws and regulations, as well as international law and regulations etc. Complex problems (Jackson, 2006) are a set of interrelated problems. These types of complex problems have also been referred to as "messes" (Ackoff, 1981), "mess management" (Midgley, 2000), or "wicked problems" (Conklin and Weil, 1997). These problems are characterized by:

- An evolving set of interlocking issues and constraints with no definition of the problem.

- There are many stakeholders that care about or have a stake in the problem to be solved. This makes the problem solving process fundamentally social.
- There are constraints on the solution. These may be limited resources or political ramifications; these could also change over time.

The social nature of the problem requires teamwork in moving towards a solution. They suggest that a cultural background where personal achievement is highly regarded has implications for teamwork. When working with wicked problems, focus needs to shift from finding a perfect solution to the quality of the problem solving process. The value of getting the right answer needs to be replaced with the value of learning.

It has been advocated that for projects where there are a number of clients or user groups, and each is concerned with different aspects of the system, client consensus or compromise needs to be achieved before the project can start (Ramesh, Cao and Baskerville, 2010). Alter (2009a) describes sociotechnical systems as reflecting similar characteristics to wicked problems, in that the social environment surrounding the technical system is never totally deterministic: the influence of the people surrounding the system brings with it each individual's skill, knowledge, judgment and incentives and these will be different for each individual. Each change or addition of stakeholders will bring a whole new personal influence to the system in each case.

This research has considered the context of complex ISD projects where the complexity includes diverse stakeholders, and implementation will influence the business processes / daily work within the organization. The environment (work practices) and long term goals of the ISD project have to be considered within the project context.

For complex problems the influence and implications of many stakeholders is part of the complexity. This calls for a more detailed study of many stakeholders, and ways to ensure that all stakeholders are involved. The possible influence of more effective user involvement on requirements analysis is expected to influence the success of the

project. This research therefore considers ways in which to realise these improvements towards project success.

2.5 The implications of many stakeholders on the complexity of an ISD project

The stakeholders of an ISD project can be a very broad group, and cannot be reduced to the term ‘users’ or ‘clients’. The client/s is the person or persons requesting the system, the direct owners, who ultimately pay the bill for the system. Depending on the context of a software system there may be an individual client, or a complex makeup of a number of clients involved in the system requirements process. Users can be identified in many other ways. There are users on the operational level that use IS to get the job done, as well as users on the managerial level that use IS to manage the business process. Stakeholders are all those that have a vested interest in the system, or anyone who will be affected by the project in any way, both directly or indirectly. The diverse stakeholders influence the software system and often have the power to render the system useless should it not become part of accepted daily business practice.

When one considers systems for government (or public agencies) it is possible that the user and the client are the same person. A municipal billing system for example is paid for by tax payers’ money and is used to bill those same tax payers. The need for consultation of the stakeholders is therefore increased in an ISD for government agencies.

A possible approach in order to achieve project success and net benefits would be to complete a stakeholder analysis for a given area of concern or possible software system. The stakeholder analysis would identify the broader stakeholder base which needs to be considered. This is complicated by the fact that stakeholders are also not always directly identifiable. There may be ‘standard stakeholders’ who are those that are easily identifiable as affected by or having an effect on the problem, ‘fiduciary stakeholders’ who represent others or act on behalf of them and ‘silent stakeholders’ who are affected by the problem but are unable to have any influence on it (Banville

et al., 1998). Omitting any of these stakeholders could result in an inability to understand all aspects of the problem. In the case where the problem is not yet identified or described, the selection and identification of the stakeholders that will in itself influence the understanding of the problem.

The following key issues need to be considered:

- The role of stakeholders. There is a complexity in the uncertainty of each actor's role in the process of describing requirements.
- Identifying all the stakeholders. As the problem is not yet defined, identification of all possible stakeholders may be difficult during the initial stages of the project. Additional stakeholders may be identified as new aspects of the problem are described (Banville *et al.*, 1998).
- Social issues. There may be power struggles that exist among the different stakeholders, resulting in some stakeholders not expressing their requirements. The more stakeholders are identified and involved, the more the complexity regarding social issues will increase.

Stakeholders are not always aware of the possibilities that a new system offers. During the project development cycle the requirements will change. This growth in understanding contributes towards requirements uncertainty (Boehm, 2006a). This is also described as dynamic requirements, as the "clients tend to change their needs *as a result of the development process*" (Wieringa, 1996: 41). It is in the communication regarding the new system, and talking about what could be achieved that the client will synthesize their thoughts, further refining their requirements and therefore making the requirements dynamic. This includes the inability of the stakeholders to describe what they want and yet they will often state that they will know it when they see it, which will usually happen when the users view a prototype. An acronym that describes this phenomenon is IKIWISI (Boehm, 2000; Sommerville *et al.*, 2012) i.e. *I Know It When I See It*. Another problem is that as the stakeholders become more familiar with the system; their requirements change because as they begin to understand the system they start to envisage new possibilities (Boehm, 2000). Boehm goes on to state that "This means that it is more

important to emerge from the initial requirements definition process with a shared vision of the system's goals and values than with a precisely defined requirements spec." (Boehm, 2000: 100). Building a shared understanding therefore is a very important consideration among stakeholders in the initial stage of requirements definition.

Understanding between stakeholders needs to be achieved before a project commences. This means achieving a common understanding of the problem or interconnected problems. This is described as requirements elicitation by Cheng and Atlee (2007: 286) who state:

> Requirements elicitation comprises activities that enable the understanding of the goals, objectives, and motives for building a proposed software system. Elicitation also involves identifying the requirements that the resulting system must satisfy in order to achieve these goals. The requirements to be elicited may range from modifications to well-understood problems and systems (e.g. software upgrades), to hazy understandings of new problems being automated, to relatively unconstrained requirements that are open to innovation.

Therefore, this requires consultation with a broad base of stakeholders in the very initial stage of a project in order to work towards a common understanding (or consensus) of the goals, objectives, and motives for a software system.

To further complicate requirements, stakeholders may change over time, which is one of the causes of requirements volatility (or changing requirements). However, the consultation of a large group of stakeholders, and the need for accommodation may result in a reduction of this risk, where one individual does not have a strong influence on the requirements.

As highlighted in section 2.3 above, although some authors claim 'user participation' has taken place in an ISD project, it has been found that there are different psychological levels of participation that influence the measure of success. The way in which the stakeholders participate needs to be defined. This participation is more

complex when there are multiple stakeholders with different perspectives. It is not only 'users' that should be involved, but all stakeholders. In most cases the studies refer to participation in the ISD process and have not focused on a specific phase of the ISD process. This study will focus on the very beginning phase of the development process that leads up to the specification of requirements. This study will focus on the very early phases of the development process in a complex project situation for which a clear representation of the business architecture and information flows serving the business processes do not even exist.

There are software systems where the social implications will directly influence the success of a project. These influences are complex and need to be identified. Possible descriptions of the problem need to be investigated in a manner which involves all clients or stakeholders. Cheng and Atlee (2007) describe requirements engineering as being about describing precisely the problem that the software is to solve, and that this is complicated by many clients/stakeholders who have different views on the problem. Relying on a select group of users to represent all interest groups may lead to critical misinterpretation of user's interests or needs (Gallivan and Keil, 2003). These multiple influences by many stakeholders could be described as the environment within which the software system is required to function.

In the traditional approach to ISD, requirements are generated from information gathered by the IT specialist (analyst) or project team. The information is gathered via questionnaires, observations, interviews and study of the existing system. This however has its own complexities in that the description is subjective as each person on the team will bring their own understanding, experience and knowledge regarding what the organization does. This complexity applies to both those giving the information and those receiving and analysing the information gathered. This difference in perception has been described as human relativism (Cordeiro, Filipe and Liu, 2010), and is a very real complexity that needs to be considered during requirements elicitation. Accommodation regarding requirements as well as a common understanding and acceptance of requirements need to be achieved in order to generate requirements of value.

A key goal of user participation is to get the requirements right. The focus has however tended to be towards the technical IT requirements. This could be a result of the information gathering being driven by the IT analyst, who will tend towards a focus on the technical. The development of a new IS project that impacts on the business process involves far more than just technical requirements. The impact of the new IS project in the social environment within which it operates needs to be considered as well. The new technical requirements need to be implemented within a new social context. This social context needs to be given more attention than it is currently given in the ISD process.

Boehm (2006a) identifies two factors that need to be resolved in gathering requirements for ISD projects, namely: incomplete requirements and changing requirements. Incomplete requirements may be a result of not including all possible stakeholders, and therefore the broad scope of what is required is not identified. Changing requirements can also be a symptom of not including all possible stakeholders, as it is when new viewpoints come to light that the requirements are changed. Incomplete and changing requirements could also be as a result of not taking into consideration the environment, and the contexts within which the new software system is to be used.

An empirical study completed by Chakraborty, Sarker and Sarker (2010) on requirements elicitation and the interaction between analysts and users, considered only two main stakeholder groups, the system analysts and the user representatives, and assumed a high level of consensus between the user representatives. They acknowledge that there may be a number of contexts where this does not apply. The need for a wider stakeholder group, the possibility of a lack of consensus and the dynamics that this introduces are described by the authors as limitations of their study. Consensus between different stakeholder groups cannot be assumed, but needs to be achieved in some way in order to have agreement on the requirements for a software system. This is not necessarily an absolute agreement but may be an understanding on the best possible way forward with the accommodation of many stakeholder views.

A number of studies have been completed that look at different aspects of requirements. One study focused on the perception gap between clients and IS developers (Chen *et al.*, 2009). This was an empirical study that identified two main categories of problems making the definition of requirements difficult. The two categories identified were:

- Requirements uncertainty; and
- The user developer perception gap.

A second paper focused on the perception gap and identified techniques that could be used to reduce this gap (Jiang *et al.*, 2009). The perception gap is further demonstrated in that most studies are engaged in from the software engineering point of view, where the clients or stakeholders already have a list of requirements in natural language (Soares, Vrancken and Verbraeck, 2010), or where the client is introduced to the requirements definition process, but from the software engineering point of view (Arthur and Gröner, 2005). Using IT specialist staff to drive the requirements gathering process has the effect of emphasising the technical issues and not recognizing the social implications on the business process that a new IT system could have.

Business managers may use business process modelling techniques to assist in drawing up requirements. A study that compared 12 process modelling techniques highlighted the fact that current process models lack contextualization and do not capture process flexibility (Recker *et al.*, 2009). The areas into which users should have influence and provide input are demonstrated in a case study by Gallivan and Keil (2003: 55) where they found that users were encouraged to consider "only technical problems, rather than broader sociotechnical issues, such as job design or performance incentives". This was discussed as a major contributor to the failure of the project in their case study. Although the users were extensively consulted, the consultation focused on the technical, which is only part of the system, and the broader issues were not considered, and the users were not asked for input into these. It is the broader issues that affected the use of the system. This case study clearly highlights the fact that in order to create project success one has to consider more than the technical requirements of an ISD project.

Some key considerations raised by Markus and Mao (2004) as needing more careful consideration when identifying the requirements for an IS are:

- Who are the most important stakeholders relative to the population of affected stakeholders?
- Which stakeholders are most likely to be affected by the solution, and whose acceptance is pivotal to the implementation of the system?

User participation in the requirements phase needs to therefore take place in such a manner so as to ensure "rich participation" as called for by Markus and Mao (2004) where the user is involved in all aspects of the new system, not just the technical specifications, thereby recognizing their influence in the resulting project.

It is important to consider that the ISD process is largely a social process which is usually ignored and a very narrow view of the ISD process is used for most projects (Hirschheim and Newman, 1991). This view is supported by Holstrom and Sawyer (2011: 35) who state that in the ISD process "socially constructed nature and the inherent conflicts among multiple users' needs are either incompletely addressed or – worse – intentionally 'black-boxed' by professional IS developers." They go on to describe how requirements are not pre-existing and need to be gathered (an assumption that is made by most requirements gathering methodologies). Requirements need to be created through socially constructed lenses where requirements are generated through negotiation and conflict resolution.

Howcroft and Light (2010) describe the social construction of technology and how the structural and political circumstances of the development for an IS will be reflected in the technological artifact that is developed. The possible conflict in social relations contributes toward the anomaly where the excellence of a technological solution will not necessarily guarantee its success. This broadening of system development to include the development and implementation of human activity systems (Checkland, 1999) as systems that contain human participants, with all their social interactions, clearly extends the scope of requirements as an information system is no longer considered as a purely technical artifact (Petkov *et al.*, 2012).

Xia and Lee (2004) identified four areas of complexity for ISD projects, and evaluated which area of complexity has the most direct effect on the possibility of project failure. The four areas were classified in a grid and described as:

1. Structural organizational complexity;
2. Structural IT complexity;
3. Dynamic organizational complexity; and
4. Dynamic IT complexity.

The four measures of success that were evaluated were:

- Delivery on time;
- Cost;
- Functionality;
- User satisfaction.

They found that structural organizational complexity had the most significant effect on project complexity and affected all four measures of success. Structural organizational complexity also had the most influence on user satisfaction. The factors in structural organizational complexity refer to support structures for the project. Given this, it is clear that there needs to be much more consideration given to the socially constructed environment, as it is complexities in this area that have a high influence on project success. Identifying and working through possible social implications before the project commences is envisaged as greatly improving the possibility of project success.

Traditionally there are two groups of people concerned with requirements elicitation: the software developers and the users, where the software developers have approached the users (loosely defined and not all stakeholders) in order to work towards the requirements. This has often resulted in the focus being on the technical aspects of the system as highlighted by Gallivan and Keil (2003). In essence their case study revealed that the information provided by users focused on the technical, and not the social implications, in terms of how the new system did not fit with their current work processes. A narrow technical approach is viewed as a reductionist

view which Sommerville *et al.* (2012) believes is not adequate for large complex systems.

Markus and Mao (2004) describe that where the focus is on the technical or functional outcomes (system requirements quality, system quality) and the associated relational and affective outcomes (participant satisfaction, user participants' perceptions of developer credibility, participants' commitment to adopt and use the system) this is not enough. Although this appears to be a comprehensive approach, the focus on these two aspects tends to not consider that user participation in development projects can easily extend into business process redesign and IT infrastructure development. It is the business process redesign and IT infrastructure development that tends to be lacking in current approaches.

A similar opinion is expressed by Xia and Lee (2004), where they describe the complexity in the interaction with the organization is often a factor that the ISD project team has no control or influence over. They may develop a technologically sound system but if there are organizational factors negatively affecting the use of the system, the project may still be regarded as a failure.

Traditionally the IT artifact is regarded as unproblematic, stable, discrete and independent (Orlikowski and Iacono, 2001) and that it operates effectively within the organization. These authors describe five broad categories that represent a common view of information technology in IS research: the tool view, the proxy view, the ensemble view, the computational view, and the nominal view. They classified articles published in the Information Systems Research journal over a ten year period 1990 to 1999 and found that the view that was the least used was the ensemble view. This confirmed their view that generally IT (or the IT artifact) is taken for granted and not considered within the complexity of a socio-technical project where the IT artifact is considered as a system embedded within a complex social environment within a larger system that comprises the enterprise or business function being served. The ensemble view takes into consideration the interactions between the technology and the people using the technology. The social and cultural perspectives of the people concerned will influence the use of the IT system. This aligns with the

call made by Steven Alter that the "work system" is what needs to be considered, and not only the technical information system (Alter, 2002; Alter and Browne, 2005; Alter, 2008a, 2009a).

The view of the broader environment being part of the IT system and the consideration that should be taken of this is presented by Alter (2008a: 451) when he defines a work system: "A work system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific products and/or services for specific internal or external customers". In essence, the IT system tends to be isolated and viewed as a technical system without consideration of the work environment in which the IT is to be used. The people that will be using the IT system and the work functions that the IT system is to support also need to be considered as part of the new system.

McLeod and Doolin (2012) describe the limitations that can take place in emphasising the technical considerations or social considerations for an ISD project as separate. For a sociotechnical system it is important to take into consideration the interactions between the social and the technical, and not to consider the two as separate systems. The interaction and how the interactions take place are significant to the development of a solution to the problem. They further suggest that "IS development processes provide both opportunities and sites for situated action and interaction among the internal and external actors involved in IS development" (McLeod and Doolin, 2012: 178).

Therefore, viewing the ISD project as a work system, the 'whole' of technical and social together as the work system is a more holistic approach and matches with the ensemble view (Orlikowski and Iacono, 2001). As the traditional approaches tend to focus on the technology, there is a need for a new approach that will encompass more than just the technology itself.

The software project needs to be considered within the context of the social environment. It cannot be considered in separate parts. The interaction of the social and technical components is important. The IS needs to be effectively used within

the business process and social environment, and needs to be an effective IS that enhances business function.

In a government or municipal system, there are political influences that also need to be taken into consideration. This implies that in the public sector there are generally more stakeholders that need to be taken into consideration when working towards systems requirements. A study completed in Western Australia regarding software systems in the public sector found that in this sector emphasis is placed on the interactions with the rest of the IT infrastructure (Elpez and Fink, 2006). This highlights that the public sector faces more complexity in the consultation of diverse stakeholder groups.

The factors affecting the requirements for an ISD project that need to be highlighted are the definition of users (or stakeholders which is far broader than users), the type of participation, the system context and also the development phase that is considered. In most cases, 'users' is a general (or nebulous) term that in some cases is defined as those directly dealing with outputs from the IS, and in most cases is left relatively undefined. The term 'participation' is also shown to be used interchangeably with the term 'user involvement'. This analysis has shown the journey from user participation and user involvement, and the eclectic and interchangeable use of these terms in the literature, to the calls for rich participation (Markus and Mao, 2004), collaboration (Alter, 2009b), coproduction (Hsu *et al.*, 2012; Hsu *et al.*, 2013) and on to pre-project partnering (Beranek, Klein and Jiang, 2014) where the emphasis is placed on the relationship between the users and developers.

The literature clearly indicates a need for a new approach to requirements elicitation when a problem is complex. Following the research directions as identified from the work of Markus and Mao (2004) and Alter (2009b) it is proposed that more attention should be paid to how well the ISD project is functioning within the context of its environment. It is based on the need to develop approaches that encourage user-developer collaboration, and release the potential of clients to better formulate their requirements for ISD projects. The context within which the ISD project will be used

bears influence, as the ongoing use of the system is a significant success factor. This indicates that the type of user participation required is influenced by the project context. For complex projects with many stakeholders, there is a need for a new approach to involving the users.

This study needs to consider the requirements for an ISD project as being socially constructed considering a broad base of stakeholders and their needs. The requirements to be considered are not only the technical IT requirements but also considerations of possible changes to work practices. This approach needs to facilitate and to take into consideration different and conflicting views of stakeholders towards the formulation of ISD requirements.

2.6 The need for a new approach to ISD project requirements elicitation and user involvement

This literature review demonstrates a need for a new approach to understanding requirements for ISD projects. This new approach is proposed as a framework of ideas that takes into consideration the implications that have been drawn from the literature. The implications drawn from the literature are:

- IT project success rates need to be improved. Information system project requirements are an area of concern that has the possibility of improving success rates.
- IT project success has two different measures. One concerns the management of ISD as a project meeting milestones of development, and the other is consideration of the incorporation of the ISD project into the day to day operation for which it was intended. The acceptance and use of the ISD project incorporated within the business process is the measure of success that is considered more significant and requires more attention.
- This research will follow the points raised by Markus and Mao (2004) and also supported by previous literature. There needs to be clear guidance on who the participants are, the quality and type of participation, the social and technical implications for an ISD project.

- This research follows the call for rich participation (Markus and Mao, 2004) and project collaboration (Alter, 2009b) in ISD projects. The framework should therefore provide for quality participation, where the stakeholders see the value associated with their participation. The framework needs to support rich participation and collaboration including all stakeholders.
- The effort must be made to identify all stakeholders, with some being more easily identified than others. There is a need to ensure as broad as possible identification of and consultation with stakeholders. Understanding and accommodation of different stakeholder needs should be achieved before the ISD project commences.
- The approach needs to be easily understood by the stakeholders and to consider the sociotechnical requirements (as well as functional requirements) using a 'facilitation' rather than a 'technical expert' approach (Markus and Mao, 2004). The ensemble view (Orlikowski and Iacono, 2001) of the IT artifact as being embedded within a complex social environment is a view that encompasses the interactions between the technology and the people using the technology, as well as the social and cultural perspectives of the people concerned.
- Complexities associated with the socially constructed environment that supports an IS development project have a high impact on project implementation success. Solutions need to take into consideration the implementation context i.e. they need to be both socially and technically sound.
- The context for which the framework will be designed is for large complex IS development projects where the complexity includes diverse stakeholders and where implementation will influence the business processes/daily work (Alter and Browne, 2005) within the organization. An emphasis on the environment and the long term goal (Bustard and Keenan, 2005) need to be considered for the ISD project.
- The effect of IS changes on business processes or work practices needs to be considered, meaning that an ISD project needs to be socially constructed

considering stakeholder needs. The requirements are therefore not only the technical IT requirements but also considerations of possible changes to work practices. The consideration of different and conflicting views of stakeholders needs to be facilitated within this process.

The IS discipline has been more broadly grouped into two categories of research, one that is technology oriented and the second socially oriented. Given the above considerations, a way of facilitating both the social and technical together is important for this research. This is recognized in that the IS discipline

> "has been driven by a dual research perspective: technical (design engineering oriented) or social (behavioural focused). This duality of man-made non-living (hardware, software, data, and procedures) and living systems (human beings, teams, organizations, and societies), the multiple interrelationships among these elements, and the socio-cultural-economic-politic and physical-natural environment, make IS a complex field of enquiry" (Mora *et al.*, 2007: 1).

Mora *et al.* (2007: 1) conclude that the systems approach is most likely to complement the technical view which generally is based on the reductionist paradigm.

The current problems in software engineering and ISD projects highlighted by Petkov *et al.* (2008a) are attributed to the separation that has occurred in research and development in the field of IS. This has resulted in silos of knowledge categorized as Computer Science, Software Engineering and Information Systems. A systems approach to both research and the problems of ISD projects is recommended as a way of achieving greater integration and may lead to improvement in ISD project success.

The technological and social are not separated into two different areas of concern for this research, but are considered as a whole. The systems approach therefore considers technical and social together as a whole.

The applicability of the systems approach to the problem of bringing clients into a clearer understanding of requirements for IS development projects is investigated further in the next chapter. The systems approach and other possible methods to assist in the facilitation of all stakeholders' rich participation therefore require further investigation. The systems approach needs to consider the social systems, the technical systems, as well as the work practices that support the business process. Systems approaches applicable to ISD projects for the project context where changes in business practice are foreseen are also analysed in the next chapter.

Chapter 3: Overview of Systems Thinking Research Applicable to the Problem of Client Understanding of Requirements

3.1 A brief overview of the use of the systems approach in Information Systems

The systems approach has been applied in many fields of study. Jackson (2009) reviews 50 years of Systems Thinking as applied to the field of Management and Management Science. Jackson explains the link between Operations Research and Systems Thinking as applied to military problems towards the end of the Second World War. From these beginnings, Jackson goes on to describe the development of Systems Thinking over the past 50 years, and the various strands of applied systems thinking. Jackson also points to future work in applying Systems Thinking, drawing attention to "the rich diversity of methodologies and methods it now has at its disposal" (Jackson, 2009: 536). The book The fifth discipline (Senge, 1990) describes systems thinking as a way in which to view the underlying structures influencing a complex situation, and applies this to the field of management, and management decision making.

Here the systems approach will be discussed with regards to its application in the field of ISD projects, which is indeed a part of the management field.

The systems approach has been applied extensively as part of the action research programme at Lancaster University in the United Kingdom. This has resulted in many prominent publications in both journals and books. Systems Thinking is first described as a way of avoiding the reductionist approach in order to make sense of a situation, as described in Systems thinking, systems practice (Checkland, 1999). These thoughts are further extended in Soft Systems Methodology in action (Checkland and Scholes, 1990), and yet it was still found that in the field of IS the reductionist approach was still prominent (Checkland and Holwell, 1997). Checkland (2000) in a 30 year retrospective of SSM describes the journey of applying systems thinking, the complexities involved, and the misinterpretations that exist.

The lack of application of the systems approach in the IS discipline at the turn of this century is highlighted by Alter (2004a: 757): "The information systems discipline is ostensibly about systems, but many of our fundamental ideas and viewpoints are about tools, not systems". Alter motivates for the application of the systems approach in a more meaningful way within ISD projects.

A special issue of the *Information Resource Management Journal* was published in 2007 that focused on the systems approach in IS. In the lead article the research paradigms and frameworks used in information systems research are analyzed using a systems approach (Mora *et al.*, 2007). The systems approach describes the general properties of a system as: "wholeness, purposefulness, emergence, organization, hierarchical order, interconnectedness, competence, information based controllability, progressive mechanization, and centralization." (Mora *et al.*, 2007: 3). In 2010 a panel discussion regarding systems thinking and the need for this approach in IS research was conducted at the 18th European Conference on Information Systems (Petkov *et al.*, 2010). In 2008, IGI Global established a new refereed journal with the title *International Journal of Information Technologies and Systems Approach* or *IJITSA*. The focus of *IJITSA* is to publish research articles where systemic interdisciplinary and/or multi-methodology research perspectives are considered with regard to IS, software engineering, systems engineering and the systems approach. A special issue of *IJITSA* (Volume 9, Issue1) on Systems Analysis and Systemic Thinking with a focus on research and teaching issues has also been published in 2016. The articles in this issue demonstrate the current application of systems thinking regarding problems in the IS field. There is also a call for there to be more evidence of the systems approach in IS curricula (Schell and Mathieu, 2016), highlighting the importance of Systems Thinking to the field of IS.

This progression demonstrates the renewed and ongoing interest in the systems approach in IS. There needs to be more work on practical ways of using the systems approach in IS. The systems approach assists in bringing a much broader understanding of the IS and how it is affected by, and has effects on, other systems within which it is embedded. A brief summary of the fairly long history of the systems approach in IS is provided below:

The systems approach was originally applied in what has been termed as ~~the~~ 'hard systems approach' in Systems Analysis, Software Engineering and Operations Research (Jackson, 2003). This approach, although recognizing the interrelated parts, assumes that the parts of the problem can be clearly identified and therefore a solution to the problem can be engineered (Checkland and Scholes, 1990). The hard system approach required that the system of concern or the problem is clearly established in an objective manner, followed by analysis in a linear fashion. In this first application of the systems approach, a system was regarded as a representation of reality that is observable. Models are used in evaluating and assessing alternative solutions to the problem. The underlying presumption is that the problem can be clearly and easily defined. Hard systems thinking is described as falling within the reductionist and positivist paradigm (Mora *et al.*, 2007). Traditional systems analysis and design methods used in IS tend towards hard systems thinking.

The stance taken in this research is that the traditional approaches for IS development are insufficient for large complex systems with many stakeholders. One problem is that the learning that is generated in coming to an understanding of the problem cannot be fully realized if you are following a linear process of systems development. This inability of the hard systems approach to deal with large complex problems leads to the development of soft systems thinking.

Jackson (2009) reviews the ways systems thinking has been applied to management since its inception as a research field. In this paper Jackson refers to Applied Systems Thinking (AST) as the production of knowledge in the form of Mode 2 that is for a particular circumstance, often across disciplines. This description of the production of knowledge as Mode 2 is taken from Gibbons *et al.* (1994) who differentiates Mode 1 as being the more traditional generation of knowledge "within a disciplinary, primarily cognitive, context" (Gibbons *et al.*, 1994: 1). Jackson states that "rigour can be brought to Mode 2 research by building explicit models and using these during the course of the intervention and for later reflection" (Jackson, 2009: 25). In this research it is Mode 2 research that will be demonstrated by building a framework (an explicit model) that is used in an intervention and then for later reflection.

Jackson (2009) describes three strands of systems thinking, namely, functionalist, structuralist and interpretive. Functionalist and structuralist AST refer to a clear problem definition and specification given by the client, which is not the case for this study. Interpretive AST is different in that there is a social group that is concerned with the problem, and not a single client. It is for this reason that interpretive AST or soft systems thinking will be further explored as applicable to this study.

In IS there is a range of problems to be solved. Information systems are used to support different levels of management, and business processes. When the information system supports transaction processing and functions close to the daily processing in the business, it may be possible to use the hard systems approach. As stated by Jackson (2003: 62) the hard systems approach is applicable "when world views converge and the problem becomes one of finding the most efficient means of arriving at agreed-on objectives". As an IS becomes more complex with an undefined problem description, it is necessary for understanding of the problem to emerge. The soft systems approach recognizes the world as complex and as being perceived differently by each observer (Stowell, 2009). The emphasis of the soft systems approach is an understanding of the problem through learning together rather than seeking a single optimal solution.

The soft systems approach therefore embraces the complexity in the problem description, and encourages learning with regard to the problem situation. The process of learning is significant and is as important as reaching an understanding of the problem. There is an understanding that there will be different views by different stakeholders due to different value systems, beliefs and philosophies (different cultural and educational background). This is in contrast to the hard systems approach which does not deal with pluralism (Jackson, 2003).

While the hard systems approach views systems as a reality, the soft systems approach views systems as constructs that include influences from different social perspectives. A further level of systems thinking is where issues of politics, power and conflict are considered as part of the social implications affecting a system. As this is an important factor for this research it is necessary to further investigate the

application of systems thinking methodologies in IS. The soft systems approach is embraced within Soft Systems Methodology (SSM), which is investigated first due to its importance and history of use in IS.

3.2 Soft Systems Methodology (SSM) and its application in Information Systems

3.2.1 The development of SSM

Soft Systems Methodology was developed at Lancaster University as a result of reflection in practice on the application of systems engineering to real-world problems. Table 3 below summarizes points regarding the 'hard' and 'soft' systems approaches identified by Jackson (2003).

The soft systems approach is based mostly on the features of SSM. Checkland (1999) presents a 30 year retrospective on the application of SSM in various projects. Checkland (1999) describes how it was found that the hard systems approach did not produce the desired results in complex systems. He therefore went on to develop SSM in the 1970s in order to address the complexity encountered. Action research was the driver in these projects. Checkland (2000) described key areas that identified project complexity that could not be resolved using hard systems thinking. The key areas were:

- When the situation was steeped within a human situation where people were trying to take action that was meaningful to them.
- When there are many possible interpretations of the problem depending on the world view of participants.

To assist in describing the possible actions 'human activity systems' were identified and described. Different interpretations of the problem leads to a number of possible solutions, with the result that there are a number of a possible solution models. It is with these key issues in mind that the development of SSM took place.

Table 3: Comparison of hard and soft systems approaches

Hard Systems approach	Soft systems approach as represented in SSM
Applying systems thinking to a real-world problem.	Applying systems thinking to a real-world problem.
Positivist paradigm.	Interpretive paradigm.
Reductionist methodology.	Hermeneutic methodology.
Social theory is functionalist.	Social theory is interpretive.
Functionalist paradigm – the efficient engineering of systems to achieve known goals.	Interpretive paradigm – bringing about mutual understanding among those with different values and beliefs.
The 'system' has clearly identified goals.	The 'problem' is vague and unstructured.
Does not handle significant complexity.	Build up the richest possible picture of the problem.
Does not allow for a plurality of views with different beliefs and values.	A number of different models that represent 'human activity systems'. These contribute to debate regarding change (desirable and culturally feasible).
There is a single optimal solution.	There are a number of different solutions, each with their own advantages and disadvantages.
Does not address issues of politics and power.	Examine the politics and how power is obtained and used.
Does not allow for multiple perceptions of reality.	Allows for multiple perceptions of reality as consideration is given to Weltanschauung (or different world views).
Requires the goal of the system of concern to be known or ascertained before analysis can proceed.	The goal of the system emerges after discussion and debate and consideration of the social implications.
Linear follow on of steps in problem resolution.	Ongoing learning cycle.

Source: adapted from Jackson (2003)

Soft Systems Methodology (Checkland and Scholes, 1990; Checkland, 1999) involves a systemic learning process which aims to identify the different world views, social and academic backgrounds of stakeholders, and the way this informs their interpretation of the problem and its possible solution. This takes into consideration that each person may have a different perception of the situation of concern.

The original seven stage process of SSM was presented in 1981 according to Checkland (1999):

- Stage 1 – the problem situation unstructured, find out about the problem situation (exploring the problem).

- Stage 2 – the problem situation expressed. In both stage 1 and stage 2 use rich pictures and other problem-structuring methods/techniques to explore the problem situation.
- Stage 3 – formulate root definitions of relevant systems and complete a CATWOE analysis which entails identifying the clients, actors, transformations, worldview (or Weltanschauung), owners and environment. From this the human activity systems required to improve the problem situation can be described.
- Stage 4 – build conceptual models based on the root definitions for each area defined, build a conceptual (systems) model of the required capabilities to achieve a given purpose or solve a particular problem.
- Stage 5 – compare the conceptual systems models of what is needed to achieve a particular purpose or solve a particular problem with what is actually happening in the 'real world'.
- Stage 6 – define feasible and desirable change derived from the comparison of the conceptual systems models with 'reality', identify and debate logically desirable and socially/politically feasible change.
- Stage 7 – develop an action plan for improvement of the problem situation on the basis of the debate in Stage 6.

As can be seen from this seven stage model the CATWOE analysis tries to ensure that important aspects in the environment have been considered. This seven stage model was used as a cycle until there was understanding and consensus on the complexities of the problem.

From experience gained in using the 7 stage model Checkland moved on in 1990 to describe a more flexible four activities model (Checkland and Scholes, 1990) which aimed to capture the now more flexible use of SSM. Again SSM in action led to the description of two ideal types of SSM described as Mode 1 and Mode 2. Essentially Mode 1 SSM is methodology driven, and applies SSM as an external recipe in an intervention. Mode 2 is more flexible and adaptable to a given situation; it is situation-driven and SSM becomes an internalized model used during interaction.

Different types of problems will call for Mode 1 or Mode 2 to be implemented. Checkland (1999) concludes in his 30 year retrospective report, that "SSM can be seen as articulating 'the social process', in the form of what Vickers calls an 'appreciative system'" (Checkland, 1999: A43). Using SSM Mode 2 is far more applicable to the very first stages of a project, where the problem itself and those that should have a stake in the project need to be identified. It is therefore SSM Mode 2 that is regarded as more applicable in this research.

Soft Systems Methodology has been further applied in two ways referred to as SSMc and SSMp (Checkland and Winter, 2006). SSMc is used to gain insight into the content of the problem, and SSMp to gain consensus on the process that will be followed or the "process of dealing with the content" (Checkland and Winter, 2006: 1435). There are four ways of gaining insight into the content in SSMc as described by Checkland and Winter (2006). Rich pictures that depict the problem situation, analysis of social characteristics ('analysis two'), analysis of the disposition of power ('analysis three'), an analysis of the intervention itself ('analysis one') (Checkland and Scholes, 1990: 44-48; Checkland, 1999: 19-20). To gain insight into the situation of concern, the first significant step in analysis one is identification of who fills the roles of client, problem solver and problem owner.

SSMp therefore addresses the intellectual process of carrying out the intervention to address the situation of concern. To gain as comprehensive a view as possible, a very broad view of 'problem owner' is encouraged. Many different views need to be taken into consideration to gain an understanding of the situation of concern which is as comprehensive as possible. The identification of these roles and the significance of the broad view of 'problem owner' are of significance, as this assists in identifying the social implications and a need for broad consultation. The value of SSMp to gain consensus on the possible steps and outcomes of the intervention needs to be considered in working towards a clearer description of the problem of requirements in an ISD project.

3.2.2 How is SSM relevant to IS development?

The problems identified in ISD have the potential to be given more clarity through the use of SSM. Bergman, King and Lyytinen (2002b) describe "Heterogeneous Engineering" as applying to large scale projects that require the successful association of entities that range from people, through skills, to artifacts and natural phenomena. Soft Systems Methodology gives consideration to all these elements and therefore is suited to this type of IS development project. The authors also state that the requirements establish links between solutions spaces and problem spaces. This is a changing environment of external conditions shifting principles and the evolution of organizational knowledge. Defining and redefining the problem and solution space can be inefficient and difficult. Also changes in the problem space can affect the solution space in a nonlinear way for example a modest change in one has a possibility of creating a large change in the other. This instability makes requirements analysis difficult. This uncertainty and instability can be addressed through the use of SSM, in that the complexity of relationship between choices made in determining the 'problem' will affect the possible solutions, and the complexity in the non-linear effect on solution spaces is also well recognized in SSM. As can be seen here this is an important step in identifying the complexity and implications of choices made. It is very important that these nuances are brought to light and understood at the beginning of a project. Choices need to be made regarding the scope of the problem within the consideration of these implications.

In a study regarding ISD requirements, Holstrom and Sawyer (2011: 35) argue that requirements are of a "socially constructed nature and the inherent conflicts among multiple user' needs are either incompletely addressed or – worse – intentionally 'black-boxed' by professional IS developers." They go on to describe how requirements are not pre-existing and need to be gathered (an assumption that is made by most requirements gathering methodologies), but rather requirements need to be created through a socially constructed lens where requirements are generated through negotiation and conflict resolution. Howcroft and Light (2010) describe the social construction of technology and highlight that structural and political circumstances of the development for an IS will be reflected in the technological

artifact that is developed. The possible conflict in social relations contributes toward the anomaly where the excellence of a technological solution will not necessarily guarantee its success. This broadening of system development to include the development and implementation of human activity systems (Checkland, 1999) or work systems (Alter, 2006, 2008a) that include human participants, with all their social interactions, clearly extends the scope of requirements. An IS is, therefore, no longer considered as a purely technical artifact.

Avison and Fitzgerald (2003) describe the progression of software development methodologies, and highlight how software development methodologies often do not clearly state when they should be applied i.e. in what type of problem or situation? Most development methodologies also do not clearly define when or how the end users will be involved, even although this involvement is often implied. To answer these two questions, this framework will be applied for large complex problems, and the stakeholders will be the focus of attention from the beginning of the project. This is discussed in more detail below.

Complex problems (Jackson, 2006) are when there is a set of interrelated problems. These have been referred to as "messes" (Ackoff, 1981), "mess management" (Midgley, 2000), or "wicked problems" (Conklin and Weil, 1997). These problems essentially have the following characteristics:

- An evolving set of interlocking issues and constraints with no clear definition of the problem.
- There are many stakeholders that care about or have a stake in the problem to be solved. This makes the problem solving process fundamentally social.
- There are constraints on the solution. These may be limited resources or political ramifications that could also change over time.
- There is no definitive problem and therefore no definitive solution. The process generally ends when the resources run out not when the perfect solution is found.

Conklin and Weil (1997) go on to describe how the stakeholders may change over time, which is one of the causes of requirements volatility. The social nature of the

problem requires teamwork in working towards a solution. They also indicate that focus needs to shift from finding a perfect solution to the quality of the problem solving process. The value of getting the right answer needs to be replaced with the value of learning. Having stakeholders accept the solution that emerges may be more important than getting the answer right!

It has been advocated that for projects where there are a number of clients or user groups, and each is concerned with different aspects of the system, client consensus or compromise needs to be achieved before the project can start (Ramesh, Cao and Baskerville, 2010).

Mingers (1995) looks at the influence SSM has had on IS development. He emphasizes how conventional IS development methods focus on the technical aspects for an IS and not on the complex social, organizational and communicational problems that are associated with the IS. Mingers goes on to emphasize how requirements specifications are often drawn up as the first informal step towards IS development, based on the assumption users know what they want, whereas in effect users are only able to describe what they currently do. This results in the phenomenon where

> "users only come to discover what they want through their participation in the process of design. Other problems with this belief are (1) information systems are part of social systems and their use cannot be specified wholly in technical terms; and (2) the technical orientation of analysts often leads to a gap between 'what the user wants' and 'what the analyst thinks the user wants." (Mingers, 1995: 20).

Soft Systems Methodology has been seen as having the potential to bring a rich understanding of the problem and resolve some of these issues. There have been a number of different approaches to combining SSM and more traditional IS development methods as can be reviewed in Mingers (1995). He raises the following issues with regard to using SSM for IS development:

- Working between the two 'conflicting' epistemologies is very difficult, SSM being interpretive in nature and IS being development positivist.

- Often using SSM to gain understanding of a problem leads to a single description of the problem (technical) when the emphasis in SSM is that there are different views of the problem and therefore many possible solutions. The 'richness' in understanding the problem is lost in a single technical specification.
- Soft system methods cannot just be grafted to the front end of existing system design methods; SSM needs to be an overall guiding methodology that keeps considering the social context throughout the project.

Mingers concludes with two suggestions which are significant for this study

> "It should be possible to keep a number of different conceptual models/views going throughout the process and to try to develop systems that are compatible with them all. This may well involve maintaining different definitions of apparently the same concept … systems should be developed that allow the users to create their own language and conversations rather than defining everything for people. This would mean that the same system might appear quite differently to different users and would maintain different concepts and sets of information, each reflecting different shared views of reality." (Mingers, 1995: 45-46).

Holwell (2000) reviews the published work on SSM in IS and warns that there are many misinterpretations of SSM. In this thesis, it is advocated that an improvement in the effective use of SSM may be achieved if it is combined with another systems approach. Further systems approaches will therefore be discussed further in this chapter.

Alter recognizes the complexity in applying systems thinking in the IS field. Alter advocates that many IS systems are developed using a "tool view" of the IS (Alter, 2004a). The implications of an IS being viewed as a tool is that the richness of the interactions between the organization, customers and the IS are not investigated. Alter (2004a: 759) provides a comparison between the "tool view" and "systems view", demonstrating the need for systems thinking in IS. Alter identifies SSM as "a systems approach because it focuses on identifying and summarizing a system that

exhibits a problem within an organization" (Alter, 2004a: 760), and calls for future research that develops tools and methods that support systems thinking. This research is about developing a framework that supports systems thinking, and follows a number of calls for directions of future research.

3.2.3 Implications of using SSM in practice

Jayaratna (1994) explains that the way in which a method is used is affected by the world view that the person may apply to the methodology. The structures used in SSM also highlight how the same activity may be described in different ways according to the view or weltanschauung that is held by the human actors. This is particularly true in human activity systems, which may have many different descriptions of the same process each according to different world views.

Jayaratna (1994) raises further issues pointing out that although SSM is commended for highlighting social and political issues, there is little guidance on understanding and intervention in these situations. The issue of ethics, where certain world views, or stakeholder needs may be ignored by the client is also not directly addressed. A rich picture approach combines conceptual/logical expression as well as physical characteristics of the situation of concern. The situation of concern can be described as a problem that represents the difference between the current state and the desired state. The desired state is a perceived expectation for a new reality. There is additional complexity in that as action is taken, the perceived expectations may change, and they are therefore dynamic. A further point that is raised is that there needs to be consensus building, and a commitment to compromise in order to achieve a shared perspective of the problem and possible desired states or solutions. This is where SSM tends to rely on the experience of those working on the investigation.

An existing observation regarding SSM use in practice is that its role is often reduced to predominantly a sense making tool (Petkov *et al*, 2012). Soft system methods should allow multiple views of the problem situation, and not only for sense making. Soft system methods are also often used as an overall guiding methodology

for an intervention. For software development projects there needs to be a practical way forward from the multiple views towards software requirements.

Bergman, King and Lyytinen (2002a) address the political nature of requirements for large systems. They state that "SSM focuses on differences in stakeholder goals and values and suggests an adaptive means to analyse and debate such differences through the use of abstract, system-based models. SSM does not provide a clear strategy to identify, analyse and model the underlying political dynamics that generate such differences." (Bergman, King and Lyytinen, 2002a: 159). They state further that "requirements engineering and large and complex systems is inherently political, requiring the establishment of stable networks of social and technical components in the midst of conflict over the resources and goals." (Bergman, King and Lyytinen, 2002a: 169). They also highlight that political issues need to be addressed at the beginning of a project. They go on to describe two categories of politics, functional politics and resource politics. Functional politics concerns the balance of power in considering which stakeholders' interests will be served in the implementation of the requirements, i.e. whose needs will be met? Resource politics considers the limited resources and predicts that often projects are under budgeted in order to be approved. This means that cost overruns will always be a factor that reflects negatively on a project.

Considering the broader spectrum of issues such as governance, stakeholder engagement, labour standards, environmental management (going green), responsible sourcing, employee and community relations, social equity and human rights have been described as corporate social responsibility (Mingers and White, 2010). Systems thinkers have given consideration to corporate social responsibility when it is necessary to understand problems within a broader context of responsibility which involves considering many other factors besides the business perspective of making a profit. In order to consider corporate social responsibility it is necessary to view a problem from multiple conflicting perspectives.

Essentially, using SSM is an abstract process for some people. Using SSM becomes accessible with years of experience. How does SSM get used by a new practitioner

who does not have experience behind them? As described by Holwell (2000), SSM is often incorrectly understood and incorrectly applied to problem situations. A potential simplification may assist in this regard; however, this is outside the scope of this research. There also needs to be a more direct approach in transforming the conceptual models into action plans, a criticism that is brought by functionalist systems thinkers (Jackson, 2003). Soft Systems Methodology also recognizes power and politics but there is no clear direction on how to deal with conflicts when they arise (Jackson, 2003). The problem emerges as a result of debate and the issue is how to ensure unbiased, open debate. Soft Systems Methodology is also dependant on the facilitator and their experience, but a facilitator may also be part of the problem and can bring in bias as to how they view the problem. As stated by Jackson (2003: 205) "It is all too easy for those with power and influence to dominate the discussions and to have their own priorities reflected in the outcome". It is this type of sentiment that has led to the conclusion that SSM merely enforces the status quo.

These criticisms compel further investigation of methods that will bring to light the political and power issues that play a part in requirements development for an ISD project. These issues can then be kept in mind to ensure unbiased and open consideration of each possible view of the problem.

3.2.4 Conclusions regarding SSM

Soft Systems Methodology is useful for sense-making and consensus-building but there is a need for a systems approach that is more tailored to the process of identifying the stakeholders and boundaries for an IS development project. Soft Systems Methodology is used to bring clarity to the problem situation but relies on the expertise and experience of those involved in the project. As the framework being developed is for client understanding, there need to be clearer building blocks to bring to light the requirements associated with the broader stakeholders, the possible political and power struggles, and also to establish the boundary of the IS development project. Using SSM as a method to establish the broad base of stakeholders through identifying key activities and the stakeholders needed to achieve each activity referred to as stakeholder identification and analysis method, is

demonstrated and applied in a recent case study (Wang, Liu and Mingers, 2015). An important aspect of this is that key stakeholders are identified together with the key activity that they perform. The use of SSM in this case focuses on tasks rather than issues. Further systems methodologies that encourage a broader view rather than the task oriented view which tends to come to the fore in SSM, need to be investigated.

In more traditional applications of SSM the emphasis is on identifying and understanding the issues associated with a problem. The issues are directly influenced by those involved with a problem. To support SSM it is therefore proposed that a further systemic methodology that supports identifying those that should be involved, as well as the issues that influence the problem should be investigated. Hence it makes sense to investigate the potential of other systems methodologies for exploring complex projects. Critical System Heuristics, a systemic methodology is considered in the next section.

3.3 Critical Systems Heuristics

3.3.1 The development of Critical Systems Heuristics (CSH)

Critical Systems Heuristics (CSH) (Ulrich, 1983, 1987, 2005) is a methodology for reflective practice that is designed to bring to light both the broader stakeholders as well as the boundary issues. Critical Systems Heuristics is investigated in the following section as a possible means of leading to the identification of all stakeholders by applying the questions in CSH that approach the problem from different perspectives. Using these questions therefore makes the exploration of different views more explicit, whereas with SSM, although the different perspectives are recognized, there is a reliance on the expertise of those involved in the study to recognize the different perspectives. Critical Systems Heuristics focuses on identifying the stakeholders, their key problems and specific concerns. It is hypothesized that in explicitly asking these questions, understanding of the different stakeholders and their different perspectives will be made easier. This understanding assists in working towards improvement on the issues of political and power conflict, identification of all stakeholders and the boundary for an IS development project. It

is important to note that the determination of the boundary will affect the other two issues i.e. who are the stakeholders? What are the political and power issues? These two factors may change according to where it is determined the boundary lies. With these possible benefits in mind CSH and its possible contribution is further investigated.

Critical Systems Heuristics is based on critical thinking and systems thinking.

- **C** is for critical thinking and the ability to reflect on the problem. Ulrich (2005) motivates that critical thinking is required in deciding issues where there is no single correct answer, stating that sound professional practice is indeed critical practice.
- **S** is the systems thinking that underpins and supports the process, ensuring that the 'whole' is considered. Boundary judgments in turn affect the delineation of the 'whole'.
- **H** is for heuristics which is the learning process (in this case the starting point would be what is the problem/ and then what would be regarded as an improvement on the problem). For heuristics Ulrich motivates that this is used to explore and learn about the problem as opposed to deductive procedures.

The questions used in CSH are provided in Table 4. Each of the questions raised within CSH need to be raised in a systemic manner, working towards understanding of the problem to become clear or to emerge (Ulrich, 1987; Reynolds, 2007; Ulrich and Reynolds, 2010). These questions bring into play critical thinking and are grouped according to four sources of influence that Ulrich identified as having influence on a system. The questions seek to identify the four sources in the form of motivation, control, expertise and legitimacy for a system. In finding answers (or negotiating answers) it will be necessary to start making boundary decisions and it then starts to become clear what falls within the scope of the system or problem, and what is excluded or outside the boundary.

Critical Systems Heuristics is considered as supporting both the emancipatory and the pluralist paradigm (Jackson, 2003) with questions that identify who benefits from design choices and seeks to empower those stakeholders affected by such choices.

Ulrich's CSH and critical thinking has been used to identify all stakeholders in two different projects (Achterkamp and Vos, 2007). Whereas Ulrich refers to the stakeholders as the involved (stakeholders) and the affected (stakeholders), Achterkamp and Vos (2007) identified stakeholders in the broad categories as actively involved or passively involved. They concluded that CSH was effective in identifying stakeholders, and their roles. Initially boundaries are expanded and then made explicit. Identification of the passively involved is particularly significant, as this forces these stakeholders to be considered. The terminology also allows for those described as passively involved to at any stage become actively involved. The results of their study found that CSH is efficient for identifying stakeholders and that it also helps clarify each stakeholder's role and their interest in the project.

Critical Systems Heuristics was also effectively used within a critical systemic approach identifying the need to consult with the involved and the affected in a case study on the re-integration process for institutionalized children in Sri Lanka (Ariyadasa and McIntyre-Mills, 2015). Using CSH clearly identified the lack of consultation that was taking place regarding the affected within this situation of concern.

Each of the questions in CSH (see Table 4) refers to the system – 'S'. This is why another approach like SSM or WSM should be used first to try and give a description for S. This description can then be used within the CSH questions as indicated.

Each CSH question is asked in the 'is' mode, to describe what currently exists, and repeated in the 'ought' mode, to describe what (in each stakeholders' view) it should be. So in total there are actually twenty four questions for CSH. Critical Systems Heuristics is designed as a set of questions to identify the boundaries of a system. Boundaries don't have to be physical; they can be differences of viewpoint, experience, expectation, or culture (Alter, 2006). Identifying where stakeholders fall, within or outside the system of concern, assists in the identification of the boundary.

There are two clear modes of working towards identifying the boundary – boundary reflection or boundary discourse. According to (Ulrich & Reynolds, 2010: 265) "through boundary *reflection*, we can achieve a new quality of professional self-reflection; through boundary *discourse*, a new quality of communication in and about professional interventions".

Table 4: The boundary questions in Critical Systems Heuristics

The boundary categories and questions of CSH				
Sources of influence	**Boundary judgments informing a system of interest (S)**			
	Social roles (Stakeholders)	Specific concerns (Stakes)	Key problems (Stakeholding issues)	Stakeholders
Sources of motivation	1. Beneficiary Who ought to be/is the intended beneficiary of the system (S)?	2. Purpose What ought to be/is the purpose of S?	3. Measure of improvement What ought to be/is S's measure of success?	**The involved**
Sources of control	4. Decision maker Who ought to be/is in control of the conditions of success of S?	5. *Resources* What conditions of success ought to be/are under the control of S?	6. Decision environment What conditions of success ought to be/are outside the control of the decision maker?	
Sources of knowledge	7. Expert Who ought to be/is providing relevant knowledge and skills for S?	8. Expertise What ought to be/are relevant new knowledge and skills for S?	9. Guarantor What ought to be/are regarded as assurances of successful implementation?	
Sources of legitimacy	10. Witness Who ought to be/ is representing the interests of those negatively affected by but not involved with S?	11. Emancipation What ought to be/are the opportunities for the interests of those negatively affected to have expression and freedom from the worldview of S?	12. Worldview What space ought to be/ is available for reconciling differing Worldviews regarding S among those involved and affected?	**The affected**

Source: Adapted from Ulrich & Reynolds (2010, p. 244)

Ulrich and Reynolds (2010: 259) recommend that the questions in Table 4 be asked in an order that identify the 'stakes' first, then the 'stakeholder/s', and then the

'issues'. They suggest that this flow in the questions is easier to follow. They also recommend asking questions in the 'ought' mode first, as this enables reflection and gets those involved to look at the bigger picture – in an ideal world 'who ought to be'? This can raise broader issues and reflect what each stakeholder thinks may be an ideal situation. Later the twelve CSH questions can be asked in the 'is' mode and then we have a 'picture' of what is currently perceived to happen, and what is possibly a better way (ought to be). A plan of how to get from the current 'is' to the envisioned 'ought to be' can then be discussed.

Critical Systems Heuristics is therefore a set of questions designed to encourage a broad approach where the possible issues regarding sources of influence, sources of motivation, sources of control, sources of knowledge and sources of legitimacy (Ulrich, 2005; Ulrich and Reynolds, 2010) are thought about and discussed. There is a genuine move towards ensuring that all voices are heard. "CSH provides a philosophically and theoretically grounded framework and means for critical consideration of the choices of stakeholders considered to be relevant to any system under design consideration" (Venable, 2009: 93). The questions are designed to create thought about what 'is' the current situation as well as what it 'ought' to be. The 'ought' context gives opportunity for those involved to consider what could possibly be a better or different way of considering the problem. In answering the questions consideration has to be given to boundary choices regarding what are considered to be within the system/problem boundary and what is not. There is a tension that exists between what is considered part of the problem and the possible associated solutions. The problem space therefore affects the solution space. This interdependence emphasises the need for full and extensive understanding of the problem as this has a significant impact on the possible solutions. It is therefore very important that discussion takes place regarding what is within the problem boundary. The CSH questions are designed to ensure that this discussion takes place and due consideration is given to the boundary of the situation of concern.

The questions are designed to identify the problem within a context and are aligned with soft systems thinking (Reynolds, 2008). Reynolds describes using CSH to assist companies in developing corporate social responsibility regarding economic, social

and environmental issues. These issues are complex and interwoven; decisions made in the interest of any one concern will affect the other two (therefore the need for systems thinking). Recognizing the different world views and therefore different perspectives of the problem is an important function that CSH is designed to bring to light.

3.3.2 Conclusions on using CSH

In Critical Systems Heuristics as well as in SSM there is emphasis on perceptions, values, beliefs and interests, as well as describing who is and who is not involved (boundaries), and those affected. Both of these approaches are interpretive. Both SSM and CSH however do not give a clear path on how to progress from this level of understanding to go forward in an action plan for ascertaining the requirements for the problem or system of concern. There is no clear direction on conflict resolution or how to determine stakeholder significance. The different world views that each stakeholder uses to interpret the problem will result in many views on a possible solution.

Critical Systems Heuristics has been used in order to assist in boundary definition and stakeholder identification in a number of system projects (Achterkamp and Vos, 2007; Ulrich and Reynolds, 2010). These projects have not all however been IS development projects, which is the area of application under consideration.

Soft system methodology is useful for sense making and consensus building and CSH is used to assist in bringing to light the different stakeholders and their points of view. CSH has a further objective of determining the boundary of the system. The boundary is significant. In determining where the boundary falls the scope of the system changes. The boundary also shows which stakeholders are included and which stakeholders are excluded. There is however a need for a systems approach that is more tailored to the process of building IS and for requirements specification for an information system. The following section will discuss a prominent original systems approach that was developed specifically within the IS field.

3.4 The Work System Method and Work System Theory

A systems approach which has been developed for business professionals and considers an IS development project within its social environment is the Work System Method (WSM). The WSM was developed with the systems approach in mind (Alter, 2004a, 2007), and therefore incorporates the thinking associated with the systems approach. It is however a more practical approach to describing the requirements for an IS development project. The WSM focuses on the business process (that is usually supported by an IT system) and is also intended to provide a basis for communication between business professionals and software developers (Alter, 2011). A work system includes all components that work together to produce a product or service to meet a business objective. This view therefore recognizes that people and technology work together in achieving a business process, and considers the work system as including all elements that are required in order to get the work done. The elements of the WSM are described further in 3.4.1.

The WSM has more recently been extended into Work System Theory (WST) the integrated body of knowledge that supports WSM (Alter, 2013). Work System Theory calls for a systems perspective view of IT-reliant systems in organizations as opposed to the prevailing view that considers the IT system as a technical artifact. This 'technical artifact' perspective loses sight of all other aspects that support and are affected by the IT system. The business processes, customers and other human participants form part of the system, and require consideration. This expands the concept of merely consulting the 'users' of the IT-reliant system to consider it within the business context. Given the broad context that includes far more than the IT-reliant system, WST needs to be given further consideration for this study.

Work System Theory is described as a design-theory for the building of a design-artifact (Alter, 2013). According to the categories of theories in the field of IS (see Gregor, 2006), Alter (2013) describes the work system framework as Type 1 analytical theory, the work system life cycle model as Type 2 explanatory theory and the Work System Method as Type 5 design theory. These motivations support the contribution to theory in the field of IS made by WST. Work System Theory

therefore works with the concept of a work system, and supports the design artifacts WSM, work system framework, and work system life cycle. Work System Theory therefore requires a more detailed analysis of the WSM, work system framework, and work system life cycle and the applicability of these to the problem of requirements understanding by clients.

3.4.1 The elements of the Work System Method

The WSM has been developed, used and extended over the past 20 years (Alter, 2011). The purpose of the WSM was "to develop a systems analysis and design method for business professionals" (Alter, 2013: 72). This is one of the few approaches to systems analysis and design where the tool is designed for the client – the business professional – and not the information technology specialist. As this study is focused on the client, and the clients understanding of requirements, the WSM may bring a valuable contribution to this framework. The WSM draws from both interpretive workplace studies and traditional IS design (Alter, 2004b). Work System Theory is a pragmatic approach (Alter, 2008a) that seeks to look at an IT system within its social environment. The work system therefore includes all components that are required to work together in getting the work done.

Although there are a number of possible descriptions of a work system, under consideration here is a work system in which human participants and/or machines perform business processes using information, technologies, and other resources to produce products and/or services for external or internal customers (Alter, 2002, 2006).

This perspective emphasizes the need to include the participants, and processes as part of the work system in an IT system within organizations. In his book on the Work System Method (Alter, 2006) the WS framework is presented in a triangle that holds six elements (Figure 2). The elements are customers, products and services, the business processes which are supported by the three elements participants, information and technologies.

The triangle has three supporting aspects and these are environment, infrastructure and strategies. 'Technologies' include equipment and techniques used by those that are participants in completing their work. 'Products and services' are what are produced by the work system. Information systems developers would use the term 'outputs' but the term 'products and services' are used as this is more meaningful to business employees. 'Environment' includes the organizational, cultural, competitive, technical and legislative environment within which the work system operates. 'Infrastructure' includes the human informational and technical resources that the work system relies on. 'Strategies' are those as laid down by the organization; the work system strategy has to align with these current business strategies.

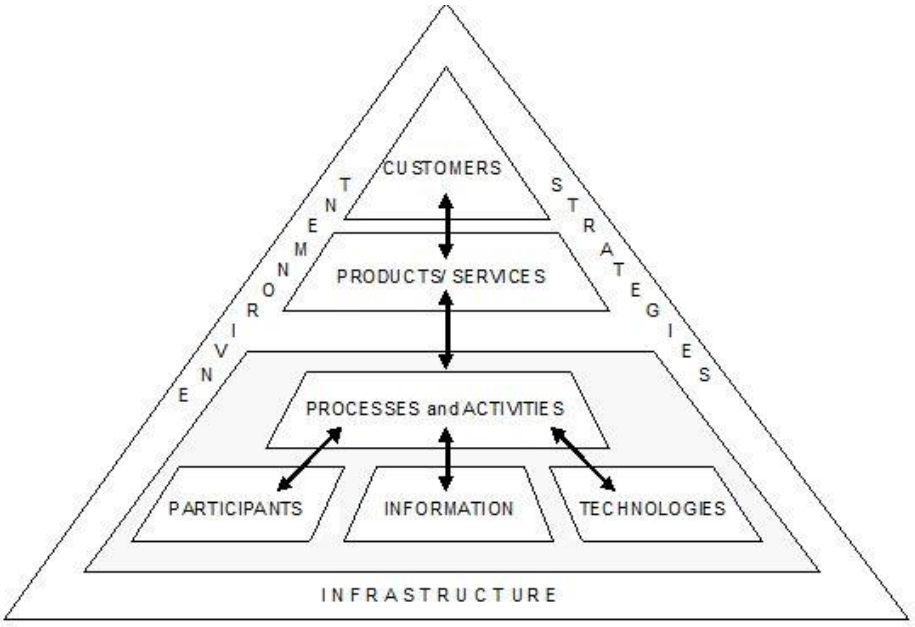


Figure 2: The Work System Framework
Source: Alter (2013: 78)

In addition to the WS framework which presents the elements of the work system there is also a WS Life Cycle model. This model represents ways in which the work system can change over time. The model recognizes that both planned and unplanned change will affect the work system over time. Unplanned change is

referred to as ‘emergent’ change (Alter, 2013). This is significant as it recognizes that it is only when the work system is being used that new requirements emerge from the current operation of the work system.

The work system framework and work system life cycle model are linked to create a design theory which is the WSM. This completes what is referred to as the Work System Theory (WST) (Alter, 2013). It is therefore WST that is applied in understanding and analyzing a work system that includes an IS, which is the system of concern for this research.

A WSS is a tabular one page summary of the system that is drawn up from the work system framework. The WSS is a tool used within the WSM, designed to present a summary of the system as drawn up or perceived by a business professional and is used to summarize the current situation as well as the recommended new work system. The WSS contains six elements that are similar to the work system framework. The purpose of the WSS is to “help people verify that they agree on a work system’s scope and purpose” (Alter, 2006: 16). The work system framework and WSS provide an organized way for business professionals to think about a system within an organization, and how that system operates. The WSM analysis is designed to help business professionals (stakeholders) better understand the system and to think of the system in terms of the business processes being supported rather than as merely a computer software system. The two are intertwined and need to be considered together. This analysis can be performed at various levels of detail as discussed in Alter (2006).

3.4.2 Using WSM in Practice

The WSM has been developed in an academic context and as such has the potential to not be adopted effectively by practitioners. Also it is possible to use the WSM without consideration of the systems concepts even though the systems view is advocated (Madsen and Vidgen, 2009).

The WSM has been used with employed MBA executives and executive MBA students (Truex, Alter and Long, 2010). Students were required to complete a work

system analysis template, which included a WSS and service responsibility tables (Alter, 2008b). Although the students produced understandable and articulate reports on a work system that includes an IS, the following problems were identified (Truex, Alter and Long, 2010: 9, 10):

- "Difficulties in naming the work system": in half the papers submitted students did not name the work system, or used a general name that did not describe the work done.
- "Confusion about the definition of terms": There was confusion on who is a customer (one of the keys in the WSF), where students described anyone who received anything as a customer, ignoring the difference between customers and other stakeholders. Also confusion in that what the work system produced was not necessarily a product for a customer.
- "Lack of clarity about the desired use of service responsibility tables".
- "Non-attention to column headings".

Truex *et al.* (2010) go on to identify that most papers suggested incremental change to the work system. The students tended to focus on the steps in the WSS, and modifications to those steps rather than new "big picture" innovations. The implications of these findings are that with the pragmatic approach there tends to be a focus on the 'tool' first. The inability to "name the system" is a significant indicator that while the steps performed by the work system could be identified, there was a general inability to view the system as a whole. The students had a problem with the definition of terms particularly as to who the customer was. This is a significant factor that requires more in depth investigation. This is despite the fact that Alter tried to make this clear when he described the nine elements (Alter, 2011) of the work system framework, and in particular customers (who are recipients of a work system's products and services) and participants (who are people who perform work within the work system).

In a further paper that reports on the modification and use of the work systems analysis template by business professionals in the form of MBA and MSIS students, the development of the WSM was described in the form of a design science research

project (Truex *et al.*, 2012). This is now referred to as Work System Analysis Template #2 and the previous study as Work System Analysis Template #1. Following the guidelines for design science research (Hevner *et al.*, 2004), the problems identified in Template #1 are addressed mainly by supplying more pertinent information to the student e.g. a list of relevant work system names.

In analyzing Template #2, it was found that there was a clear correlation between the strength of the problem statement and the validity of the recommendations made, showing that the clarity of the problem statement is very significant in working towards a good result. Using a template was a significant tool in getting the students to think about the situation and to bring more clarity. Some students, however, mentioned that the use of a template was restrictive, and prevented creativity. Problems that still exist are clarity regarding the term 'customer' and a number of possible customer descriptions are highlighted, for example, "internal vs. external customer, the firm as a customer, self-service, and so on" (Truex *et al.*, 2012: 25). This leads to discussion on whether the work system should be considered as a service system or as a production system. There are a number of implications of the different views that need further investigation. The engagement between business professionals and IT developers is identified as not taking place very easily; "the relatively rare ability of some IT analysts to engage with business professionals while using these tools in no way implies that existing methods and tools for IT professionals fully addresses difficulties in collaboration between most business and IT professionals." (Truex *et al.*, 2012: 19.)

Work System Theory is described by its originator as an application of design theory, applying knowledge of systems in organizations, and making that knowledge usable (Alter, 2014). Work System Theory has also been reviewed and evaluated as an effective theory in the IS field, with questions being asked regarding its practical application in the field (Niederman and March, 2014). The authors note, however, that for business professionals, the concept of working with a work system often assists in bringing clarity to describing a business process.

Approaching the problem as a work system helps the business professional to look at the business process first, and then to consider the technical IT system within the business process work system (Alter, 2004a). This was found by Alter to improve the understanding of the function of the system by the business professional, and reduce the risk of focusing on the technical aspects only of a work system.

This ability to work effectively between the IT and business function has been identified as a very rare occurrence. "We use the term boundary spanner to highlight our belief that organizations need human individuals possessing the necessary cognitive and behavioural skills to bridge the communication gap to leverage the full potential of IT in organizations" (Eckhardt and Rosenkranz, 2010: 25). The authors go on to identify 25 characteristics that such an individual should have. It is however advocated here that working towards a framework that assists business professional will be more effective than simply identifying a key individual that is responsible for the interaction between business and IT.

3.4.3 Comparing WSM and SSM

The WSM was designed as a tool that supports systems thinking (Alter, 2011). Although this is the intention, the system thinking needs to be encouraged through discussion and communication. When the WSM is used as a template or tool (as discussed above) the possibilities for the richness in system thinking may be compromised. This has been identified by others with the observation that SSM (interpretive approach) does not mix with traditional systems analysis and design (pragmatic approach) as the two paradigms cannot be drawn together (Mingers and White, 2010).

Some comparisons between the WSM and SSM as applied to work systems have been drawn. It is argued that WSM and SSM contribute together towards solving problems identified in IS development (Petkova and Petkov, 2012). Using the WSM in combination with SSM has been proposed as a possible way forward in working towards the functional requirements for a system (Petkov *et al.*, 2012). Combining SSM with WSM can provide a tool that moves the initial SSM study towards the

more practical functional requirements of the system. Here the combination of WSM and SSM is discussed in terms of project contexts and the System of Systems Methodologies (SOSM) (Petkov *et al.*, 2013). It is advocated that when using WSM for a project context that is complex and pluralist, elements of SSM to supplement WSM should be used. Petkov *et al.* (2013) map WSM and SSM within project contexts but do not provide any detail regarding the specific tools and aspects of SSM that should be used in combination with WSM, although they do point towards the benefits and the need for this to be done when a problem is complex and pluralist.

On the theoretical level, from an epistemological point of view, WSM supports the interpretive paradigm. There is a need for an approach that will encompass all stakeholders and give them a voice. This would therefore support the emancipation of stakeholders. With the identification of all stakeholders, consideration of political and power issues also needs to take place. The WSM and SSM both support the interpretive paradigm but more than this is needed for complex systems. All stakeholders need to be effectively involved and a path forward that creates an opportunity for effective participation is needed. All stakeholders need to make a contribution.

The uses of the systems approach and the applicability to IS of SSM, CSH and WST have been reviewed. These methodologies were chosen after a consideration of a broad range of hard and soft systems thinking methodologies discussed in Jackson (2003) and elsewhere and on the basis of their relevance for IS. Each of them has an area of typical applications, strengths and limitations. The complexity of complex IS development projects requires more than one approach if we want to utilize those strengths. There is therefore a need to mix methods so as to support systems thinking, and so that the problems and their interactions within a single project will emerge. The mix of methods needs to be designed to include elements that support each of the four paradigms. This requires investigation into the mixing of methods and how this should be done.

3.5 Mixing methods in an IS development project

3.5.1 Motivation for mixing methods

Information system development is a diverse field in which many different approaches have been used. This is illustrated by the four different paradigms of IS development that were identified in the literature by Hirschheim and Klein (1989):

- The analyst as systems expert;
- The analyst as facilitator;
- The analyst as labour partisan; and
- The analyst as emancipator or social therapist.

These different paradigms for IS development were identified according to the nature of the assumptions about knowledge and how to generate knowledge or the ontological and epistemological standpoints. These four different paradigms demonstrate how the field of IS is complex and that there are a number of different approaches used in practice. Each different approach is based on assumptions made that dictate the approach to the problem. This complexity needs to be dealt with in a holistic way that uses more than one method.

A holistic approach is described by Jackson (2003) in his book Systems thinking: creative holism for managers. Although the book is written for managers, any system that is managed will in most cases also involve an IS in some way. Jackson highlights that a manager's approach to a situation is dictated by past experience and assumptions made regarding the problem situation. An awareness of these locked in ideas and assumptions is likely to bring more diverse thinking and encourages approaching the problem from different perspectives. The combination of different approaches in working with a problem situation is the holism that Jackson refers to. The common factor of all the methods reviewed by Jackson is systems thinking, which is applied in some way.

Jackson presents different systems approaches and provides critique discussing the strengths and weaknesses of each approach. It is these differences in each approach that gives rise to the call for using the different approaches in combination. To

achieve this combination Jackson discusses two approaches: Total Systems Intervention (TSI) and Critical Systems Practice (CSP). Both of these approaches are based on the philosophy and theory of Critical Systems Thinking (CST). Critical Systems Thinking is discussed below in terms of CST being a basis for the mixing of methods.

3.5.2 Critical Systems Thinking

Critical systems thinking emerged in the 1990's. Jackson (1992) described CST as a development from systems thinking. He goes on to describe CST in IS as supporting five pillars (Jackson, 1992: 83-84):

- Critical awareness;
- Social awareness;
- Complementarism at the methodological level;
- Complementarism at the theoretical level; and
- Dedication to human well-being and emancipation.

Therefore, according to Jackson, CST requires the combination of available systems methods, with an understanding of the strengths and weaknesses of each approach (critical awareness). This should be done within the 'social awareness' of those affected. The methodological and theoretical awareness relates to the knowledge of the systemic approaches used. Throughout CST is "dedicated to human emancipation and seeks to achieve for all individuals the maximum development of their potential" (Jackson, 1992: 91). Critical systems thinking can therefore be used to allocate different systems methodologies according to different tasks that need to be performed; the methodologies need to serve technical, practical and emancipatory considerations.

According to Ulrich, CST was developed along two strands: Critical Systems Heuristics (CSH) and Total Systems Intervention (TSI) (Ulrich, 2003; Ulrich, 2012). Critical Systems Heuristics is a framework for the implementation of systems thinking and boundary judgment proposed in 1983 by Ulrich, and can therefore be considered "the first systematic attempt at providing both philosophical foundation

and a practical framework for CST" (Ulrich, 2003: 327). Critical Systems Heuristics was discussed in the previous sections and does not support the mix of methods in a systemic intervention and hence the need to investigate further the CST strand as advocated by Jackson.

Total Systems Intervention (TSI) is the second strand of CST as described by Flood and Jackson (1991) and Jackson (2003), and also referred to in its present form as CSP and also as creative holism (Jackson, 2003; Ulrich, 2012). Total systems intervention is considered a metamethodology that calls for the use in combination of different systems methodologies and methods according to the type of problem to be solved (Jackson, 2006). Total systems intervention proposes that a problem cannot be analyzed from one perspective, but multiple views or perspectives of a problem need to be looked at. Different methodologies can be used to gain insight into each of the different perspectives of the same problem. The sequential application of whole methodologies is referred to as TSI version 1. The type of problem or problem context can be placed within the SOSM grid (see Jackson, 2003) and that is then used to select a suitable methodology or additional methodology that will be used in sequence after the first one. The critical systems approach allows for the use of different methodologies in relation to the same problem.

Jackson (2006) suggests that the difficulties associated with the use of different methodologies is reduced if a dominant methodology is used to run an intervention, with alternate methodologies being used in the background reflecting alternative paradigms. Criticisms of TSI version 1, however, relate to:

- Using only whole methodologies whose use in the intervention is guided at a meta-level; and
- The methodology used is required to be used in its entirety, exactly as specified by that methodology.

These criticisms point to a lack of flexibility (Jackson, 2006), and led to further work on mixing of methods in a systemic intervention.

The next two subsections will discuss briefly the main existing approaches for mixing parts of methodologies in one intervention.

3.5.3 Multimethodology

Multimethodology was suggested by Mingers around 1997 (see Mingers, 2001) and is one way for mixing methods from different methodologies in the same intervention and is described as being applicable to complex problems. This has also been described as a pluralist approach to systems research and to IS research (Mingers, 2001) where it is proposed that richer results will be the obtained by combining different research methods from different paradigms. Multimethodology therefore recognizes the value in combining different methods. The arguments presented by Mingers (2001: 243) in support of multimethodology in information system research are:

i. "Loose pluralism, holding that the IS discipline as a whole should support and encourage a variety of research paradigms and methods within it, but should not specify when or how they be used.
ii. "Complementarism, where different paradigms are viewed as internally consistent, and based on different assumptions about their context of use, such that each paradigm would be seen as more or less appropriate for a particular research situation.
iii. "Strong pluralism, where all research situations are seen as inherently complex and multidimensional, and would thus benefit from a range of methods".

Mingers and White (2010) go on to discuss many different multimethodology approaches in terms of different application areas.

With regard to any complex problem there are three dimensions of importance: the material world, the social world, and the personal world as defined originally by Habermas (1984) and used by Mingers (2001) for justifying what methods to use for specific purposes. Mingers (2010: 3389) describes each of these dimensions as follows:

> There will be aspects that are relatively hard and observer-independent, particularly material and physical processes, which we can observe and model. There will be aspects that are socially constituted, dependent on

particular cultures, social practices, languages, and power structures, which we must come to share and participate in. Finally, there will be aspects that are individual, such as beliefs, values, fears, and emotions, which we must try to express and understand.

It is this dichotomy that brings complexity. In order to address the three dimensions, multimethodology needs to be applied. As discussed by Mingers (2001) multimethodology is philosophically based on Critical Realism. This distinguishes it from the next two approaches to mixing methods that are based on Critical Social Theory.

3.5.4 The process of systemic intervention as implemented in Midgley's Creative Design of Methods

Midgley provides a comprehensive review of the philosophy, methodology and practice of systemic intervention (Midgley, 2000). He investigates the philosophy that underpins systemic intervention and clearly demonstrates that the need for pluralism is evidenced in what it means to be systemic. He suggests that a systemic intervention is characterized by three things (Midgley, 2000: 129-130):

- Critically reflect on boundary choices. The choices need to be considered from different points of view, with some understanding of the ethics involved in the choices, and the ethical consequences of the choices made.
- Make judgment choices between theories and methods to guide action. Here Midgley supports both theoretical and methodological pluralism. These choices are directly affected by the boundary judgments in the first point.
- Be explicit about taking action for improvement. This should be localized to the area of study in terms that are understood by those involved.

Systemic intervention, therefore, is purposeful action to create change for improvement. The three elements in his process of systemic intervention are: boundary critique, judgment on theories and methods to use and action. They all interrelate and influence each other and are discussed further below.

Midgley develops his own method of boundary critique. He also reviews CSH as proposed by Ulrich. For Midgley the choice of boundaries usually involves some form of conflict and it is the resolution of this conflict that is most important. Whether you use boundary critique or CSH, he asks the question: When consensus was reached was it through coercion or negotiation and understanding? Coercion implies that issues of politics and power were involved, and therefore this will not be an accurate reflection of what the problem could be. Midgley (2000: 209) suggests using CSH in two modes to avoid coercion; "mode one involves value clarification within a stakeholder group" and mode two "comes into operation when stakeholders can work together to generate answers to the CSH questions that transcend the narrowly defined interests of any one group". Where the boundaries lie will also influence the choice of methods.

In the second step it is necessary to make judgment choices between theories and methods to guide action. Midgley proposed the approach be called the creative design of methods. He is careful to state that the creative design of methods provides one strategy (there are others) for choosing and mixing methods in an intervention. Here Midgley supports both theoretical and methodological pluralism. The initial step is to understand the situation in which you wish to intervene. For each purpose in the intervention, choose a method or part of a method that will best address the purpose described. Emphasis is placed on emergence over time and also different levels of analysis (depth). The creative design of methods is based on choices made during the intervention, which does not apply for this framework. In this study the choices of the methodologies used is based on a general problem and the choices are made before the intervention in a specific real-world problem begins. The guidelines and reasons for both theoretical and methodological pluralism are however valid for this framework.

The last phase of systemic intervention, taking action, will be evidenced in application of the framework to a field study where the framework is implemented through a series of workshops. The action affects the real-world problem, and reflects back on the validity of the choices made in the drawing together of the framework.

A further approach for drawing together methods and methodologies, supporting both methodological and theoretical pluralism, is proposed in Critical Systems Practice (CSP) discussed in the following section.

3.5.5 Critical Systems Practice for mixing methods

Jackson (2003, 2006) extends Total Systems Intervention to Creative Holism which is described as a critical systems approach for complex problem situations. The present operational version of Creative Holism is also called Critical Systems Practice (Jackson, 2003). The three commitments of CSP are critical awareness, pluralism and improvement. Critical Systems Practice can also be used in justifying the mixing of methods from different methodologies in the same intervention like the previous two approaches.

Critical Systems Practice is a metamethodology developed as an extension from CST and multimethodology (Jackson, 2003). Jackson explains how the five commitments in CST are reduced to three in CSP. Critical awareness includes social awareness. Critical awareness incorporates critiquing and considering the theoretical underpinnings of different system methods as well as consideration of social factors such as cultural, political and personal constraints and how this impacts on the problem. Improvement includes both methodological and theoretical pluralism. The purpose, therefore, of CSP is to "protect paradigm diversity and encourage critique between the paradigms" (Jackson, 2003: 306). The different theoretical and methodological paradigms with their different purposes are recognized and used in combination.

The CST dedication to human well-being and emancipation cannot be fully realized in a single problem. In CSP the focus is more on bringing about improvement. This improvement will be of a social and political nature (see the first commitment), and will affect those involved with the problem.

Critical Systems Practice is described as having four phases; the first three are creativity, choice and implementation. The fourth phase is reflection and learning within the context of a real-world intervention. Critical Systems Practice suggests

that the perspectives of the four paradigms (functionalist, interpretive, emancipatory and post modernism) should be used in the creativity phase to bring the broadest possible critical view of the problem situation, with the aim to bring focus to what is most important at the time (Jackson, 2010). With this in mind, when a methodology is employed this must be within the perspective of the theoretical background of the paradigm that the methodology supports. The reflection phase should reflect on whether the conclusions drawn from the different paradigms were reflected in the real-world intervention. Critical Systems Practice should also realize research findings regarding the management of the relationships between different paradigms, the philosophy, the methods and methodologies used (Jackson, 2010). Critical Systems Practice is designed as an action research approach in that it should "contribute both to research and to improving real-world problem situations" (Jackson, 2003: 307).

Given the nature of the problem under consideration in this research, it is CSP which will be used in drawing together a framework for client understanding of requirements. The framework for improved understanding of user requirements by clients will be designed to bring about a holistic understanding of the problem, from many divergent perspectives and therefore a clearer understanding of requirements.

This research on clients' participation for improved understanding of project requirements specifically will involve a mix of methods from different paradigms to better serve the complexity of a project situation. It can be labelled also as strong pluralism in terms of the classification provided by Mingers as was mentioned above.

It was decided that CSP will be used in justifying the methods included in a framework for client understanding of requirements because it is the newest and least researched approach to mixing methods in the same intervention. The three ways for mixing methods that were discussed above each have some advantages or disadvantages and, according to Jackson (2006), only evidence from practice will show which is better.

The support for pluralism in CSP will allow for the combination of methods from methodologies from the emancipatory, interpretive and pragmatic paradigms. The systems methodologies are Critical Systems Heuristics, Soft Systems Methodology and Work System Method respectively. This is necessary in order to address the social, political and power issues associated with IS as well as to consider the different views that different stakeholder groups may have.

3.6 Conclusion

This chapter includes a review of systems thinking research applicable to the problem of user participation and understanding of requirements. This started with a brief review of the uses of the systems approach and the reason why the systems approach is applicable to IS studies. The need to apply the systems approach more effectively in IS research and in application to real-world problems was demonstrated from the literature analysis in Chapters 2 and 3. The strands of systems thinking referred to as 'hard' and soft' were described and the role of the IS development context was underlined as a factor for understanding project complexity. Soft Systems Methodology (Checkland and Scholes, 1990; Checkland, 1999) was investigated regarding its relevance to the problem. However, SSM relies on the expertise of those involved and is not explicit in the process of discovering all stakeholders and identifying political and power issues. Critical Systems Heuristics is reviewed as a possible methodology to be included in the proposed framework to assist with determining boundaries for the problem. Both SSM and CSH support systems thinking about identification of the structure in the software project context, the relevant stakeholders and only partially about processes and information flows. The latter two aspects are better analysed through the WSM which was investigated next. The WSM method brings attention to the work system first and then the IT system as it functions within the work system. Combining WSM with SSM will assist in ensuring that the strengths of each of them are applied to project contexts that are either unitary or pluralist with respect to the interests of the stakeholders involved.

In this chapter, care has been taken to identify the possible benefits of using methods from each methodology as well as the possible weaknesses. The next step is to look at ways in which the mixing of methods can be implemented within the scope of IS development projects, with the aim of identifying the way in which the mixing should be done for this project. The diversity in IS project contexts and the strengths of specific systemic methodologies for given contexts is a key motivation for mixing methods, in order to draw upon as many different perspectives as possible. Critical Systems Practice is presented as a way for mixing methods in an intervention that supports the combination of methods from methodologies from various paradigms, with an understanding of their different strengths and weaknesses (Jackson, 2003). The application of CSP in drawing together the framework for improved client understanding of requirements is illustrated in the next chapter.

Chapter 4: A Framework for Improved Understanding of Requirements by Clients in Information Systems Development

4.1 The objectives of a framework for requirements understanding

A framework is a set of ideas or thoughts that when applied to a problem, will assist in bringing clarity in some way, and can be considered as a meta model for assisting methodology users (Jayaratna, 1994). A framework is designed with a specific purpose and is often depicted in a graphic that shows implications of related concepts. Often this is a 'new' relationship that has not before been clearly described (or a number of 'new' relationships). The framework is also supported by theory and will have an expected outcome (or a measured outcome). In this research the framework is designed to bring individuals into a clearer understanding of requirements, when the framework is applied to an area of concern. These three components, the framework, area of application and methodology are components in the action research strand advocated by Checkland (see Hindle *et al.*, 1995).

The framework for improved understanding of requirements by clients in systems development therefore needs to be supported by theory, and include methods with the expected outcome of improved understanding of requirements by clients. The framework also needs to generate collaboration (Alter, 2009b) and rich participation (Markus and Mao, 2004) and therefore take into account the following guidelines as highlighted by Markus and Mao (2004: 536):

- Choose analysis techniques that are appropriate for users with non-specialist IT knowledge.
- Choose analysis techniques that capture socio-technical requirements in addition to functional requirements.
- Change agents should use a 'facilitation' approach rather than a 'technical expert' approach to participation.

It has been established (see Chapter 2) that there are a number of problems associated with clients' understanding of requirements. The objectives for the framework are designed to address the issues identified.

The objectives for this framework are as follows:

- The framework should be applicable to all six project contexts as defined by Alter and Browne (2005) and especially the last one "SA & D for organizational change or reengineering that brings the most direct focus on work practices" as these are the most difficult and wicked types of problems.
- The framework should promote project collaboration between clients and developers (Alter, 2009b).
- The framework needs to provide clear guidance on who the participants are (as broad as possible identification of, and consultation with stakeholders), as well as provide for quality participation, where the stakeholders see the value associated with their participation.
- The consideration of different and conflicting views of stakeholders regarding the ISD project needs to be facilitated.
- The requirements are therefore not only the technical IT requirements but also considerations of possible changes to the work practices (involving both social and technical implications). This incorporates the ensemble view of the IT artifact (Orlikowski and Iacono, 2001), embedded within a complex social environment and encompasses the interactions between the technology and the people using the technology, as well as the social and cultural perspectives of the people concerned.
- Possible changes in work practice should be considered. Those actions that support the ISD project, and its ongoing implementation need to be considered as part of the problem (Markus and Mao, 2004; Alter, 2009b).

Thus, the framework is designed with these objectives in mind. In this case, the project context that is assumed to exist is:

- A wicked problem, the problem itself is not clear therefore the requirements need to be constructed through a social and technological lens.
- Multiple groups of stakeholders exist, some of which may be affected but are not necessarily involved.
- The problem includes aspects related to building an IS.
- The problem includes a possible change in business practice.

This differentiation between the technological artifact of an IS being considered on its own without consideration of the social context has led to many problems. The approach to ISD projects has tended towards the tool view where an IS can be engineered and then implemented. By not considering the context within which the IS is to be used leads to the problem of conflict. Lack of acceptance and lack of effective use of the IS is often the result. For the effective adoption of the IS a social context needs to be developed within which the IS is understood, accepted and adopted into use. This tension between the technological requirements for an IS and the social context within which the IS is to be used is a complex problem. Understanding of the problem therefore emerges as a result of interaction between stakeholders. One view of an IT artifact has been referred to as the ensemble view where understanding needs to be generated between the technological and social aspects of an IS and where the two have a reciprocal relationship and keep on influencing each other as knowledge is gained (Orlikowski and Iacono, 2001). It is motivated here that this complex problem will require a mixing of different methods in order to bring understanding to the complex whole, an ensemble IT artifact that includes both the technology and the social view.

The framework will address the nature of the problem regarding understanding of requirements that are applicable in the very initial stages of a software development project. This framework will be generated using the guidelines on the process of systemic intervention derived by Petkov *et al.* (2008b), as follows:

- Understand the theoretical underpinnings of the methodologies that are applied.
- Choose appropriate methods for the interventions on the basis of how they support different viewpoints of stakeholders.
- Consider the justifications and criticisms of each method and use those in mixing and joining different methods together.
- Choose a suitable process for the intervention.
- In the implementation keep explanation of concepts as simple as possible.

4.2 Consideration of applying Design Science and Action Research

This section will investigate issues related to Design Science in IS (see Hevner *et al.*, 2004) and Action Research and existing ideas on the process of conducting design science research. In their seminal paper on design science in IS, Hevner *et al.* (2004) describe how the behavioural science paradigm "seeks to develop and verify theories that explain or predict human or organizational behaviour" whereas the design science paradigm "seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts" (Hevner *et al.*, 2004: 75). They describe design science research as following from behavioural science research. Some examples of the theories that apply to IS research that fall within behavioural science and describe behaviour with respect to an IT artifacts use are: intention to use, perceived usefulness, net benefits, service, and information quality (DeLone and McLean, 1992; DeLone, 2003). Design science continues from these theories to design artifacts to solve information system related problems. The artifact is described as a broad spectrum that includes software, frameworks, formal logic, and mathematical proofs to descriptions in natural language. The process of constructing a new and innovative artifact will require a clear understanding of the problem, the feasibility of the approach, and the effectiveness of the solution. Design science (where design is both a noun and a verb) therefore includes both process and product.

A well-known process of Design Science as described by Peffers *et al.* (2007) includes the following six steps:

- Problem identification and motivation.
- Definition of the objectives for the solution.
- Design and development of solution.
- Demonstration.
- Evaluation.
- Communication.

This process shows how design science is often presented as a set of sequential steps. Even if there is some cycling between the steps as learning takes place, the focus still

remains on the design of the artifact and therefore emphasizes the technological view or tool view of the artifact. The separation of building from evaluation is described as the problem of sequencing and separation that exist in design science research (Sein *et al.*, 2011). This separation tends towards ignoring the interplay between the planned design and the context that is so important for the ensemble artifact.

In this study, it is the context of the ISD project that is significant. In describing this context, the framework for client understanding of requirements for ISD projects is designed for projects within a complex organizational context. It is the context that brings the complexity that impacts on the ISD project. The framework is designed to facilitate learning in this area of complexity. As such, a methodological approach that encompasses learning and the emergence of understanding of requirements through interaction within organizational elements that encompass the ISD needs to be considered. Hence the process as suggested by Peffers *et al.* (2007) is not very suitable.

Design science is also often linked to theory building. Gregory (2011) and Winter (2008) go as far as to break design science research into two parts where 'design research' deals with the creation of an IT artifact and 'design science' is about generating theoretical insights. The successful design of an artifact has supporting theory in the design, this theory therefore becomes part of the theory base for IS research. This can be seen in a design theory that supports emergent knowledge processes (Markus, Majchrzak and Gasser, 2002), where the theory supports the emergent knowledge process when wicked problems exist and knowledge emerges as a process of interaction. The relationship between design science and theory building is described by Walls, Widmeyer and El Sawy (2004). Design theory has the purpose of guiding artifact creation. Gregory (2011) however compares design science research (DSR) with grounded theory method and warns that the differences in research strategy need to be carefully considered. The categories used for the comparison are: theory focus, research process, research goal, nature of research, epistemology and research outcome. The way in which theory is developed in a design science research project is also presented by Kuechler and Vaishnavi (2008). In their research the focus is on the artifact, a framework for understanding client

requirements in a complex project. Their study therefore follows the strand of design science research that deals with the creation of an artifact; in this case the artifact is a framework for better understanding of client requirements in software projects.

Although DSR involves a learning cycle, how the learning takes place within DSR has been described in a number of ways. One way in which the learning cycle is described is that the learning takes place through action research. Since a number of authors have pointed to the similarities between design science and action research, it is appropriate to discuss some aspects of action research.

The application of action research to the field of IS has been investigated over a number of years prior to the description of design science as provided by Hevner *et al.* (2004). Action research initially was not applied to many IS projects (in the 1980's and early 1990's) even although it was a primary methodology for organizational development or change within organizations (Baskerville and Wood-Harper, 1996). These authors called for the use of action research in complex IS projects, in order to create learning. Action research calls for close collaboration between the researchers and practitioners, as they work towards a common goal. Baskerville and Wood-Harper (1996: 239) posit three distinctive characteristics of action research:

1) "The researcher is actively involved, with expected benefit for both researcher and organization.
2) "The knowledge obtained can be immediately applied. There is not the sense of the detached observer, but that of an active participant wishing to utilize any new knowledge based on an explicit, clear conceptual framework.
3) "The research is a cyclical process linking theory and practice".

They motivate that action research is therefore applicable for learning within the field of IS.

In a later paper, Baskerville and Wood-Harper (1998) describe different types of action research within the field of IS. The development of action research is described as progressing through four generations, characterized as: origins, disputes, fragmentation, and diffusion. The fourth generation of diffusion describes

how various forms of action research are applied according to the research purpose. The forms of action research identified within IS are: iterative IS action research, canonical action research, SSM and, lastly, prototyping. They conclude by describing the need for action research within the IS paradigm, the importance of selecting an appropriate form of action research and the need for declaring an explicit methodology in advance.

Further clear guidelines for using action research for investigating IS are presented in Baskerville (1999). The distinction between facilitating an action research study and acting as an external consultant for an IS project is discussed. In essence the difference lies in allowing the problem to emerge as a participatory process (action research) rather than as the opinion of an expert (external consultant).

The learning takes place within the organization, as a result of action, given the following descriptions: "Action Research aims at organizational action to create change in order to discover new knowledge in a clinical mode" (Baskerville, Pries-Heje and Venable, 2009: 2), and "action research applies intervention to address a problem of a specific client while at the same time contributing to academic knowledge" (Conboy, Fitzgerald and Mathiassen, 2012: 114). In both these descriptions there is consensus that knowledge is generated as a result of an action research study.

The principles of emergence and participation (facilitation) in action research are further underscored by Reason and Bradbury with their working definition of action research as:

> action research is a participatory process concerned with developing practical knowing in the pursuit of worthwhile human purposes. It seeks to bring together action and reflection, theory and practice, in participation with others, in pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities. (Reason and Bradbury, 2008: 4)

They further describe five interdependent characteristics of action research: human flourishing, practical issues, knowledge in action, participation and democracy, emergent developmental form. The first four characteristics interact to generate the emergent developmental form. This is "a living, emergent process that cannot be pre-determined but changes and develops as those engaged deepen their understanding of the issues to be addressed and develop their capacity as co-inquirers both individually and collectively" (Reason and Bradbury, 2008: 4). This emergent, dynamic characteristic of action research describes what has been pointed to as needed in the ensemble view of IS. An IS is essentially a technology tool but for it to be effective within the environment within which it is used, there are many social factors that need to be taken into consideration. The IS tool needs to be seen through different social lenses, the common understanding of the problem will therefore be an emergent process that will keep on changing as more understanding is gained. Action Research which facilitates different social lenses has also been specifically applied to the field of information technology in various studies.

When embarking on action research, a relationship between action and learning (research) takes place. The recording and understanding of this relationship can later be translated into theory as stated by Baskerville (1999: 19) "Action should continue until the immediate problem situation is relieved. Actions that relieve an immediate problem setting are powerful evidence of the practical effectiveness of an underlying theory". The action researcher therefore needs to identify the underlying theory which supports relief in the problem situation.

The relationship between action and learning has resulted in authors bringing together methods that support a learning cycle and design science. This has been described in various ways, the most well-known of which are soft design science and action design which will be discussed next.

4.3 Soft Design Science and Action Design

Soft design science methodology suggested in Baskerville, Pries-Heje and Venable (2009) proposes using action research and SSM in combination with design science. They argue that both design science and action research "generate scientific

knowledge by intentionally modifying a real setting and by carefully evaluating the result" (Baskerville, Pries-Heje and Venable, 2009: 3).

Soft design science incorporates thinking from SSM, action research and design science. One of the first distinctions made is that the focus of action research is action to bring about change, whereas the focus of design science is to create an artifact. Although these appear to be separate foci in that they focus on different things, the design science artifact will encompass change of some kind if it solves a problem and therefore we can see the similarity between the two. Soft Systems Methodology is then included as an approach to design science research as motivated by Baskerville, Pries-Heje and Venable (2009: 4) where "the study subject includes research into the interaction between an artifact and a social system". Using SSM opens a way forward to study the artifact in relation to the social system, and to evaluate the artifact within the social system. "The advantage of SSM is its ability to study the artifact in relation to the social system into which the artifact is inserted and evaluated" (Baskerville, Pries-Heje and Venable, 2009: 4). In this case the artifact that will be applied is the framework for improved understanding of requirements by clients. The soft design science research methodology has seven activities (Baskerville, Pries-Heje and Venable, 2009: 5) which are:

- A specific problem is identified and delineated.
- This problem must then be expressed as a specific set of requirements.
- The requirements for the specific problem are systemically abstracted and translated into a general problem with both technical and social dimensions. Here the design thinking is about a class of problems rather than the specific problem owned by the client.
- A general solution design (a class of solutions) for the general problem is derived through systems thinking and expressed in terms of general requirements. This activity involves a combination of design science techniques, such as the search for general components of the solution together with expression using imperative logic.

- The general design requirements are compared with the specific problem for fit. In this activity the specific problem is re-articulated in terms of the general requirements and the imperative logic.
- A declarative search is then made for the specific components that will provide a workable instance of a solution to the general requirements. The declarative search is made necessary by difficulties in operating imperative logic.

These seven activities in soft design science start with a specific real-world problem. However, the assumption that the problem can be expressed with a specific set of requirements is not true for more complex problems like those for which this framework is designed to be applied. The seven steps proposed in soft design science do not include evidence for considering a specified learning cycle regarding the problem, and focus mainly on defining requirements that fit the problem. The defined problem is taken as an existing starting point for the IT artifact – the resulting information system. This contradicts the requirement for the desired framework for understanding client requirements defined earlier in the chapter. The framework should address projects where the project context of SA&D for organizational change or reengineering that brings the most direct focus on work practices (see Alter and Browne, 2005) and does not imply that the original problem is well defined and known at the start of the project. Soft design science is therefore not suited to this study as it aims to propose a framework for requirements elicitation of wicked problems. Hence, another method combining action research and design science referred to as action design will be investigated further as possibly being more applicable to this study.

Action Design has been described as an approach that merges action research and design science (Sein *et al.*, 2011). Action design gives consideration to the interactions that need to take place to ensure that the IT artifact meets the unique needs identified. The combination of action research and design science is described as action design research (ADR) (Sein *et al.*, 2011). This methodology is specifically described as being for the study of the ensemble view of the IT artifact (following Orlikowski and Iacono, 2001). This underlines the importance of systems thinking in

Action Design Research as it supports best the ensemble view of the artifact defined by Orlikowski and Iacono.

There is ongoing debate regarding the similarities and differences that exist between design science and action research (Papas, O'Keefe and Seltsikas, 2012). The design science / action research debate is more concerned with using action research in the design of an artifact (Papas, O'Keefe and Seltsikas, 2012), where the artifact solves a specific client problem. In this study the framework for understanding is justified (using CSP) to solve the general problem of requirements understanding for an ISD project. Following the process of ADR, the framework for understanding will then be built and applied to a specific area of concern, where a specific real-world problem that includes an IS requires clearer understanding of requirements. An action cycle will be used during the application of the framework to facilitate the emergence of understanding of the problem. The effectiveness of the framework in facilitating the emergence of understanding will then be evaluated.

It is interesting to compare the four stages of ADR (Sein *et al.*, 2011) with the four phases of CSP. The similarities and differences between CSP and ADR are shown in Table 5 and discussed below.

The first stage in ADR is about problem formulation with hints at systems ideas but there are few specifics on how the problems are formulated in ADR. Hence, ADR may benefit from the experience and existing body of knowledge in CSP (or any of the other methodologies for mixing methods in a systemic intervention as discussed in Chapter 3). The second and third stages in CSP are combined in one phase in ADR which has also an added element of evaluation. The third phase of ADR stresses reflection and learning while learning is inherent in the fourth phase of CSP; thus there is an overlap between the third phase in ADR and the fourth phase of CSP. The next phase in ADR is about formalization of learning, an issue that has been neglected in CSP probably due to the complexities associated with it when dealing with unique complex systems problems which are rarely similar. This might, however, be one of the greatest challenges for systems science and hence CSP might benefit from exploring formalization of learning. It can be concluded that essentially

ADR is a practical elaboration of the ideas articulated in CSP, extending it with activities in the fourth stage that have significance for the improvement of the practice of IS development.

Table 5: Comparing 4 stages of Action Design Research Method with the four phases of Critical Systems Practice

CSP phases[a] **Used in *creating* (alpha version) and possible modifications to the framework (beta version)**	**ADR Method**[b] **Used in the *implementation* of the framework**
1. Creativity	1. Problem formulation
2. Choice	2. Building, intervention, and evaluation
3. Implementation *Note that in this project ADR method is applied here steps 1 to 4 in a cycle of learning – generating the beta version of the framework. (there may be a number of incremental changes)*	3. Reflection and learning
4. Reflection	4. Formalization of learning

[a] Source: Jackson (2003)
[b] Source: Sein *et al.* (2011)

The alignment of the description of ADR and the objectives of the framework to be designed in this study can clearly be seen in the following comment from the major theorists in this area (Sein *et al.* [2011: 53] italics in original text): "ADR reaches into the very core of IS: *designing* IT artifacts while allowing for their *emergence* in an organizational context, and seeking utility in the *ensemble* they represent". Emergence occurs through the process of iterations of the learning cycle; the understanding of the problem situation emerges as a result of applying the framework. The stages and principles of ADR facilitate the learning that needs to take place in the implementation of the framework. This fits well with the systems thinking approach, supported by Critical Systems Practice. Action design provides good support for the mixing of methods in an intervention according to Papas, O'Keefe and Seltsikas (2012). Action design also supports a learning cycle rather than a linear process, and supports the grounding of the design in theory which is aligned with the principle of critical awareness in CSP. This therefore fits well with the need to develop a systemic framework for the problem with which this research is concerned. For these reasons ADR (Sein *et al.*, 2011) enriched with ideas from

CSP will be followed as the practical process at the core of the proposed framework for requirements understanding in this study.

4.4 On the process of applying Action Design Research in the development of the framework for requirements understanding

The ADR methodology (Sein *et al.*, 2011: 41) has four stages and is supported by seven principles that apply to different stages as depicted in Table 6. The first three stages, although listed in a linear fashion below, are repeated within a learning cycle. This cycle ends when there is evidence of stability and no significant new learning.

For the framework for improved understanding of requirements for ISD projects, the problem identification and motivation relates to a general problem of requirements understanding. The complexity of this problem and the factors identified as lacking in existing methods of identifying requirements for ISD projects have been drawn from the literature. Complex problem situations are identified as concerning the social nature of IS requirements and also the integration of IS into the work systems within an organization and the changes that are invoked in the work system as a result of the IS implementation (see the last two types of project contexts defined by Alter and Browne (2005). The social acceptance of an IS by those required to use it and the integration into the business process are identified as a key requirement that the framework is aimed to cause to emerge. This is the first stage in the ADR method of problem formulation and applies the principles of practice-inspired research.

Table 6: Action Design Research (ADR) method: stages and principles

	ADR Stages (1-4)	**ADR Principles (1-7)**
Cycle repeating stages 1 to 3 as they reflect on each other	1. Problem Formulation	1. Practice-Inspired research
		2. Theory-Ingrained Artifact
	2. Building, Intervention, and Evaluation	3. Reciprocal Shaping
		4. Mutually Influential Roles
		5. Authentic and Concurrent Evaluation
	3. Reflection and Learning	6. Guided Emergence
	4. Formalization of Learning	7. Generalized Outcomes

Source: Sein *et al.* (2011)

The factors that will directly influence the success of a project include:

- Consensus regarding requirements (or rather accommodation);
- A common understanding; and
- Acceptance of requirements and consideration of the larger whole rather than separate social and technical systems.

This is essentially design and evaluation research as described by Conboy, Fitzgerald and Mathiassen (2012: 114): "design and evaluation research focuses on normative knowledge related to design and evaluation of policies, systems, and models for solving practical problems within a profession". Systemic thinking is used in creating a framework that addresses the practical problem of client understanding of requirements for an ISD project in order to capture better its multifaceted dimensions.

The second principle of stage one (problem formulation) in ADR is producing a theory-ingrained artifact. This is completed in the design and development of the framework that is drawn together using different methods from existing methodologies, with consideration of their possible contributions to the framework. The theories associated with each methodology from which methods are selected are presented. In the current study, the theory supporting the drawing together of the framework from the point of view of systemic thinking has been examined and presented in the previous chapter. Critical Systems Practice is the metamethodology used in choosing the methods and the justification of their use as a combination. The framework for understanding of requirements for ISD projects is therefore drawn together using CSP with consideration of the existing theory within each methodology. This therefore completes the first stage in ADR which is then followed by the building and the implementation of the framework in a real-world problem.

Stage two in ADR is described as building, intervention and evaluation given the acronym BIE (Sein *et al.*, 2011). They further describe two types of artifact:

- IT-dominant BIE; and
- Organization-dominant BIE

In this study the theory ingrained artifact is the framework as presented in section 4.5.1.2 in this chapter. In this study the framework is developed for project contexts characterized with significant changes in the work system and the application of the framework might be categorized as organization-dominant BIE. During the iterations "the ADR team challenges organizational participants' existing ideas and assumptions about the artifact's specific use context in order to create and improve the design. Each iteration ends with an assessment of the artifact and design principles that it represents" (Sein *et al.*, 2011: 42). This stage will take place in applying the framework to a real-world problem (as opposed to a scenario or laboratory simulated problem). The principles of reciprocal shaping, mutually influential roles and authentic and concurrent evaluation as described by Sein *et al.* (2011: 43) are as follows:

- "**Reciprocal Shaping**. This principle emphasizes the inseparable influences mutually exerted by the two domains: the IT artifact and the organizational context. The ADR team may engage in recursive cycles of decisions at finer levels of detail in each domain.
- "**Mutually Influential Roles**. This principle points to the importance of mutual learning among the different project participants. Action design researchers bring their knowledge of theory and technological advances, while the practitioners bring practical hypothesis and knowledge of organizational work practices.
- "**Authentic and Concurrent Evaluation**. This principle emphasizes a key characteristic of ADR: evaluation is *not* a separate stage of the research process that follows building... decisions about designing shaping, and reshaping the ensemble artifact and intervening in organizational work practices should be interwoven with ongoing evaluation, although their specific format may vary based on the BIE form."

Reciprocal shaping is facilitated through the application of the framework, as the influences between the contexts of the ISD project and the social aspects including affected business processes shape each other. To facilitate reciprocal shaping, the people involved need to learn from each other; mutual learning is important so there

needs to be an atmosphere of learning and mutual respect with cognisance of what each person brings in order to facilitate mutual learning. The design of the framework facilitates reciprocal shaping and mutual learning with the attention paid to those involved, ensuring that the problem is looked at from different paradigms, with the mixing of methods. Throughout this process the ADR method emphasizes authentic and concurrent evaluation. This is facilitated in using ADR in the implementation of the framework. As has been established for this framework there needs to be a learning together, consideration of different possible views of the problem, and the emergence of the most acceptable view of the problem that is agreed upon by a broad group of stakeholders. This clearly reflects the cycling process through the above three principles, and shows how ADR aligns with the purpose of this framework.

Stage three is reflection and learning which moves conceptually from the focus on a specific real-world problem to which the framework has been applied to apply the learning to a broader class of problems and reflect on the use of the framework within the context of an ensemble artifact. According to Sein *et al.* (2011: 44)

> The stage recognizes that the research process involves more than simply solving a problem. Conscious reflection on the problem framing, the theories chosen, and the emerging ensemble is critical to ensure that contributions to knowledge are identified. It is also important to adjust the research process based on early evaluation results to reflect the increasing understanding of the ensemble artifact.

The principle of "guided emergence" is applied in stage three. This emphasizes the emergence of the requirements for a project through improved user participation. In terms of this research, as a result of the use of the framework, we can observe the guided emergence of better understanding of client requirements.

Also it is important to note that there is a cycle of influence and possible changes that runs through stage one to three. When does the cycling stop? For an organization-dominant BIE, the iterations stop when "the organization decides to adopt or reject the ensemble artifact and/or when the contributions of additional

cycles are marginal" (Sein *et al.*, 2011: 42). The researcher needs to be sensitive to this in order to determine when this stage ends.

The next stage is evaluation of the framework and reflection on whether improved requirements understanding have been achieved. Has the framework been effective in achieving this understanding or are there required changes to the approach? Following Sein *et al.* (2011), this is stage four in ADR, the formalization of learning. The formalization of learning relates back to principle one and two. For principle one, the learning from the application of the framework to a specific real-world problem is further developed and expanded to general solutions for a specific context of field problems. For principle two the formalized outcomes can be characterized as design principles, and this can be used to refine the theories that contributed to the initial design. This fourth stage is guided by the principle of generalized outcomes. As described by Sein *et al.* (2011: 44),

> Generalization is challenging because of the highly situated nature of ADR outcomes that include organizational change along with the implementation of an IT artifact. The resulting ensemble is, by definition, a bundle of properties in different domains. This ensemble represents a *solution* that addresses a *problem*. Both can be generalized. This move from the specific-and-unique to generic-and-abstract is a critical component of ADR. We suggest three levels for this conceptual move: (1) generalization of the problem instance, (2) generalization of the solution instance, and (3) derivation of design principles from the design research outcomes.

The above discussion leads to the decision that the process of applying and evaluating the framework for improved understanding of client requirements in complex IS projects will be based on the process of ADR enriched with insights from CSP regarding the choice of methods and their mixing and other systems ideas in drawing together the framework.

4.5 The process of development of the framework following ADR

4.5.1 The first stage following ADR: problem formulation

4.5.1.1 The role of CSP in understanding of the problem formulation in the development of the framework

To face the complexity of the problem of understanding of client requirements in complex IT projects involving significant organizational changes, it is necessary to draw on a mix of methods as no single method or methodology can be sufficient as was shown in Chapter 3. The way in which the mix is brought together will be informed by the ideas of Critical Systems Practice (CSP) as described by Jackson (2003). Critical Systems Practice is based on the principles of CST and is considered a metamethodology supporting the mixing of methods in an intervention following the analysis in Chapter 3. Critical Systems Practice supports the drawing together of methods from different paradigms according to their strengths and weaknesses.

The strengths and weaknesses and theoretical underpinnings of the possible methods to be included in the framework were investigated in Chapter 3 and will be further elaborated in this chapter. The purpose of the critique of different systems methods is in order to identify the reasons why a method or part of a method should be used. This needs to be done within the context of the social and organizational factors that influence the systems' methods (Jackson, 2003).

Improvement is the motivation and driving force for an intervention such as a large IT project. Improvement in this case is sought in client understanding of requirements for an ISD project. Striving for this improvement is what drives the critical awareness (point 1).

Pluralism "is about using different systems theories, methodologies and methods in combination" (Jackson, 2003: 304). One way of embracing pluralism in an intervention is to draw on multiparadigm multimethodology. In this research parts of different methodologies will be used together for the same problem i.e. "the whole methodologies are 'broken up' and the methods, models and techniques usually

associated with them brought together in new combinations according to the requirements of the particular intervention" (Jackson, 2003: 305).

Critical Systems Practice is chosen to guide the choice and mix of methods in this intervention for the following reasons:

- The techniques to be considered need to support different paradigmatic assumptions, as this problem requires an as broad as possible understanding. Being able to view the problem through the lens of each of the four paradigms is important.
- The ability to be flexible and creative in choosing methods for use within the framework is important.
- The choice of methods to be applied takes place before implementation in a real-world problem. The choice of methods relates to the general problem of requirements understanding, and not the specific field study.

The philosophical assumptions and support for different paradigms in the framework are discussed in more detail below.

4.5.1.2 The proposed framework considered as a systemic epistemology and its philosophical assumptions

A systemic epistemology (Houghton, 2009) generates rich insights, and seeks to derive knowledge that attempts to makes sense of conflicting perspectives or more specifically "the systems concept is an epistemology that was created through various philosophical traditions and for this reason is an epistemological framework in its own right" (Houghton, 2009: 101). This project is grounded in systemic epistemology as it demonstrates the hallmarks of variegation, perspective shifting, pluralism and synthesis. Variegation will be established in that the problem needs to emerge from the different perspectives or lenses of different stakeholders. Perspective shifting is achieved by moving towards a problem description that is stretched by the different perspectives and can be accepted by all stakeholders. Pluralism within the context of the current problem will produce different views. An attempt to draw together the different views of the problem is described as synthesis.

Synthesis is what occurs at the end of the process where knowledge is gained regarding the different perspectives and any possible generalizations that can be drawn. A systems epistemology offers the opportunity to provide rich insight for sense making which is needed in a complex world.

Midgley (2011) argues that systemic action research when based on a single foundational epistemological theory restricts the ability to view the different perspectives of the problem/s His philosophical debate describes how an individual moves between rational domains in describing and understanding a problem from different perspectives. Midgley's methodological pluralism is mirrored in Houghton's systemic epistemology (Houghton, 2009), where multiple interrelated perspectives need to be considered at all times in the study, taking care not to marginalize any stakeholders. Midgley (2011: 13) concludes that

> methodological pluralism (drawing upon methods from different paradigms) is a partner to theoretical pluralism, given that methodology is itself theoretical in nature and defines the legitimacy of particular methods. Not only can methodological pluralism be justified with reference to the kind of systemic philosophy outlined in this paper, but it can significantly enhance action research practice by encouraging both the use of a wide range of methods and learning across methodological boundaries.

Methodological pluralism (Midgley, 2011) is justified for this study as there will be multiple interrelated perspectives from stakeholders; care will be taken to identify and consult all stakeholders and the problem will therefore need to be understood from different perspectives. This needs to take place within a learning cycle of action research. Methodological pluralism will facilitate the learning process from the different perspectives. The generalization of results is therefore made possible by the systemic epistemology (Houghton, 2009) supported in the framework. A systems view is premised on the fact that there will be different views of the problem, and therefore contradictions and conflicts will arise. The emergent views and contradictions are part of the problem, and need to be investigated. The framework of understanding is designed with this in mind, and it is hoped will generate rich

insights which can then be generalized. The systems view allows understanding of the problem to emerge.

Systemic epistemology underpins the framework through systems thinking. Systems' thinking (the whole) is applied as the problem is complex mainly due to the interrelationships between the parts. The different views/perceptions of different stakeholders will be considered. This is complex as each stakeholder will be able to articulate different perspectives (individual perspectives) within groups of stakeholders and the groups themselves can articulate different perspectives (group perspectives). There may be differences between the individual and group perspectives and the reasons or causes of these differences need to be considered. Understanding of these interrelationships and different views will be essential in understanding the problem. The framework supports a systemic epistemology. Epistemology is "the forms of knowledge and knowledge creation" (Mingers, 2003: 561). It is assumed that multiple views exist for a broad range of stakeholders and these views need to be synthesized in order for the problem to emerge. Learning regarding the problem situation will be based on synthesis of interacting realities, comparing and contrasting multiple inputs in a complex manner. Using different paradigms will facilitate the emergence of different perspectives, contributing to the richness of understanding regarding the problem.

Although systems theory is well established in a number of disciplines, there is still a lack of its application in IS. The systemic nature of the framework for understanding can be demonstrated in that the framework is designed to:

- Implement systems thinking based on synthesis. Synthesis is a creative process that takes multiple inputs, creating a view that contains the richness of the perspectives involved (Houghton, 2009). It is important to not exclude any of the diverse perspectives.
- Demonstrate variegation. It is expected that the framework will identify "on-going conflicting realities, different methods of thinking and an overarching commitment to the multi-sidedness of dialectical realities" (Grint, 2003 cited in Houghton, 2009: 103).

To gain understanding of the problem, different perspectives will be used. Petkov *et al.* (2008b) used the three worlds of Habermas (1984): the Technical world, the Social world and the Personal world. At the same time as Habermas's writing, another author Linstone (1984) described three different perspectives from which a problem should be viewed. These perspectives reflect similar thinking to Habermas, namely, Technical perspective, Organizational perspective, and Personal perspective. In this case the three perspectives of Linstone (1984) will be used, the difference being in the terminology, and subtleties of understanding. The Organizational perspective directly relates to business processes and could highlight where assumptions are made by individuals regarding what the business wants. This could differ considerably for each individual and will be a reflection of what is perceived by each individual as being an organizational perspective. This organizational perspective is still different from the personal perspective where each individual can state their own personal view as opposed to their perceived organizational view.

The following discussion regards the ontology and axiology upon which the framework is built.

Ontology is "what types of entities are taken to have existence" (Mingers, 2003: 561). The ontology for the framework is that a real-world problem exists and that the problem is seen from different perspectives or world views by different stakeholders. These different views need to be processed through debate with the purpose of the emergence of a common understanding of the problem.

Axiology is "what is valued or considered good. This is manifest in what the purposes or uses of the model are, and who (analyst, facilitator, participant) develops and uses the model" (Mingers, 2003: 561). The framework for understanding has been developed by the researcher. The framework will be applied to a real-world problem using ADR. The framework will be used by as broad a spectrum of stakeholders as possible. Part of the function required of the framework is to identify stakeholders that may not have previously been considered as having a stake in the problem. During this process, it may be necessary to make modifications to the framework for understanding.

These are the main philosophical assumptions that are made by the researcher with regards to the framework for understanding requirements by clients that lead to the choice of methods to be used in the framework discussed in the next section.

4.5.2 The second stage following ADR: building, intervention and evaluation

4.5.2.1 Choice of suitable methods for the framework

Methodologies chosen as contributing to the framework are SSM, WST and CSH. In defining the framework, these three methodologies are chosen and justified based on their role in the SOSM (Jackson and Keys, 1984; Jackson, 2006). The WSM is more suitable for problems where the interests of the stakeholders are unitary. Soft Systems Methodology is more suitable where the interests of the stakeholders are pluralist. Critical Systems Heuristics is suitable for both emancipatory problems and pluralist problems. Following Critical Systems Practice and its guidelines that the methods included should be justified on the basis of their position within the system of system methodologies. These three methodologies were chosen as in this way a very broad and diverse range of stakeholders' interests is covered, from unitary to pluralist and even coercive interests.

All three methodologies SSM, WST and CSH are based in systems thinking. Critical Systems Practice will be the metamethodology guiding the choice of methods that form part of the framework. Critical Systems Practice is an extension of CST, which, according to Jackson (2003: 284), "is about putting *all* the different system approaches to work, according to their strengths and weaknesses, and the social conditions prevailing, in the service of a more general project of improvement." It can be concluded, therefore, that paradigm pluralism is supported by CSP. This paradigm pluralism is also justified in the understanding of systemic epistemology (Houghton, 2009), where learning is based on synthesis of interacting realities, comparing and contrasting multiple inputs in a complex manner.

Paradigm plurality for this framework is reflected in the fact that it involves methods from methodologies that were originally developed for diverse paradigms. Thus it includes the WSS from WST which can be categorized as close to the functionalist

paradigm, and methods from SSM that support the interpretive paradigm and from CSH that are considered as representatives of the emancipatory paradigm, and the pluralist paradigm.

It is expected that there will be differences in the perception by stakeholders of the problem associated with a specific IS project and the use of diverse methods will enable the development of diverse perspectives as a result of the application of the framework. "User participation requires considerable interpersonal and political skills and commitment to compromise" (Jayaratna, 1994: 135). The framework is designed to bring these different perspectives to light and to promote better collaboration between the clients and the developers.

Drawing together methods from methodologies originating in different paradigms is justified by the need for theoretical pluralism (Midgley, 2011). The theoretical underpinning for each of these methodologies, and the reasons why a mix of methods is used within the framework has been described in Chapter 3. The methods drawn together into a single framework to improve understanding of requirements by clients is described next, followed by a description of the contributions expected from each method (or technique).

4.5.2.2 The elements of the proposed framework for better formulation of user requirements in complex project situations

The framework to improve understanding of requirements by clients uses methods from SSM, WST and CSH in combination. The framework is expected to facilitate working towards an understanding of the problem. In each case the methodology brings something new to the framework, and the method chosen from each methodology brings another perspective to both deepen and broaden the understanding. Where there is an overlap in ideas raised from each method, this will serve to validate the importance of the issue raised.

The framework to facilitate client understanding of requirements for an ISD project is presented in Figure 3. The framework will be used within a learning cycle, in that

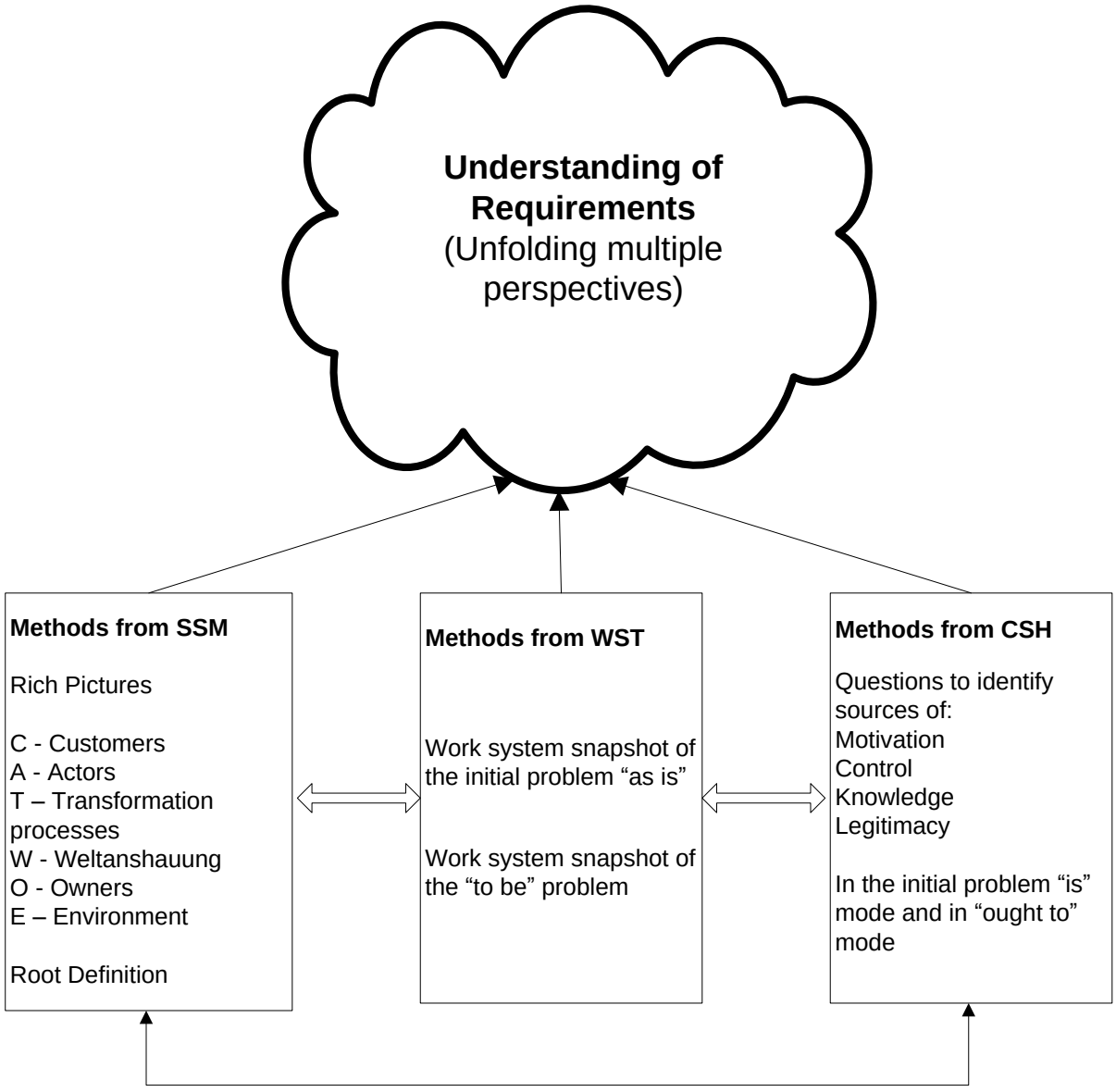


Figure 3: Framework to facilitate client understanding of requirements for an Information Systems Development project

the framework will be applied in a cycle with deeper understanding being gained in each cycle.

This framework seeks to develop a common understanding of the problem by those involved. In order to achieve this, the rationality of all stakeholders needs to be affected. Rationalization is how each individual brings understanding to a situation (Cecez-Kecmanovic, Janson and Brown, 2002). This framework therefore supports

communication rationality where "actors use language for effectively building mutual understanding and a common interpretation of a situation" (Cecez-Kecmanovic, Janson and Brown, 2002: 217). In this case the common language through which a common understanding is developed is through the framework. The framework becomes the 'common language' through which a clearer understanding of requirements emerges.

The following sections describe the expected contribution of each methodology and the methods chosen from within each methodology.

4.5.2.2.1 Soft Systems Methodology and how it contributes to the framework for improved understanding of requirements

Soft Systems Methodology is a methodology for identifying a number of different perspectives of the problem. Soft Systems Methodology (Checkland and Scholes, 1990; Checkland, 1999) involves a systemic learning process which aims to identify the different world views, social and academic backgrounds of stakeholders and the way this informs their interpretation of the problem and its possible solution.

Soft Systems Methodology is an approach which enables those taking part to learn their way to agreed action which they perceive will 'improve' the problem situation; it is a consciously organized process of inquiring and learning. The focus of concern is a human situation which someone sees as being problematic, that is to say, a situation worthy of applying some effort to improve (Checkland and Winter, 2006). In order to learn their way to agreed action communication rationality is required. Communication rationality is described by Cecez-Kecmanovic, Janson and Brown (2002) as being achieved in IS by social interaction where arguments are given and received, with any claim needing to have supporting arguments. In this way a common understanding of the problem emerges.

In this framework SSM Mode 2 will be applied with the focus being on the problem or situation at hand, with interaction in order to create a common understanding of the problem. SSM will also be used within the context of the two phases SSMp and SSMc (Checkland and Winter, 2006) as they were described in Chapter 3.

The contributions sought from the use of SSM are:

- SSMp to gain agreement on the process that will be followed in understanding the problem. This agreement would be between the known stakeholders.

Once there is consensus on the process, the next phase of SSMc will be applied to bring clarity in understanding the problem or situation of concern. The steps below will be accomplished within SSMc:

- Identification of the different points of view that are held by different stakeholders. To facilitate this CATWOE analysis can be used in order to identify the stakeholders classified as customers, actors, owners and environment. These stakeholders are identified within the context of the transformation process that is currently the area of concern.
- A rich picture which can be used to bring clarity in the discussion of the problem.
- Identification of the problem as clearly as possible in the form of a root definition. This root definition will then be used in CSH to assist in identifying all stakeholders and clarifying the boundaries of the system as described below, being aware that there may be more than one root definition at first. It is recommended that where there is more than one root definition, full consideration and analysis is completed for each. In this way it is envisaged that common understanding will emerge.

Soft Systems Methodology supports learning and as such is employed within a cycle. The elements of a root definition, CATWOE analysis and rich pictures will be reviewed and used in discussion. This will be done within the level 2 application of the WSM. It is during this discussion that a clearer understanding of the problem is expected to emerge. This understanding will be dependent on the different views raised. Care needs to be taken that there is a genuine understanding and accommodation of diverse views, and that there is no coercion regarding a view that is held by those that have more power.

Soft Systems Methodology is used in understanding the complexity of the problem, the whole, not just to simplify the complexity to a single problem.

There are places where SSM requires further support as regards client understanding of requirements, as itemized below:

- There may be a number of perspectives on the root definition, and it may therefore be necessary to consider more than one root definition. As the problem under consideration includes IS development, there may be a tendency towards focusing on the Technical view, without considering the Organizational and Personal views as well.
- The CATWOE analysis is completed with respect to the transformation process and therefore may miss the broad spectrum of all stakeholders, especially the affected that are not necessarily the involved.
- The rich picture may not be able to show all perspectives for the problem in a single picture.

Work System Theory has been chosen to complement the learning in SSM. The WST is an approach that purposely identifies the IS system as forming part of a larger work system. This therefore brings to the attention of participants the business processes that support, and are supported by, the IS.

4.5.2.2.2 Work System Theory and how it contributes to the framework for improved understanding of requirements

The WSS from WST will be applied in the framework for improved understanding of requirements. The WSS captures the various dimensions of a work system as they are shown in the work system framework, representing a static view of the work system.

The WSS is a technique for summarizing the elements of the work system as a table summary of the work system. In this case the work system framework is not used directly, as the work systems framework identifies the elements involved in the work system by means of SSMc, using the CATWOE analysis. The WSS provides for the clarification of the function of the work system i.e. the purposes it serves, the

stakeholders involved and most importantly it documents the work practices or processes and information flows.

The WSM by definition (see Chapter 3) also recognizes that there will be an impact on business processes. To assist in the analysis of the work system framework and formulation of a WSS, depending on the needs of a project and the level of detail of the investigation it may be necessary to use the level two analysis of the WSM as described by Alter (2006: 23-26) which essentially involves providing answers to three sets of questions. The three sets of questions relate to the definition of the system of concern and associated problems, analysis and possibilities, and recommendations and justification. For more details on these questions and also on deeper levels of work system analysis one may refer to Alter (2006). It needs to be pointed that the text of the questions in the three stages of Work System Method analysis needs to be adapted to the context of the problem of concern by the facilitator of the analysis.

The WSM was designed with the business professional in mind, and poses questions to lead to understanding of a problem, and any possible changes that could be beneficial. Insights from a prior application of SSM methods like rich pictures and CATWOE analysis will support the generation of findings by applying the WSM questions and in defining the WSS as a way of documenting the developing understanding of the problem.

The contributions sought from the use of WSM are:

- A description of the project context in terms of the structure of the work system, described through the understanding of the participants (or stakeholders) and the work processes and any problems associated with them.
- Documenting the analysis of the work system through also identifying customers, products and services, information and technologies used.
- Identifying work practices or business processes in the WSS for subsequent generation of use cases (see Alter and Bolloju, 2016).

- Consensus building using the WSS as a picture of the view of the problem 'as is' at the beginning of the project and the 'to be' snapshot as the summary of the desired changes.

The areas where WSM requires further support as regards client understanding of requirements are as follows:

- There is no clear direction on conflict resolution. It is assumed that consensus can be reached regarding a description of the system and problems.
- There is also a tendency towards a 'narrow view' of the problem and no mechanism to promote the possibilities of changing the boundaries of the proposed problem.

Critical system heuristics has therefore been chosen as the third methodology included in the framework that helps in providing a comprehensive understanding of requirements. Critical system heuristics is a process of enquiry that supports questions that highlight who the stakeholders are, and who the stakeholders could be, as well as where the boundary for the problem should be. The factor that most affects the stakeholder identification is the choice of the boundary for the problem that emerges. Different boundary choices will impact on which stakeholders are within the problem and which are not.

4.5.2.2.3 Critical System Heuristics and its contribution to the framework for improved understanding of requirements

Critical system heuristics (Ulrich, 1983; Ulrich and Reynolds, 2010) will use the problem root definition from SSMc and will bring further clarity regarding system boundaries and identification of all possible stakeholders. Critical system heuristics requires an initial identification of the problem, as the questions are asked within the context of the problem. The questions used in CSH (see Table 4) are designed to bring into consideration four social phenomena which will influence an ISD project. The four sources of influence are identified as motivation, control, knowledge and legitimacy. The twelve questions of CSH are asked in two different modes, the '*is'* and '*ought to be'* mode. These questions are designed to bring a new level of

reflection. With this in mind it is recommended that the questions are asked in the '*ought to be mode*' first. This reflection will encourage *an ideal world*, where the *bigger picture is considered* first. As each question is answered by different stakeholders, there is a requirement for open discussion and a deeper level of communication is encouraged. Following this with the same questions in the *'is'* mode, provides a picture of how the problem appears now. The discussion can then identify how to get from the perceived current state (*is*) to the ideal state (*ought to be*). In each case these questions can also be asked with regards to an individual's personal view and the perceived organizational view. The expected result in the discussion regarding these questions and the possible answers will affect the boundary of the problem. Giving consideration to the problem boundary and what falls within the boundary will have direct bearing on who is involved (the stakeholders).

Throughout this discussion there are many possible different views of the same problem. Each of these views will have their own merits and faults. It is important that the different possible views are taken into consideration, and specifically that no individual view is disregarded, without due consideration.

Critical system heuristics is considered as emancipatory and pluralist with questions that identify who benefits from design choices and seeks to identify and empower stakeholders affected by those choices. In this framework, CSH will be a tool that is used to ensure that all stakeholders have been identified, and also to bring clarity to the problem definition through boundary definition. The question of boundary is significant. Where the boundary to the problem is questioned, the possible views or perspectives of the problem will be affected by where the boundary lies. Critical system heuristics not only identifies stakeholders that may previously have been neglected, but also the problem boundary. Critical system heuristics will be used to awaken 'thinking outside the box'. The questions invoked in the 'ought to be' mode will be an action that facilitates more diverse thinking in consideration of the problem. Keeping in mind the systemic underpinning, there should also possibly be more than one description of the problem, to facilitate the different perspectives.

Each possible problem description will give different perspectives when answering the questions in CSH.

The contributions sought from the use of CSH are:

- Identification of the boundary of the problem as clearly as possible, resulting in greater clarity regarding the problem of concern.
- Identification of all stakeholders, both those involved and those affected.
- Consensus regarding the sources of influence associated with the problem of concern. The sources of motivation, control, knowledge and legitimacy.

The areas where CSH requires further support as regards client understanding of requirements are:

- There is no clear direction on conflict resolution although both CSH and SSM imply that conflict is reduced by aligning the values of the stakeholders in the process of a systemic intervention which, in this case, is in the process of requirements understanding for a complex IT project.
- How do you determine stakeholder significance? Prioritisation of stakeholders has been proposed in order to address this concern.

These issues are addressed in the process of applying the framework discussed next.

4.5.2.3 Suggested process of the intervention of applying the framework and the interaction of the various methods in it

In the previous section, Figure 3 captures the many interdependencies between the elements in the framework and reflects the richness of the interaction between them.

The framework to facilitate client understanding of requirements can be applied within a learning cycle as depicted in Figure 4.

The learning cycle is a useful guide for the use of the methods in the framework. The contribution that each method chosen from various methodologies makes to the framework is also the justification as to why the methodology was chosen to be part of the framework of understanding for ISD projects. The contribution of each methodology and its methods is discussed further in the next section.

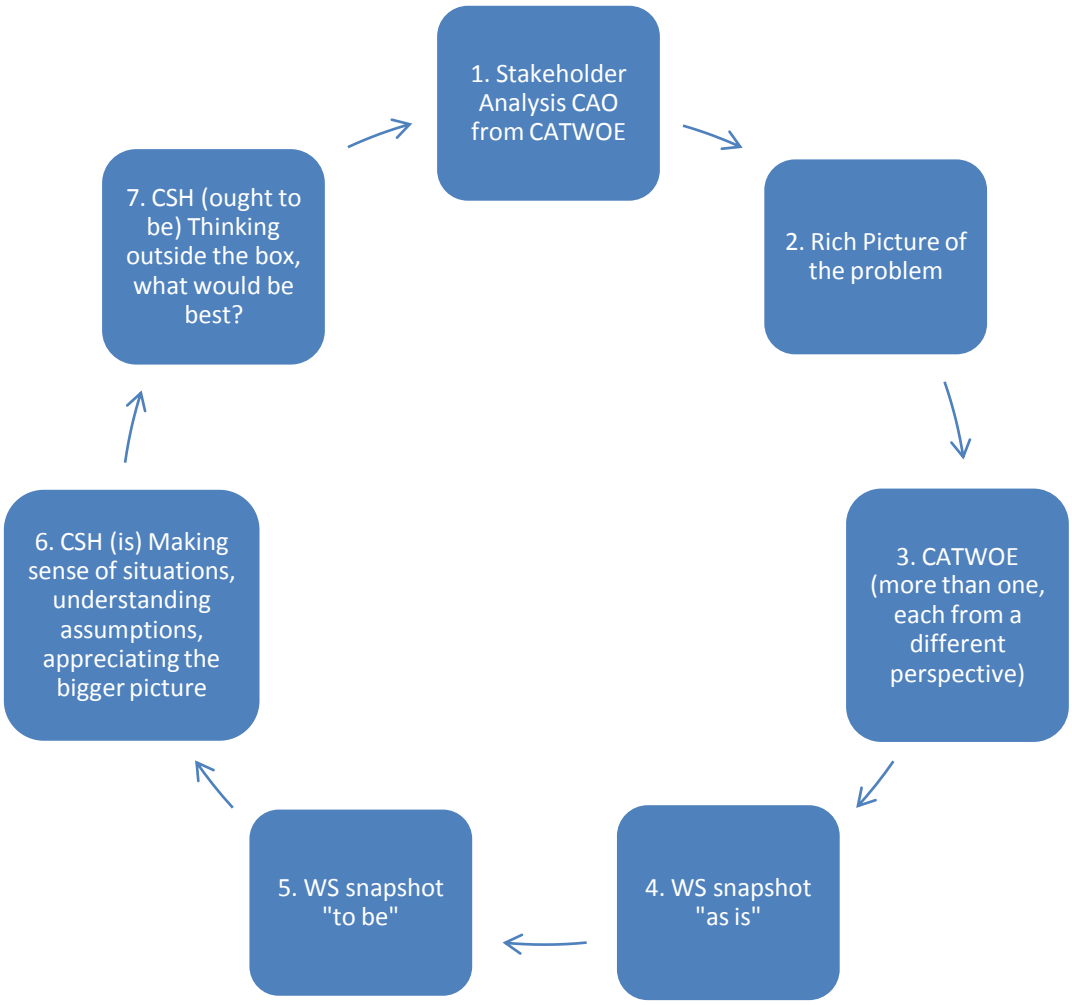


Figure 4: Suggested process for the intervention using the Framework for Understanding of Software Requirements by Clients

The framework for understanding requirements uses methods from three different methodologies to gain as comprehensive an understanding as possible of the problem. Soft Systems Methodology is described as interpretive, CSH is described as emancipatory though it has value as an interpretative approach and WST is described as pragmatic though it can be seen also as an interpretive approach. As they all promote better understanding of a project situation through different methods the proposed framework involves using SSM, WST and CSH in

combination to work towards an understanding of the requirements for software development. In each case the methodology brings something new to the framework.

Where there is an overlap in ideas raised by applying methods from different methodologies, this will validate the importance of the point raised. For example, with regard to stakeholder identification, CSH brings consideration of the stakeholders involved and those that are affected. However, stakeholders are also considered separately in the WSS of WSM as well, and in SSM through the CATWOE analysis and the rich pictures.

The information gained through the CSH questions regarding the sources of motivation, control, knowledge and legitimacy will assist in identifying the boundary choices for the problem of concern. Essentially SSM will be used to enrich the WSM analysis identifying the agreements and differences in views, highlighting areas of concern of the different stakeholders with respect to differences of opinion on the requirements of the system that is investigated, as well as areas with clear agreement.

The WSM recommendations provide for validation of the understanding gained, and the means for listing the key findings from the implementation of the framework.

It is important at this stage to describe more specifically that the outcome of the application of the framework is related to the identification of the *Business Architecture* for the problem of concern. The business architecture is associated with the work system dealing with the problem. The business architecture defines the organizational structure and the processes associated with the problem (Zachman, 1987; Zacarias *et al.*, 2007; Caetano, Silva and Tribolet, 2009; Pessi *et al.*, 2014; Ulrich and Kuehn, 2015).

A further outcome is associated with the formulation of the Information Architecture associated with the problem and the information flows associated with the Business Architecture problem (Brancheau, Schuster and March, 1989; Galliers, 1993; Pereira and Sousa, 2005). The framework does not aim to provide further operationalization of the requirements into detailed process and data models for an information system for the messy problem of concern. It leads however to the formulation of a WSS of

the system to be. The latter leads directly to the formulation of use cases as is demonstrated in a recent paper by Alter and Bolloju (2016). Hence the outcome of the framework has a considerable practical value for the subsequent work on elaboration of the IS requirements.

The choice of several methods from the systems methodologies in the framework is based on the principles of CSP (see Jackson, 2003), a meta-methodology enabling mixing of methods in a systemic intervention. The first two phases in CSP (creativity and choice) were followed in the development of the framework. The implementation of the framework brings into focus the last two phases in CSP which are implementation and reflection but as was pointed earlier it was decided to follow for that purpose instead the stages of ADR.

4.6 Conclusion

In this study the framework for improved understanding of client requirements is justified as a systemic approach based on CSP which is applied as a metamethodology for the selection of methods to be included in the framework.

The development of the framework also follows the process of ADR as shown in the second column of Table 5. In this study the design artifact in the form of a framework for improved understanding of requirements has been built using CSP. It now remains to implement the framework (an intervention) and then evaluate the framework. This follows the second stage of the ADR process which involves the building of the framework, discussed in this chapter and a subsequent intervention applying and evaluating the framework, which will be discussed in the next chapter. The building, intervention and evaluation (BIE) of the framework (design artifact) is therefore presented over these two chapters.

The practical process of the implementation of the framework is based on a recent idea in Design Science called Action Design Research. The expected interaction of the methods from different methodologies involved in the framework has been discussed. The theoretical foundations of the validation will be discussed also in Chapter 5 together with the analysis of the pilot implementation that was used as a

means for validation of the framework. Following reflection on the pilot study implementation, the framework will then be applied to a larger field study discussed also in the next chapter.

Chapter 5: Validation and Implementation of the Framework for Requirements Understanding

5.1 On the method for validation of the framework for software requirements understanding

A framework for improved understanding of client requirements in IT projects was developed in the previous chapter. The framework is designed using the guidelines of CSP in the light of existing problems identified in the literature (as described in Chapter 2) that relate to the development of software requirements.

The implementation of the framework follows the process of ADR from Sein *et al.* (2011), a recent idea in design science. As described by these authors, the evaluation of ADR projects needs to take into consideration "the research process as containing the inseparable and inherently interwoven activities of building the IT artifact, intervening in the organization, and evaluating it concurrently" (Sein *et al.*, 2011: 37). In this case the framework is the artifact of the design process. The evaluation will therefore be of the framework for understanding of requirements. Given that "Evaluation provides evidence that a new technology developed in DSR 'works' or achieves the purpose for which it was designed" (Venable, Pries-Heje and Baskerville, 2012: 424), it will be necessary to provide evidence that the framework achieves its objectives.

A recent study that reviewed design science research validation considered 148 design science research (DSR) articles published in selected top IS, computer science and engineering journals (Peffers *et al.*, 2012). They identified different types of artifacts evaluated in DS studies such as algorithms, constructs, frameworks, instantiations, methods and models. In this case, it is a framework that will be evaluated. They further classify and identify evaluation methods in DSR as presented in Table 7.

Giving consideration to the nature of project situations for which the framework is proposed, the evaluation method associated with action research is applicable.

Following Table 7, the use of the 'artifact', the framework for requirements understanding will be applied in a real-world situation as part of a research intervention followed by an evaluation of its effect on the real-world situation. The framework will then be implemented in a pilot study, followed by a larger intervention in the same context and the results reflected upon. In the pilot study small group interviews will be used to evaluate the framework. The results from the pilot study intervention will be reflected on and any changes deemed necessary to the framework will be made before the main study. In the main study, a questionnaire will be used to evaluate if the objectives of the framework have been achieved.

Table 7: Evaluation method types for Design Science Research

Evaluation Method Types	
Logical Argument	An argument with face validity.
Expert Evaluation	Assessment of an artifact by one or more experts (e.g., Del-phi study).
Technical Experiment	A performance evaluation of an algorithm implementation using real-world data, synthetic data, or no data, designed to evaluate the technical performance, rather than its performance in relation to the real-world.
Subject-based Experiment	A test involving subjects to evaluate whether an assertion is true.
Action research	Use of an artifact in a real-world situation as part of a research intervention, evaluating its effect on the real-world situation
Prototype	Implementation of an artifact aimed at demonstrating the utility or suitability of the artifact.
Case Study	Application of an artifact to a real-world situation, evaluating its effect on the real-world situation.
Illustrative Scenario	Application of an artifact to a synthetic or real-world situation aimed at illustrating suitability or utility of the artifact.

Source: Peffers *et al.* (2012: 402)

A comprehensive approach for evaluation in DSR is presented by Venable, Pries-Heje and Baskerville (2012), who propose a DSR Evaluation Method Selection Grid shown here as Figure 5.

DSR Evaluation Method Selection Framework	Ex Ante	Ex Post
Naturalistic	• Action Research • Focus Group	• Action Research • Case Study • Focus Group • Participant Observation • Ethnography • Phenomenology • Survey (qualitative or quantitative)
Artificial	• Mathematical or Logical Proof • Criteria-Based Evaluation • Lab Experiment • Computer Simulation	• Mathematical or Logical Proof • Lab Experiment • Role Playing Simulation • Computer Simulation • Field Experiment

Figure 5: A Design Science Research evaluation method selection grid

Source: Venable, Pries-Heje and Baskerville (2012: 433)

The horizontal grid presents 'ex ante' and 'ex post' which relates to the time when the evaluation takes place. Ex ante presents an evaluation of the framework before the framework takes its final form. Ex post presents an evaluation of the framework after its final implementation. The vertical grid presents the type of problem for evaluation as naturalistic or artificial. A naturalistic evaluation would include a real-world situation where the effect on the real-world situation is studied. An artificial problem relates to an artificial situation, where an environment is simulated in some way. This may be by using scenarios, or by computer simulation, essentially any testing or evaluation that is applied in a simulated environment that is an abstraction of the real-world in order to evaluate the design science research.

The framework for understanding of requirements and improved user participation will first be implemented in a pilot study (a real-world problem that exists/naturalistic), and evaluated and adjusted according to the experience and knowledge gained in the pilot implementation (ex ante). After reflection and adjustment to the framework as a result of the pilot study, the framework will be applied in a further study, within the same context, with a larger scope. The evaluation of the framework for the main implementation study is still naturalistic, as the framework is applied to a real-world problem. The main implementation study is also ex post, as the evaluation of the framework will be completed in reflection after

the framework has been applied in the pilot study. Action research is therefore a valid evaluation method for this study on the basis of the work by Peffers *et al.* (2012) and the Method Selection Grid presented in Figure 5.

The evaluation has four phases as described by Venable, Pries-Heje and Baskerville (2012: 434/435), namely:

- "Analyze the context of the evaluation …
- "Match the needed contextual factors (goals, artifact properties, etc.) of the evaluation (from step 1) to the criteria …
- "Select appropriate evaluation methods …
- "Design the DSR evaluation in detail …"

The four phases will be completed as follows:

- The context of the evaluation can be categorized as a soft systems research problem following Checkland (1981).
- The relevant criteria for validation in soft systems thinking are twofold. The two aspects are described by Checkland (1995: 52-53): "the validity question becomes the question of how we can tell a 'good' device from a 'bad' one. There are two aspects to this question: the question of whether a model is actually 'relevant' or not, and the technical question of whether a given model is competently built". These two guidelines will therefore be applied to validate the framework for client understanding i.e. is the framework relevant? Is the framework competently built?
- The evaluation method will be action research following the guidelines of Venable, Pries-Heje and Baskerville (2012).
- The detailed design of the validation of the framework will be presented in the next subsection.

5.2 Planning for the validation of the framework

The situation of concern chosen for the pilot implementation of the framework is the Kenneth Gardens Wellness Centre located in the Kenneth Gardens Housing Complex in Durban, South Africa which is run through a nonprofit organization

(NPO) named Senzokuhle. The purpose of the pilot study is to implement the proposed framework in an action research real-world setting in order to validate the framework (following the guidelines of Venable, Pries-Heje and Baskerville, 2012, 2014), reflect on the frameworks effectiveness, and consider any possible changes to the framework as a result of the pilot implementation.

As described by Hindle *et al.* (1995: 454) "'action' implies the desire to improve matters in a real-world situation within which the research activity is directly involved, and the 'research' element a desire to produce rigorous, generalizable results". The elements present are:

- F – framework of ideas;
- A – area of application; and
- M – declared methodology that defines the nature of the research intervention.

In this case the framework for understanding (F) is applied to the real-world situation of the Kenneth Gardens Wellness Centre (A) using the chosen systemic framework (M) that includes methods from several methodologies as discussed earlier.

For the pilot study, the framework for client understanding of requirements occurred in the context of three workshop sessions. The evaluation method was action research as suggested by Venable, Pries-Heje and Baskerville (2012), with small group interviews conducted after the implementation of the framework, in order to evaluate the framework and identify any adjustments that could improve the framework. This completed the ex ante evaluation of the framework in the pilot study. The questions for the small group interviews are presented in Appendix A. The questions were open ended to encourage participation and natural responses to the framework. These questions were used to evaluate whether the framework is relevant, the first criterion for validation. This researcher followed Checkland (1995) who describes two criteria for validation in soft systems thinking research:

- Is the framework relevant?
- Is the framework competently built?

The pilot study implementation of the framework and the presentation of the framework at an internationally recognized IS conference will serve to complete the ex ante validation of the framework (Wing, Andrew and Petkov, 2015).

The subsequent full implementation of the framework in the main study (a larger problem), the improvement in the management of the Kenneth Gardens Housing Estate, will provide further evidence for the field evaluation of the framework. This is the ex post validation of the relevance of the framework.

The framework will be evaluated in both the pilot and main study in terms of the following criteria:-

- Relevance, is the framework relevant to the situation of concern
- Completeness, does a more complete understanding of the situation emerge
- Comprehensiveness, in the emergent understanding comprehensive, including different perspectives
- Consistency, are the factors identified through using different methods from each methodology consistent
- Appropriateness of the methods used to generate the emergence of understanding

5.3 Nature of the problem considered in the implementation of the framework

Kenneth Gardens is the largest municipal housing estate in the suburb of Umbilo, within the city of Durban. Kenneth Gardens currently provides subsidized housing to 1500 to 1800 individuals and families. The original purpose of the Kenneth Gardens Housing Estate was to provide subsidized housing to low income 'White' workers, especially those who had been in service during the Second World War and were now returning home. The housing estate is well situated for public transport routes and schools. There have however always been negative public perceptions of Kenneth Gardens, associating the estate with alcohol and drug abuse, youth gangs, disruptive and abhorrent behaviour, as well as domestic violence. In due course the

racial mix of residents began to change. With the Group Areas Act[1] under pressure, in 1988 the state drastically reduced its funding to be spent on 'White' housing. In 1989 the first 'Black' family moved into Kenneth Gardens. When the Group Areas Act was repealed in 1991, the racial mix became more diverse (Erwin, Marks and Couchman, 2014).

Today Kenneth Gardens houses a racial mix that is fairly unique. The previously disadvantaged races have only been there a relatively short time compared to some of the old established residents. This mix has resulted in a vastly diverse community. At its inception, the subsidized housing estate provided a number of social services and access to good medical care. Residents could go to King Edward Hospital, a public hospital of high standard, less than two kilometres from Kenneth Gardens. As the laws changed and housing, as well as other services, was opened to all races, the support facilities for Kenneth Gardens were gradually withdrawn. The residents of Kenneth Gardens no longer have access to King Edward Hospital, and they were rezoned to attend Wentworth Hospital, some 20 kilometres away. This requires two taxi trips, which is costly and also very difficult for the disabled and chronically ill.

In 2009 a non-profit organization called Senzokuhle was established. Senzokuhle is run by volunteers from the Kenneth Gardens community who provide informal home based care for residents in need. Senzokuhle runs a Wellness Centre from a building within Kenneth Gardens. The Durban University of Technology (DUT) Department of Homeopathy supports the Wellness Centre by providing a homeopathic clinic each Wednesday from 9am to 12 noon.

The Wellness Centre was established based on perception of the need for such a centre, and is run on a volunteer basis. The fact that each volunteer has made an effort based on their personal view of society and wish to contribute to the Kenneth Gardens community brings uncertainty as the volunteers could withdraw at any time. The DUT students however do earn practical community experience and this is a requirement for these students in order to graduate. There are therefore tensions

[1] The Group Areas Act (Act No. 41) passed in 1950, consolidated existing discrimination and segregation in South Africa through legalizing, and enforcing, separate residential spaces and facilities based on racial classification.

created between the volunteer nature of those working within the Wellness Centre and the students and patients that depend on the facility for in-service training and wellness respectively.

Faced with these challenges and the complexity of issues influencing the Kenneth Gardens Wellness Centre, the framework was applied as a pilot study for this situation of concern. The improvement in the management of the Kenneth Gardens Wellness Centre was selected as an area of concern for the pilot study. The framework was therefore applied in order to learn more regarding the nature of the 'problem', and to move towards understanding how an information system could assist in alleviating the problem.

Following from the pilot implementation of the framework, the main study considered the larger context, the possible improvement to the management of the Kenneth Gardens Housing Estate as a whole, and the possible elements of an information system that would better support this. The pilot study was completed from July to September 2015. The main study was completed in February to June 2016. This implementation of the framework at Kenneth Gardens Wellness Centre as a pilot study, and the Kenneth Gardens Housing Estate as a main study completes the implementation phase in CSP.

5.4 An account of the pilot implementation of the framework

5.4.1 Scope of the pilot implementation and its goals

The scope of the pilot implementation of the framework is the Kenneth Gardens Wellness Centre. The goals of the pilot implementation were to validate the framework in order to establish its relevance applied to the problem of client understanding of software requirements. The framework was therefore applied in order to bring clients into a clearer understanding of the roles of the Wellness Center within Kenneth Gardens, and the possibilities for improvement through an information system. The aim was to identify the work system that is associated with and supports the operation of the Wellness Centre, and identify the organizational

structure and processes as well as the information flow that would better support the functioning of the Wellness Centre.

5.4.2 Stakeholder analysis

Workshops were held with stakeholders and the elements in the framework were used during these workshops.

Table 8 shows a summary of the stakeholders invited to the workshops. The purpose of these workshops was to use the framework to conduct an analysis of the information requirements for a system promoting improvement in the management of the Kenneth Gardens Wellness Centre.

Table 8: Summary of stakeholders for Kenneth Gardens Wellness Centre pilot implementation of the Framework for Requirements Understanding by Clients

PATIENTS	Senzokuhle volunteers
	Residents of Kenneth Gardens
	Non-Residents
DUT	DUT Urban Futures Center
	Department of Homeopathy
	Homeopathy students/interns
	Department of Food and Nutrition
	Food and Nutrition students
OTHER	Glenridge Church
	Information Technology representatives
	Visiting students from University of California, Santa Cruz

The stakeholder group referred to as patients is essentially patients of the Wellness Centre but can also be residents or non-residents of Kenneth Gardens, and may also be Senzokuhle volunteers. The Senzokuhle volunteers facilitate the home based care of patients that are physically unable to attend the Wellness Centre, the administration of visits to the Homeopathy Clinic, any translation required between the patients and interns as well as assistance with filling in forms. The Senzokuhle

volunteers also have a dual role in that they are also patients at the Centre themselves. This group of stakeholders was invited to the first workshop held in the Wellness Centre at Kenneth Gardens.

The second workshop was held at DUT with the DUT stakeholders as well as the stakeholders described as 'other'. The first DUT stakeholder is the Urban Futures Centre at DUT who has been working in the Kenneth Garden community for a number of years. The further DUT stakeholders are those that work at the Wellness Centre on Wednesday mornings. This includes Dr. Couchman from homeopathy as well as the homeopathy students. The consultation time spent at the Centre is logged for each homeopathy student as they have to complete a certain number of hours in community service. The homeopathy students invited to attend the workshop had spent many hours at the Kenneth Gardens Wellness Centre and therefore had some experience they could report on. The Food and Nutrition Department is also a DUT stakeholder and was also well represented by staff and students. The Food and Nutrition students support the Wellness Centre on a Wednesday morning and also log hours of community service at the Wellness Centre. These students support the homeopathic clinic by providing advice regarding nutrition and wellness. They have also developed information booklets for chronic conditions such as hypertension and diabetes that can be given to patients. These students also complete body mass index (BMI) calculations for patients and advise them on programs for weight loss, and weight gain.

The stakeholders described as 'other' are those that also have a stake in the Wellness Centre. Glenridge church has provided for the Centre by renovating the building that houses the Centre. As a community church they have identified some of the needs in Kenneth Gardens and have made a valuable contribution to assist the NPO's within Kenneth Gardens.

The Information Technology representatives were post graduate students from the Department of Information Technology at DUT. The students from the University of California (Santa Cruz) were on exchange programme for a two month period, and working within the Kenneth Gardens community. These students were trained in

Information Technology, Multimedia Studies and Social Studies. They were linked to DUT through the Urban Futures Centre.

A third workshop to which all stakeholders were invited was conducted at DUT. The following narrative describes what was derived from the interactions in these three workshops.

5.4.3 Brief description of the application of the framework and the results generated

The framework was applied within a learning cycle. The choices made for the framework were driven by the need to generate a rich participation experience for those who participated. This participation was encouraged by using methods from SSM, CSH and WST that were appropriate for users with non-specialist IT knowledge that captured socio-technical requirements in addition to functional requirements, also by using a facilitation approach rather than a technical expert approach as suggested by Markus and Mao (2004). The learning cycle demonstrates the moving between methods in the framework. There are multiple iterations in the learning cycle. These iterations can be guided by the facilitator, but also can happen naturally as a result of discussion around a particular point.

In this pilot study the participants worked with rich pictures and the CSH questions. The WS snapshot and different CATWOE analysis with their root definitions were drawn by the researcher from the rich discussion that took place.

The rich pictures drawn in the workshops were gathered together, and a composite rich picture incorporating all the issues identified was drawn by the researcher. This rich picture was presented to the participants in the follow up small group interviews conducted with each stakeholder group. This rich picture was well received by stakeholders, and accepted as representing a comprehensive picture of the factors influencing the Wellness Centre. The composite rich picture (Figure 6) shows both the external and internal elements that influence the Wellness Centre.

In describing these elements it became evident that there are many powerful forces, political and other, which influence the Wellness Centre, including:

- The zoning of state hospitals, where currently residents of Kenneth Gardens are zoned and required to travel a long distance to Wentworth Hospital. This has a direct bearing on the need for the Wellness Centre to provide health care for those that cannot afford private health care and are unable to pay the required taxi or bus fares or are physically unable to travel to Wentworth Hospital.
- There is a Municipal councillor office housed (a physical building) within the Kenneth Gardens estate. This office is for use by a PR councillor (proportional representative councillor) appointed by the ruling party, currently the ANC. At the time of this pilot study, there was no officer currently appointed.
- The eThekwini Municipality is the owner and administrator of the Kenneth Gardens Housing Estate. They hold the lease documents and in this way have an influence on what the buildings are used for. Currently, the building that is home to the Wellness Centre falls under the lease of one of the residents as servants' quarters. This makes the current running of the Centre in this venue an illegal use of the building. The building also has no electricity. As this building is being used for a community service, the allocation and billing of electricity becomes a complex debate. The building also has no number or address by which it could be referenced. Senzokuhle currently has a request that eThekwini municipality should sponsor the electricity for the Wellness Centre.
- Glenridge Church was responsible for the renovation of the building which houses the Wellness Centre. The church is available to assist the Wellness Centre, but requires a proper paper trail which indicates clearly where money is spent. Currently donations are noted and hand written into a book and it is not always clear how the donations are distributed. The distribution of donations takes place as the needs arise and according to the decisions made by the volunteers running Senzokuhle.

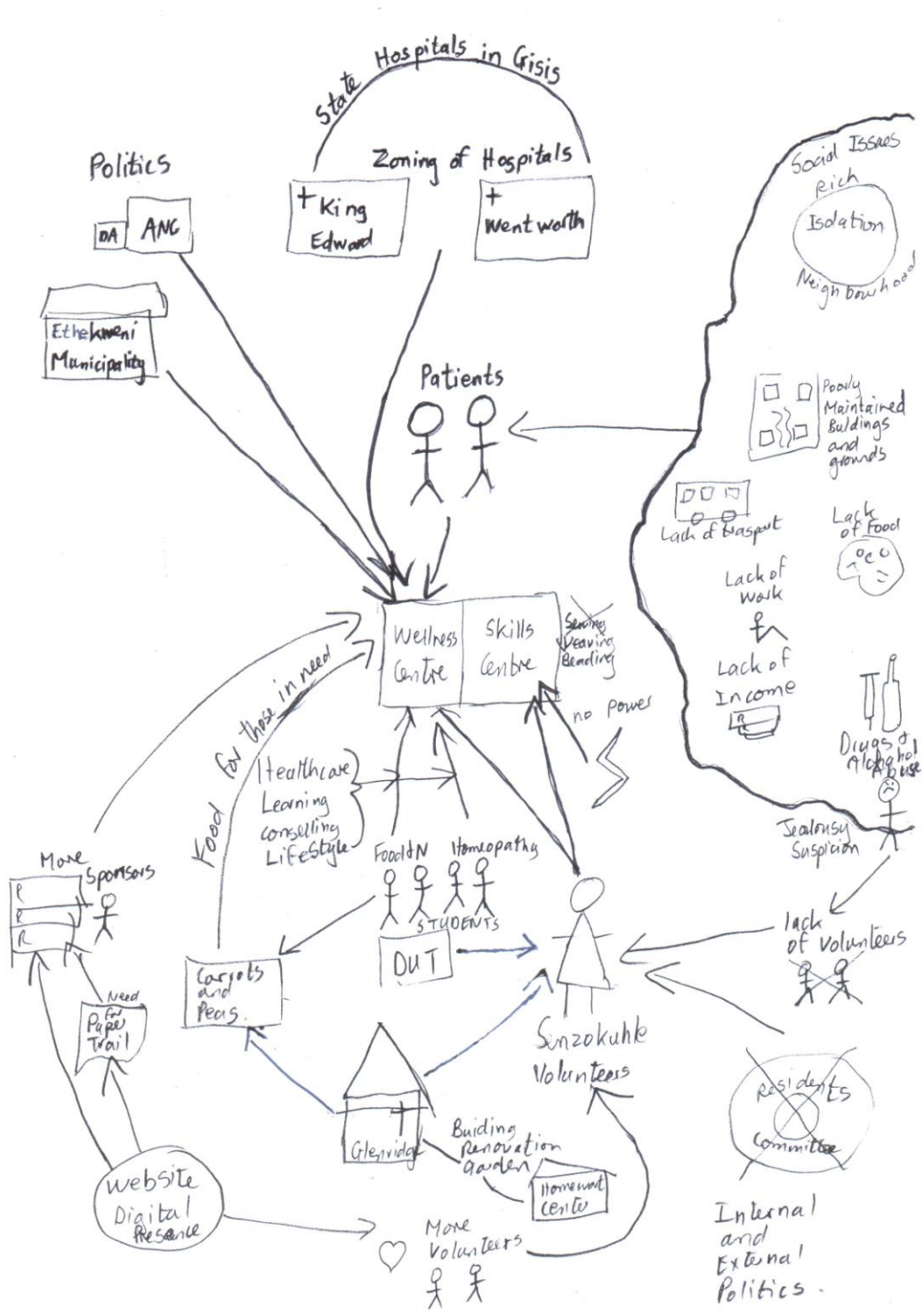


Figure 6: Rich picture associated with the Wellness Centre generated through the application of the Framework for Software Requirements Understanding by Clients

- The Urban Futures Centre from DUT has been involved with the entire Kenneth Gardens Estate, and therefore also the Wellness Centre as part of a research project funded by the National Research Foundation. This project concluded at the end of 2015. It is noted that other independent researchers also often approach the Wellness Centre in order to conduct research.
- The social issues affecting the residents of Kenneth Gardens also influence the patients, and the volunteers. The issues identified include lack of food, lack of work, lack of income, drug and alcohol abuse, lack of transport, and poorly maintained buildings and grounds. There is a feeling of isolation as the 'poor' housing complex is situated within a 'rich' neighbourhood. The deep needs of some of the residents lead them to living in a survival mode. The emotions of jealousy and suspicion often arise when it is perceived that a person has benefited from their position as a volunteer. This results in conflict between residents and volunteers and also between volunteers. The need for open and auditable financial records could possibly reduce the jealousy and suspicion.
- At the time of this pilot study (July to September 2016) there was no resident committee functioning for the Kenneth Gardens community.
- Carrot and Peas is a second NPO that provides hot lunch on Tuesdays Wednesdays and Thursdays for anyone that does not have food. The volunteers from the Wellness Centre (Senzokuhle) collect food for those that are unable to collect food themselves. This is part of the home based care programme.
- The DUT students from the Homeopathy Department generate in service training hours as they assist at the Wellness Centre on a Wednesday morning. There is also a homeopathic doctor present to validate diagnosis and dispense the homeopathic medication. The medicines are sponsored by DUT and the doctors own pocket. Extensive records are kept of each visitor to the Centre and their history. These records are kept in large lever arch files, in alphabetical order, according to patient surname. All the records for a patient are kept in a single plastic sleeve.

- Another group of students which generate in service training hours are from the Food and Nutrition Department. These students assist patients with diet related advice and BMI measurements. They also volunteer their time to assist with food preparation at Carrot and Peas. The Wellness Centre is dependent on these students for their expertise, but the students are equally dependant on the Wellness Centre to gain experience and learning and earning in service training hours.
- A possible website/digital presence is indicated in the rich picture as a way to show more transparently the receiving and use of funds for sponsorship of the Wellness Centre.

An important aspect in the rich picture is the elements that are crossed out and illustrate hindrances to information flow. At the point in time when this pilot study was completed, the lack of a Residents Committee and the lack of volunteers for Senzokuhle were elements bearing a negative influence on the possible information flow.

The rich picture therefore provides a comprehensive synthesis of issues affecting the Wellness Centre. The contributions sought from the use of SSM are an understanding of the problem among the known stakeholders. This was achieved in that the various stakeholders were able to express their points of view in an open and non-threatening atmosphere (workshops 1 and 2). The rich pictures were instrumental in bringing to light different perspectives.

Still within SSM, a CATWOE analysis of the problem situation showed that there could be variations on the classification of the issues, depending on where you set the boundaries and the different world views. The CATWOE analysis (see Appendix B) shows three possible descriptions for the Wellness Centre, depending on where the boundary falls. In each case, a wider boundary is considered which affects the customers and/or actors. The root definitions given highlight the difference in boundaries.

- The Wellness Centre – a homeopathic clinic run on Wednesday mornings.

- The Wellness Centre – to promote health and vitality for the greater Kenneth Gardens Community.
- The Wellness Centre – to promote general health and vitality with the support of the Municipality.

Customers, actors, transformation process, world view (weltanschauung), environmental constraints analysis facilitated the identification of the different points of view held by different stakeholders. The root definition changed according to the boundary that could be set for the problem. The envisaged usefulness of the elements used from SSM were therefore realised in this pilot study. The benefits of a systemic framework, the demonstration of variegation, perspective shifting, and pluralism (Houghton, 2009) have been demonstrated in the use of methods from SSM.

The implementation of the framework continued with methods from WST and CSH. The technique used from WST (Alter, 2014) was the WSS. The WSS 'as is' (see Appendix C) and WSS 'to be' (see Appendix D) were developed by the researcher through the information gathered during interaction in the workshops. The WS snapshots were useful in identifying the main processes that form a part of the system for the Wellness Centre.

The CSH questions were completed in 'is' mode (see Appendix E) and 'ought to be' mode (see Appendix F). The CSH questions interrogated the stakeholders both involved and affected. The CSH questions were used in the 'is' mode in the first workshop and in the 'ought to be' mode in the third workshop. Rich discussion took place when considering these questions in workshop one. The CSH questions assisted in approaching the problem from different perspectives and thereby gaining a richer understanding. It was interesting that even although in the first workshop the discussion was about the 'is' mode, stakeholders sometimes discussed the 'ought to be' mode. This demonstrates that there are possible improvements that could take place and there was consideration for what ought to be taking place rather than the current status quo. The emphasis on control in the CSH questions was debated as suggesting a hierarchical structure and essentially Kenneth Gardens should be run by the people living there and not through control in some type of hierarchical structure.

The stakeholders present emphasized that control and success are in the hands of the community. The CSH questions therefore made an effective contribution in this pilot study, looking at issues of ownership and control. It is therefore useful to consider the response to these questions by the participants before moving to the WSS 'to be' which represents the proposal regarding a possible improved work system. The WSS 'to be' also asked specific questions relating to information and technologies which made it possible to imagine the nature and type of technologies that could facilitate the data needed by the Wellness Centre, in order to facilitate better management of its functions.

Essentially the system of concern was approached using different methods from the systems methodologies SSM, WST and CSH. This facilitated the emergence of common issues and this commonality was clearly evidenced in the workshops. There was correlation between elements of the CATWOE analysis and the WSS. Where CATWOE identifies customers, actors and owners the WS snapshot identifies customers and participants. The CSH questions were designed to lead to a clearer understanding of the sources of influence (people/stakeholders) regarding the motivation, control, knowledge and legitimacy for the Wellness Centre. In this way it could be validated that all those involved had been identified, and the duplication of stakeholders in the different methods confirmed their validity as stakeholders, and their role with regards to the Wellness Centre. The CATWOE analysis described a transformation process, and this was broken down into major activities and processes in the WSS. It is important that the major activities and processes from the WS snapshot should fall within the description of the transformation process described in the CATWOE analysis. These common issues that are identified in each of the methods used demonstrates validation in that the same issues, stakes and stakeholders were identified using the different methods in the framework.

The information flow diagram (Figure 7) is effective in describing the possible information flow that is within the rich picture, but not explicitly clear to an observer, and represents where the capture of data in electronic form could facilitate

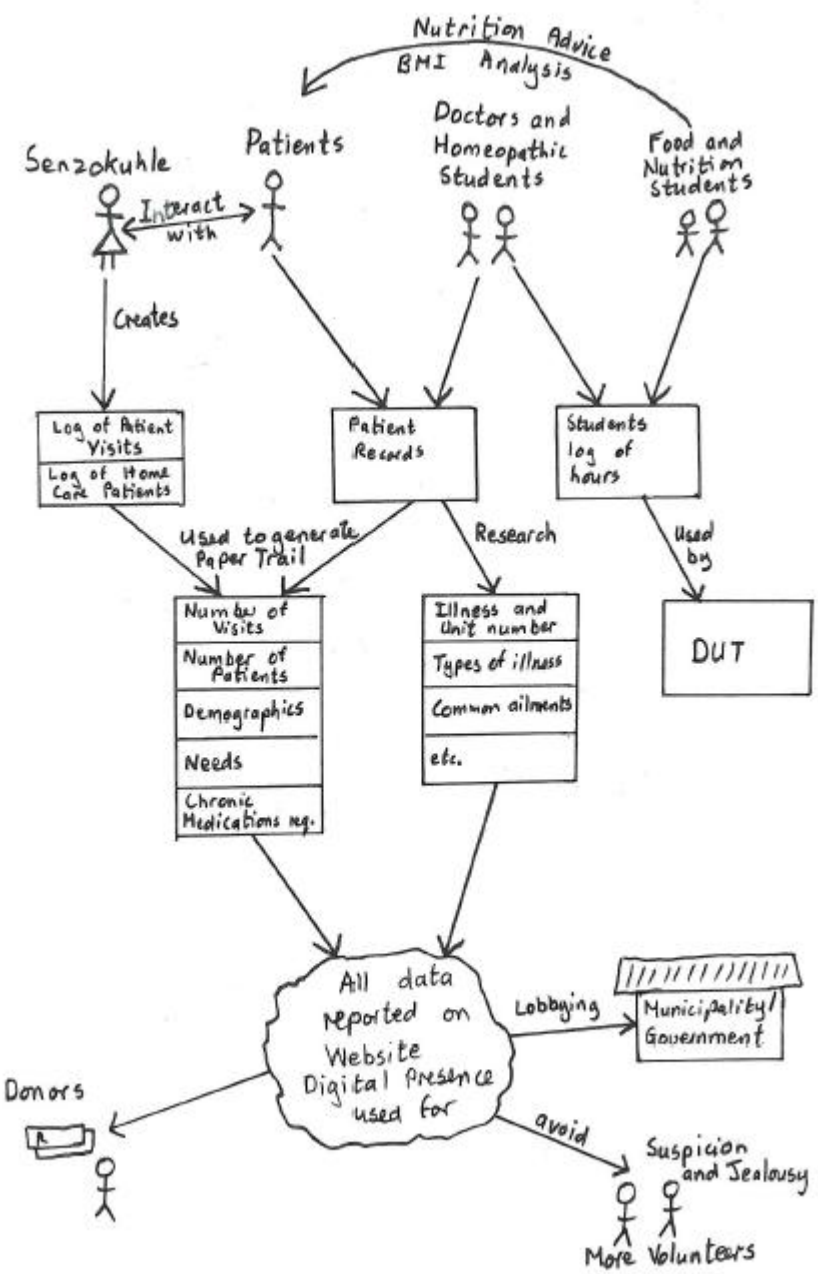


Figure 7: Information flow diagram associated with the Wellness Centre generated through the application of the Framework for Requirements Understanding by Clients

an improvement in operation. This is necessary in reviewing a manual system, but will also be helpful where a new information flow that was not previously considered arises from applying the framework to a problem of concern. The

information flow diagram represents the Information Architecture upon which an IS could be built. The information flow could be used for the purposes of transparency within the community, a record of finances received from sponsors and where the sponsorships were applied, information used in lobbying the municipality, and easier analysis regarding health issues and treatments for the purpose of management and research.

Where the information architecture is concerned with information flows and the supporting processes, the business architecture can also be generated from Figure 7, as stakeholders and the processes with which they are associated are also presented in this diagram.

The business architecture and information architecture are key building blocks when considering the requirements for an ISD project.

5.4.4 Validation of the framework as applied in the pilot study

The validation followed the previously described criteria by Checkland (1995). In order to evaluate the relevance of the framework, and the learning that was facilitated through the application of the framework, an evaluation from a stakeholder perspective was completed in the form of small group interviews held with each stakeholder group. This also provided "a systematic and focused way of managing the change process through problem-solving, decision-making and reflection" (Chiu, 2003: 166). In this case, each group consisted of stakeholders that were similar to each other according to their categorization as patients, volunteers and external stakeholders (including those from DUT). In the small group interview, each stakeholder group was presented with the result diagrams from the workshops. This included the consolidated rich picture (Figure 6), the CATWOE analysis (Appendix B), the WSS 'as is' (Appendix C) and 'to be' (Appendix D), the completed CSH questions in both 'as is' (Appendix E) and 'ought to be' mode (Appendix F), as well as the possible Information Flow Diagram (Figure 7). These diagrams were discussed according to the questions provided in Appendix A. The groups identified for the group interviews were:

- Homeopathy group (doctor and students);
- IT group;
- Patients and Senzokuhle volunteers;
- UFC at DUT;
- Food and Nutrition group; and
- Sponsor/donor group.

The general response across all groups regarding the rich picture was that it was informative and useful, generating an understanding of the issues affecting the Wellness Centre at Kenneth Gardens. One of the most difficult issues when faced with drawing the rich picture was a reluctance to actually draw. Using the rich picture in combination with the CATWOE analysis was useful in identifying the purpose of the Wellness Centre and how that could change.

The general response across all groups is that the WSS 'to be' did describe all the processes that take place as well as the initiator for each process. To facilitate better decision making the way in which data is recorded needs to change. The data can then be processed and presented in multiple formats, as required by each of the stakeholder groups. Data in electronic format is easier to analyse and present to stakeholders, as opposed to the availability of data in a manual filing system. The CSH questions assisted in considering who the stakeholders should be, and where the possible boundary for the system supporting the Wellness Centre should lie.

The general response across all groups regarding the possible information flow diagram was that the information flow can support the functioning of the Wellness Centre and be beneficial. This possible information flow had not been previously considered, as all information is currently recorded in lever arch files and books.

The participants responded that they had a more complete picture of the complexity associated with the Wellness Centre, including a more comprehensive identification of stakeholders. There was no specific group of stakeholders that were identified as not having been identified before.

Some comments from the group interviews that support the above conclusions are provided in Table 9.

Table 9: Comments made during small group interviews, identified by group, used in the ex ante validation of the Framework for Requirements Understanding by Clients

Stakeholder Group	Comments
Homeopathy group (Doctor and students)	Students "We just did not think about the complexity of the factors that influence our patients." "The rich picture helps in showing the complexity."
IT group	"From the Work System Snapshot 'to be' it would be easy to go ahead and develop Use/Cases for each work practice." "The WS Snapshot is useful as it describes the actor for each of the identified work practices and suggests the tools and information that should be used."
Patients and Senzokuhle volunteers	"To easily share information would greatly assist us." "Currently we are considering some medical Doctors to come here for consultations, it would be nice if they had the information from homeopathy for patients that consult both, and that they could share information with each other."
UFC at DUT	"It is very interesting that the lack of a residents' committee is seen as an influence on the Wellness Centre and a hindrance to information flow."
Sponsor/donor group	"This does show the complexity in the conflict at many levels that influence the Wellness Centre. If the jealousy and suspicion could just be reduced it would be a great help."

A broader understanding of the factors influencing the Wellness Centre was generated as a result of the workshops. The possible data flows and structures that could support the wellness Centre were identified. This evaluation therefore supports the relevance of the framework, demonstrated by the learning that was evidenced and reported on by those involved in the workshops regarding the Wellness Centre.

The second criterion for validation as described by Checkland (1995) is whether the framework is defensible, and is the framework competently built? The recognition and acceptance of a paper on the framework by the reviewers for a prestigious IS conference is used as evidence that the framework is competently built (see Wing, Andrew and Petkov, 2015). There were four reviewers for the conference paper and the following anonymous reviewers' comments demonstrated that the framework was competently built.

Reviewer 1 declared "I would argue strongly for accepting this submission" and went on to comment that the framework encourages a "progression state and tools for enhancing knowledge development during analysis and design of software requirements". Reviewer 2 commented: "This paper provides an interesting and novel premise of a mixed methodology approach to complex system design. It has solid grounding in current literature and thinking. The use of frameworks in eliciting requirements is a useful step in what is an on-going problem area. It provides the practitioner with socio-technical tools that allow them to develop critical thinking in requirements elicitation."

This framework was therefore validated in two ways; the acceptance and presentation of the framework at the ECIS 2015 conference validates that the framework is competently built. Following the conference, the framework was used in a pilot study at the Kenneth Gardens Wellness Centre to demonstrate the relevance of the framework and the learning that took place. This therefore completes the ex ante validation of the framework according to the two criteria as described by Checkland (1995) of being relevant and competently built.

The pilot study purpose was also to consider any adjustment that should be made to the framework as a result of reflection on its use.

5.4.5 Adjustments made to the framework as a result of the pilot study

This framework was applied within a context that was steeped in competing interests and where power relations between groups of stakeholders became apparent in the pilot study. The researcher has been made aware of many influences that could cause those involved to feel threatened. It is these issues of power that could explain the community reaction to the CSH questions, regarding control. This is a community project where hierarchy of control is rejected as control needs to be from the community themselves. It was noted that there was great sensitivity to any form of control being imposed on the community. This was clearly evidenced when there was a combined meeting of all stakeholders (workshop 3), and accounts for the stiff and formal atmosphere and a reticence on behalf of the participants to openly discuss

issues. This was a very strong contrast to the openness and engagement between participants in workshops one and two.

Resulting from this experience, in situations where there are competing interests and power relations or a group that has recognized authority over another group it is recommended that the framework be presented in workshops where only one stakeholder group is present. The results from the separate workshops can then be drawn together by the researcher and presented to a combined stakeholder group meeting for further discussion and reflection. This is a change where it was previously recommended that the initial presentation of the framework would be to a combined group of stakeholders.

The information flow diagram represents the Information Architecture upon which an information system could be built (Brancheau, Schuster and March, 1989; Galliers, 1993; Pereira and Sousa, 2005). This is a valuable outcome from the application of the framework in the form of a report back tool, and is generated from discussion that takes place during the implementation of the three methodologies (SSM, WST and CSH). In the case of Kenneth Gardens Wellness Centre there is currently no electronic management information system only a manual system. The information flow diagram was particularly useful in moving towards formulation of the requirements for an IS.

The WSS ‘as is’ was the first time that the consideration of technologies that could support the work system, were presented. The information flow diagram should be used in conjunction with the rich picture in future report back sessions and both affect the formulation of the WSS ‘to be’. The learning cycle for the framework is therefore adjusted so that the WS Snapshot ‘to be’ is the last element that is considered, as all the other methods develop understanding culminating in the WSS ‘to be’. This revised learning cycle is presented in Figure 8 and can be contrasted to Figure 4.

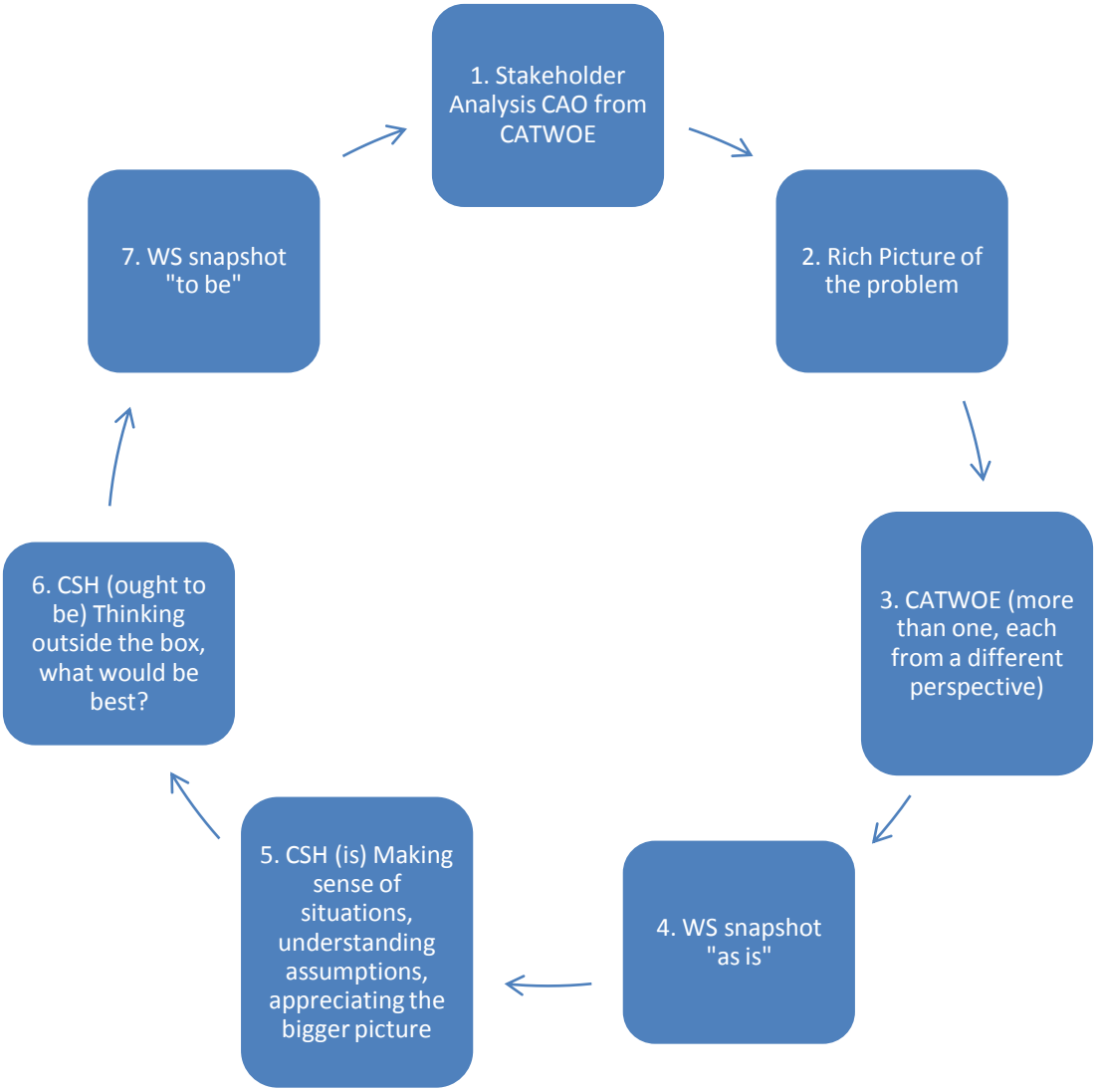
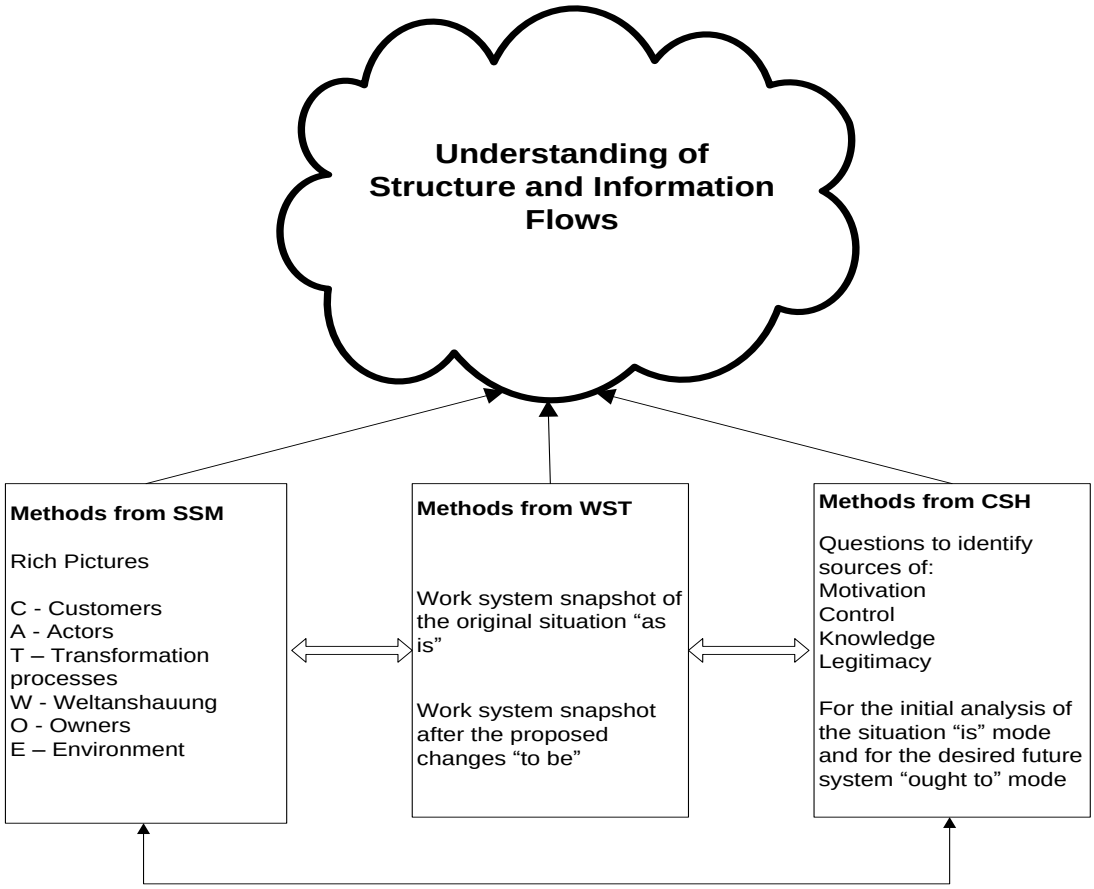


Figure 8: Revised Learning Cycle in the application of the Framework for Understanding of Requirements by Clients

In the pilot study, not all methods were used in full view of all the participants. This created confusion for some of the participants. It is therefore proposed that an introduction to the framework and methods used should be given at the beginning of the workshop. This includes a slightly modified framework diagram, so as to be more understandable to users. The new framework diagram and brief explanation designed for the main study are presented in Figure 9.

Purpose: The use of techniques and methods within a framework to gain understanding of, and promoting improvement in the management of Kenneth Gardens, in terms of identifying a suitable structure, processes and supporting information. The framework can be expressed as follows:



Methods from Soft Systems Methodology (SSM) – aim to identify the stakeholders, the structure of the problem and the processes associated with them in the form of a rich picture. Further the aim is to stimulate the development of multiple possible perspectives of the management of Kenneth Gardens through CATWOE analyses. Each CATWOE analysis defines several important aspects of a situation from a specific point of view like Customers, Actors, Transformation process, Worldview (Weltanschauung), Owners, Environmental constraints. Both methods are used to bring understanding on the complexities of the situation.

Methods from Work System Theory (WST) – we will apply methods from WST to draw up the Work System Snapshot (WSS) of the current situation and of the new system after the proposed changes. The WSS clarifies who are the customers associated with the situation, what are the products or services that are provided to them, what are the processes or activities associated with the delivery of the services, who are the participants or stakeholders in the problem, what is the information necessary for delivery of those products or services and what technology is used for producing the products and services. The work system under consideration is the Kenneth Gardens complex.

Methods from CSH – these questions are designed to identify the sources of motivation, control, knowledge and legitimacy for the management of Kenneth Gardens. These questions are used to describe the current situation (is-mode) and also the possible improvement (ought to be-mode). Answering these questions also helps identify what falls within or outside the scope of the problem – improvement of the management of Kenneth Gardens.

Figure 9: Modified framework diagram and introduction for future applications of the framework

5.4.6 Conclusion from the pilot implementation

The expected contributions (as outlined in Chapter 4) from SSM, WST and CSH used in combination in the framework were realized in the pilot implementation of the framework. The modifications proposed to the application of the framework as a result of the pilot implementation have been discussed and motivated in the previous section. Essentially this pilot implementation was a rich experience, showing how the elements in the framework effectively worked together to create an in depth appreciation of the possible improvements an information system could bring to the situation of concern.

Developing a common understanding of the problem, and a community that demonstrates this is referred to as the creation of normative knowledge (Conboy, Fitzgerald and Mathiassen, 2012). In terms of this project, as a result of the use of the framework we can observe the guided emergence of better understanding of client requirements for the Wellness Centre at Kenneth Gardens. This is in the form of better understanding of the elements influencing the Wellness Centre, and possible information flows that would better support the Wellness Centre.

The common understanding generated among the stakeholders creates a shared foundation upon which a possible IS to support the management of the Wellness Centre could be built. The WSS ‘to be’ provides a clearer foundation for the requirements of an ISD project which can be further developed into Use Case diagrams for the use of developers.

The validation of the framework has been presented through the effective use of the framework in a pilot study, demonstrating that learning took place, as well as in the presentation and acceptance of the framework at an international conference in IS.

The above reflection and improvements were used in guiding the main implementation of the framework discussed in the next section.

5.5 Results from the main study implementation of the framework to improve clients understanding of software requirements

5.5.1 The main study implementation of the framework

For the main study implementation of the framework, the larger situation of concern, the possible improvement in the management of the Kenneth Gardens Housing Estate and an information system that could support this was considered. The main study therefore encompasses a broader group of stakeholders than the pilot study. As the main study is still concerned with the Kenneth Gardens Housing Estate, some understanding of the community has been gained through the pilot study This experience and understanding assists in the broader description of stakeholders.

5.5.2 Stakeholder analysis expanded

The stakeholder analysis for the main study, considered the following stakeholders:

- The eThekwini Municipality, Department of Housing and Human Settlements.
- The Residents Committee of Kenneth Gardens. Although there was a Residents Committee, at the time of the study this committee was self-appointed, and was in the process of organizing for elections to take place.
- The youth of Kenneth Gardens. The group considered were those youth that had finished their formal schooling in the past three years.
- The NPO Carrot and Peas that supplies hot nutritional meals three days a week.
- The NPO Senzokuhle that provides home care and the Wellness Centre.
- Glenridge Church, community support, linked in with the NPO's and also "the Homework Centre".
- Durban University of Technology, the Urban Futures Centre, Department of Homeopathy, Department of Food and Nutrition.
- Glenmore Primary School, community support.
- Glenmore Community Watch.
- Community Police Forum Representative and Umbilo Police.

- The Ward councillor (duly elected for Ward 33, the municipal ward that includes Kenneth Gardens).
- The PR councillor, elected by the current political ruling party.
- The residents of Kenneth Gardens were represented through a number of the stakeholder groups described above and not treated as a separate group.

5.5.3 Application of the framework in the main study regarding the management of the Kenneth Gardens Housing Estate as a whole

The purpose in the application of the framework is to bring about an understanding of the complexity of issues affecting Kenneth Gardens and to contribute towards identifying suitable structures, processes and supporting information that an information system could provide and thereby could support improvement of the management of Kenneth Gardens.

With this purpose in mind, the modified framework (see Figure 9) was implemented in a series of workshops. Stakeholder groups that had already been involved in the pilot study were not called again to workshops. The stakeholders included through the pilot study were the NPO Senzokuhle, Patients of the Wellness Centre, the Homeopathy and Food and Nutrition departments from Durban University of Technology, Glenridge Church (Donor), the Urban Futures Centre from Durban University of Technology and software developers. The results from the pilot study workshops were included within the main study, as these stakeholders were considered to be stakeholders for the Kenneth Gardens Housing Estate.

For this main study, workshops were run with the Residents' Committee, a group of Youth from Kenneth Gardens, and the eThekwini municipality Department of Housing and Human Settlements staff. The residents' committee was a newly formed committee which had been drawn together with assistance from Dr. Rama Naidu the executive director of the Democracy Development Program (DDP). Due to the level of conflict and social tensions, separate workshops were held with each stakeholder group. In each case, the workshop worked through the methods in the framework in order to understand the problem and then moved forward to identify

suitable structures, processes and information to support the management of Kenneth Gardens. The results from the three separate workshops were considered and reviewed in small meetings with further stakeholders associated with Kenneth Gardens.

The further stakeholders included by consultation were the following:

- Glenmore School;
- The PR counsellor situated in Kenneth Gardens;
- The ward counsellor for Ward 33;
- Glenmore Community Watch;
- Community Police Forum representative and Umbilo Police;
- A Social Worker from eThekwini municipality; and
- The NPO Carrot and Peas.

The results from the separate workshops, and consultations with further stakeholders were then presented in a working session to which all stakeholders were invited. This included the pilot and main study stakeholder groups, as well as those individual stakeholders who had been consulted. This joint meeting to which all stakeholders were invited served as a working session as the results presented were open for discussion and modification by the stakeholders present. Care was taken to ensure that what was presented was generated from the facilitation of understanding in the application of the framework and not the researcher's own thoughts.

The results presented in this thesis are the results of multiple workshops where the framework was implemented and stakeholders consulted. Care was taken by the researcher to ensure that throughout implementation, the researcher did not insert their own view within the results. A brief presentation of the results of the methods used in the framework is presented next. In each case the researcher presents a composite view that was generated through the multiple workshops. Together these methods represent the complexity in understanding the situation of concern at Kenneth Gardens.

5.5.3.1 A rich picture

The composite rich picture showing the complexity of issues affecting Kenneth Gardens is depicted in Figure 10. This rich picture shows the Kenneth Gardens Housing Estate which is situated between the three neighbourhoods of Glenmore, Glenwood and Umbilo. The upper middle class homes surrounding Kenneth Gardens create a stark visual contrast to Kenneth Gardens.

Also within walking distance is UKZN's Howard College Campus and the Settlers Nursing Home. These have an impact on Kenneth Gardens in that there is a high demand for accommodation in the area. In some cases this has led to subletting of flats.

A number of schools are within walking distance from Kenneth Gardens. The easy access to schools also places a high demand for accommodation within Kenneth Gardens. There are also a number of crèche and pre-school facilities in close proximity to Kenneth Gardens.

Both within Kenneth Gardens and in the municipal parks adjacent to Kenneth Gardens, there is evidence of drug and alcohol abuse, as well as these areas becoming a general gathering place for people with loud music that disturbs the peace. It is also noted that fights often break out between revellers.

The flat units within Kenneth Gardens are in separate blocks, some of which are in an acceptable state, and some of which are in dire need of repair. There is also structural damage to a number of pathways, staircases and windows. There are some broken washing lines, and a children's' playground that is in disrepair. At the beginning of 2016, the grounds were very overgrown, which adds to the general derelict state of Kenneth Gardens.

Adding to this rundown state is a lot of litter, including broken glass. There is also dumping of rubbish unused/broken furniture. Although there is a set dumping site, recognized by the municipality, illegal dumping takes place in a number of places.

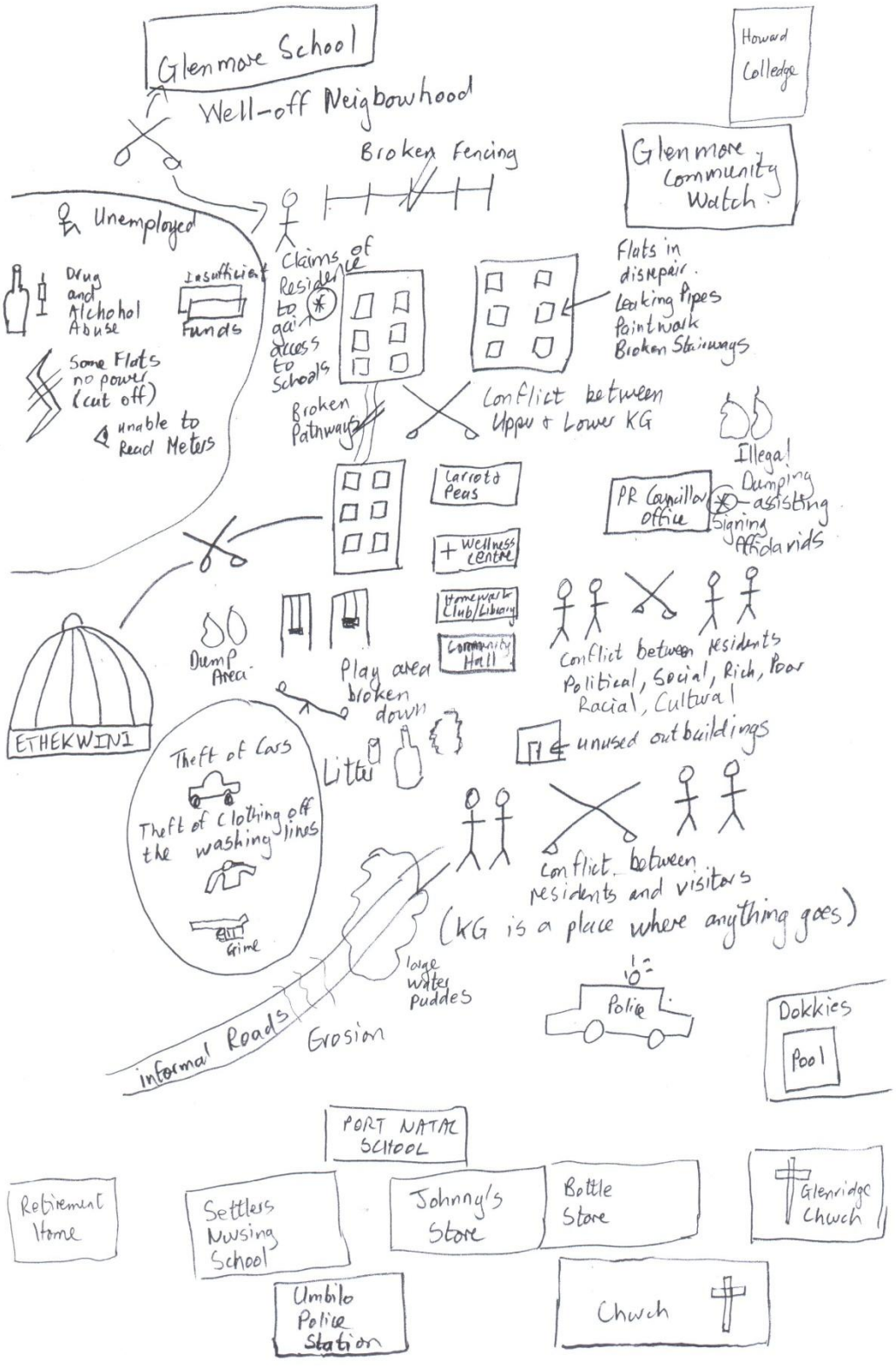


Figure 10: Rich picture identifying issues and structures affecting Kenneth Gardens Housing Estate

The fence that surrounds Kenneth Gardens is broken in places, and in some places non-existent. The easy access to Kenneth Gardens results in people using access to the grounds as a short cut and also for general access by those that want to join in, visiting and partying with others, creating a mix of residents and non- residents.

A number of informal roads have been created within Kenneth Gardens by residents wishing to park their cars as close as possible to their flat. According to residents it is not safe to park your car in the street. These informal roads have resulted in erosion, and large water puddles which form after rain. These roads also cut across what used to be children's play areas. As Kenneth Gardens is a municipal housing estate for people of low income, the municipality questions the need for roads and parking, as public transport should be being used.

There are also reports of theft off the washing lines and other theft that is attributed to those walking through the complex as a short cut.

There are various levels of conflict between residents of Kenneth Gardens. The conflict between neighbours may be due to different cultures, resentment between the 'haves' and 'have nots', political differences, even conflict between upper and lower Kenneth Gardens, or it may just be personal as can often happens between neighbours. There are some residents that run businesses from their flats (illegal according to the lease agreement) and this can also cause conflict between neighbours. There are also some unused store rooms and outbuildings which are invaded by squatters who live there.

There are a number of outbuildings that have been privately renovated through community initiated projects (the Wellness Centre, the Homework Club). The homework club provides a venue for children to be able to work at a desk and complete their homework. There is also a library for the children. All these initiatives have been from within the Kenneth Gardens community, relying on support from within the community and also charity organizations that may be outside the community. Some of these initiatives have the support of the municipality, but this is not always the case.

5.5.3.2 CATWOE analysis, different perspectives regarding the Kenneth Gardens Housing Estate

Continuing with SSM, various CATWOE analysis tables were completed in the different workshops that showed different perspectives for the management of Kenneth Gardens.

CATWOE analyses were completed from the following perspectives:

- CATWOE analysis eThekwini Municipality;
- CATWOE analysis sponsor/business;
- CATWOE analysis the residents' committee;
- CATWOE analysis completed in the youth workshop, from the point of view of the youth; and
- CATWOE analysis for the Wellness Centre

In these CATWOE analyses it was possible to see common elements that appear within each different perspective. These common elements are important in moving forward.

- The **C**ustomers are the tenants currently residing in Kenneth Gardens and any future tenants.
- The **A**ctors are the municipality, the Kenneth Gardens community, service providers and sponsors.
- The **T**ransformation is from the current state to improved living conditions.
- The **W**orldview is that the community working together will make a difference at Kenneth Gardens. The community needs to be effectively involved.
- The **O**wner of the buildings and leases is the municipality; the **O**wner of making Kenneth Gardens a better place to stay is the current residents of Kenneth Gardens.
- The **E**nvironment is affected by politics which means with each municipal election there may be changes to the management of Kenneth Gardens. The municipality in turn also operates within strict budget constraints. There is currently frustration and conflict between all actors.

The rich picture and multiple CATWOE analysis bring understanding regarding the complexity of the problem and the different views held by stakeholders.

Using CSH created further discussion regarding the different stakeholders (social roles), the specific concerns (stakes) and key problems (stake holding issues).

5.5.3.3 Critical Systems Heuristics

Critical Systems Heuristics was used in further exploring the stakeholders, specific concerns and key problems. The CSH questions were completed in both the 'is' and 'ought to be' modes. The CSH 'ought to be' shown in Table 10, represents the collective answers from stakeholders participating in the workshops.

Table 10: Composite response to Critical System Heuristics questions in the 'ought to be' mode for the Kenneth Gardens Housing Estate

CSH Questions – OUGHT TO BE
The first group of questions are used to identify the different stakeholders (social roles). **1.** Who ought to be the beneficiary ('client') of the management of the Kenneth Gardens housing estate? *Tenants.* **2.** Who ought to be the decision maker (in command of resources) that enables the success of the management of the Kenneth Gardens housing estate? *Landlord (eThekwini Municipality).* *The chairperson of housing Mr Gumede.* *The residents' committee is making a difference in representing the Kenneth Gardens community to the municipality and negotiating regarding issues of concern.* **3.** Who ought to be involved as providing expert support for the management of the Kenneth Gardens housing estate? *eThekwini Municipality.* **4.** Who ought to be representing the interests of those affected by the management of the Kenneth Gardens housing estate, including those that cannot speak for themselves (e.g. future generations, environmental issues...)? *Residents' committee, councillor ward 33 and PR councillor*
The second group of questions are used to identify the specific concerns (stakes). **5.** What ought to be the purpose of the management of Kenneth Gardens? *To provide low income rentals for the community.* *To maintain the property in a good state.* *To ensure safety of those living there.* **6.** What conditions of success ought to be under the control of the management of Kenneth Gardens? *The municipality is in control of all factors such as maintenance, service provision etc.* *The people of Kenneth Gardens working together could add to the success.* **7.** What ought to be relevant new knowledge and skills for the management of Kenneth Gardens? *Empower the people that are living there.* *Partnership between the residents' committee and the municipality.*

Schedules for maintenance of flats, schedules for cutting grass etc. so there is regular care and maintenance.

8. To what degree and in what way ought the interests of the affected to be free from the effects of the management of Kenneth Gardens?
The interested and affected are NOT free from the effects of the management of Kenneth Gardens. There are some however that have renovated the flats that they live in and due to this ability to complete their own maintenance do not suffer as much as those that cannot afford their own maintenance.
The affected are the tenants. If the tenant is a law abiding citizen receiving low income housing they should really be able to live without being affected by the management of Kenneth Gardens. As long as the grass is cut and the flat is maintained there is no problem. When the tenant is breaking the rules, then there is confrontation between the tenant and the Municipality.

The last group of questions are used to identify the key problems (stake holding issues).

9. What ought to be the management of Kenneth Gardens measure of success (or improvement)?
When all complaints are resolved within the time frame. Happy tenants. Collection of 100% rental.
Improvement in the living environment for those living in Kenneth Gardens – maintenance of buildings, pathways, storm water drains, playground, plumbing, post boxes etc. (Note: to measure this improvement need to show requests made, and requests answered.)
10. What conditions of success ought to be outside the control of the decision maker?
The external conditions of success rest with the municipality.
Motivation and dignity – this has to come from those living in Kenneth Gardens.
11. What ought to be regarded as assurances of success for the management of Kenneth Gardens?
Feedback from tenants (unknown if the problem was resolved).
Visiting – open communication, having the time to check up on issues.
The support from all residents in Kenneth Gardens for the residents' committee – one united voice presented to the municipality rather than a fractured community.
12. What opportunities ought to be there for reconciling the different worldviews of those involved and affected by the management of Kenneth Gardens?
Communication (what is the municipality doing, what issues have been resolved).
Visits from senior officials, acknowledging the tenants and their issues/requests.
What is being done, what is not being done (and the reasons why).
United residents that all buy into the safety and security issues. Agreement of residents to work through the structure of a residents' committee rather than making individual representations to the municipality. Opportunities lie in a coordinated and communicating community.

It was noted by the researcher that although separate workshops were held with different stakeholder groups, there was a lot of commonality in the response to the CSH questions.

5.5.3.4 The work system snapshot

A composite work systems snapshot of 'what could be' is presented in Appendix G showing the customers, products and services, major activities and processes as well

as the participants, information and technologies to support the activities and processes.

5.5.4 Main study, reflections and learning about the problem situation

This was indeed a complex problem situation that was fraught with many areas of possible conflict. Running workshops with separate stakeholder groups was a way to get each group to effectively participate, rather than be concerned with debate with other stakeholders. These separate workshops were necessary to build an element of trust between the researcher and the different stakeholder groups. The need for separate workshops was a conclusion from the pilot study and proved effective in the main study. Working with a municipal department that has to work within the budget and procedures as determined by the City Management, and a community that reports a lack of service delivery over the last fifteen years was indeed an intimidating task. The following understanding was gained through the implementation of the framework. It needs to be stressed that this understanding was gained by those who participated in the workshops and consultation meetings as well as by the researcher.

The eThekwini Municipality owns the Kenneth Gardens flats. The Department of Housing and Human Settlements lets the Kenneth Gardens flats to low income tenants. The Department therefore acts as the landlord and as such is responsible for the maintenance (external) of the flats. The factors affecting Kenneth Gardens, both social and physical has been represented in the rich picture and narrative in the previous section. The following main issues were identified using the framework in the workshops:

- **Allocations/De-Allocation of flats**

The Department of Housing works within the current lease agreement and the accepted processes and procedures that are defined within the eThekwini municipality. Currently the lease agreement does not state that a flat should be left in the condition it was when it was first leased (adding to the maintenance budget). Substitution (inheriting a lease) is also possible but the new tenant has to be screened

to see if they meet the tenant requirements. Being in breach of the lease agreement can be described as taking place in the following ways:

- Non-payment – this is handed over to the bad debts department for collection.
- Absconding – this often results in illegal occupants, and problems of debt collection.
- Breaking the rules of the lease agreement – sub-letting, running a business, pets, earning additional income (over the income bracket).

When a person is moving out they should report to the Department of Housing and Human Settlements, giving one month's notice and returning the keys. Often this does not take place, and tenants abscond. This may sometimes be due to outstanding rental, but there is really no mechanism to monitor this. Tenants that are termed 'illegals' move in, often this happens over a weekend (when no officials are on duty). Current legislation makes it very difficult to evict an occupant once they have taken up residence. Requests for allocation are forwarded to the housing department by the social worker. The social worker currently has to prioritise the sick and the elderly but the Kenneth Gardens flats are not designed for the disabled (flights of stairs), and the zoned hospital is Wentworth Hospital which is a two leg taxi trip away. Requests for allocations also come through management directly from City Hall (usually for those seeking political asylum and a safe place to stay). This process has not been reflected in the information flow diagram, as it is an issue that is essentially internal to the Department of Housing and Human Settlements, but this directly affects the Kenneth Gardens community, and is a cause of concern for the community. The community however needs to play their part in making it accepted practice to inform the Department of Housing and Human Settlements when tenants are moving out to prevent the 'illegal' occupation of units.

- **Maintenance issues**

Currently there is ongoing conflict between the tenants in Kenneth Gardens and the Municipality regarding the maintenance of flats and surrounds. The municipality by nature is affected by politics, both at the local and provincial levels. The

municipality works within structures and procedures that are in place regarding billing and maintenance. With regards to the management of Kenneth Gardens the concern directly bearing an impact between tenants and the municipality is maintenance. There are many perceptions and misconceptions regarding maintenance. A system put in place to effectively log maintenance requests, the nature of the request, and the resolution regarding the request should be available to assist both the management of Kenneth Gardens, and communication to the tenants regarding their request. Communication of decisions made is important. Due to budget constraints there are requests that will not be met but these decisions need to be communicated to the Kenneth Gardens community. Cyclic maintenance (for example painting of blocks) need to be consistently budgeted for and the planned schedule communicated to the Kenneth Gardens community.

- **Security**

Security is an issue that is a concern for Kenneth Gardens' residents. The Glenmore Community Watch would like to be able to liaise with Kenneth Gardens regarding security issues and events that occur in the area. There is no communication regarding security issues and incidents, only word of mouth. Substance abuse is also an issue of concern at Kenneth Gardens.

- **Consolidated Billing Electricity and Water**

Another issue concerns billing and electricity. As explained by the residents it is very difficult to budget for electricity costs, when the meters are read at the end of the month, and the bill is received the following month. The possibility for pay as you go electricity units to be installed could assist in resolving these issues. Water is also not individually metered to each flat. A total reading is divided equally to each flat unit. This does not consider the number of people housed in each flat. Given the current drought and water shortage, separate meters would encourage a more responsible water usage, and a fairer billing for water.

- **General concerns**

There is also no clear direction regarding donors or sponsors. Should a donor wish to make a contribution to Kenneth Gardens, who do they communicate with? Other issues that are of concern are environmental. There are dumping and litter issues. There are currently no facilities for recycling. Another issue that was raised was regarding tenants that are up to date with their rental and those that are in arrears. Is it feasible to consider tenants that are up to date on their rental differently? For example, install pay as you go electricity meters for those that are up to date?

Given these above issues that were identified through the workshops, a business architecture diagram is provided in Figure 11. Essentially there needs to be a structure that efficiently affects communication between the residents of Kenneth Gardens, the organizational units that exist and the municipality. Should the residents' committee become a duly elected committee, elected by the residents of Kenneth Gardens it is possible that the residents' committee could fulfil this role. Another possibility is to have a supervisor present at Kenneth Gardens that could fulfil this role.

The elements identified in the workshop that are not currently present are shown as standing on their own: security, recycling, donors and any other possible new initiatives. These can only become part of Kenneth Gardens by organization within the community themselves. A way forward for donors and any other new initiatives needs to be created so that there is a responsible body that can be communicated with. This could be the residents' committee or a supervisor but this needs to be with the support and recognition of the community at Kenneth Gardens.

The communication between the municipality and residents needs to be greatly improved. At the moment there is too much dependence on verbal communication especially regarding maintenance issues. One possibility is to use text messages to a cell phone; not only is this cheaper than voice but the message is static so can be reviewed at a later date. In addition, general information which applies to all residents could be communicated in this way. A system using all lease holders cell phones would make communication from the municipality easier and cheaper.

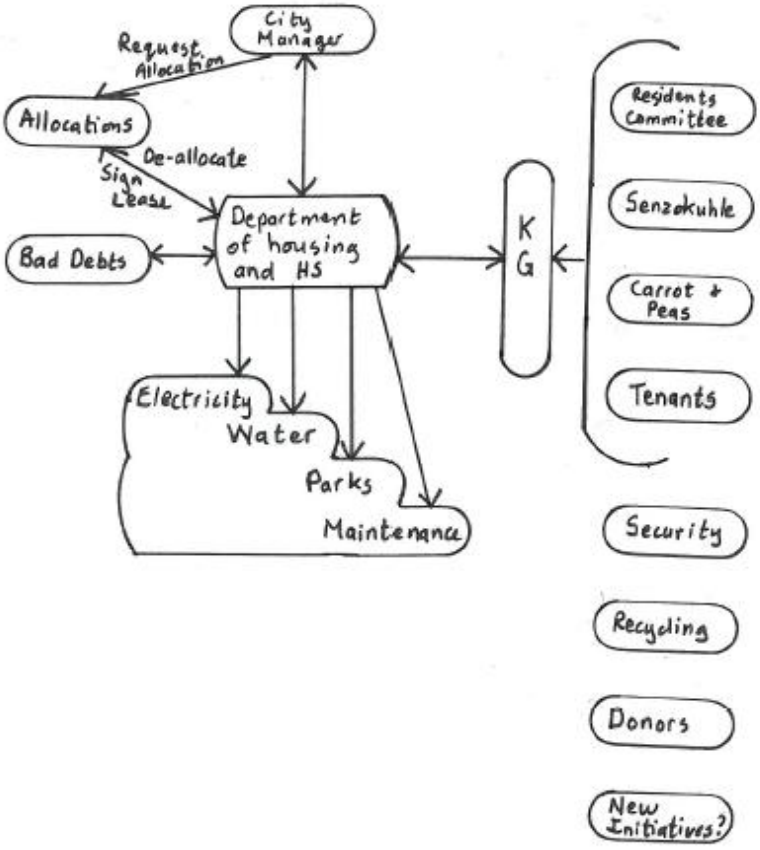


Figure 11: Business architecture for the management of Kenneth Gardens Housing Estate

Shown in Figure 11 are the other departments within the municipality that the Department of Housing and Human Settlements works with in managing Kenneth Gardens. What is not shown in the diagram is the need to separate maintenance into two major categories. This is shown in the information flow for maintenance that could improve the management for Kenneth Gardens presented in Figure 12.

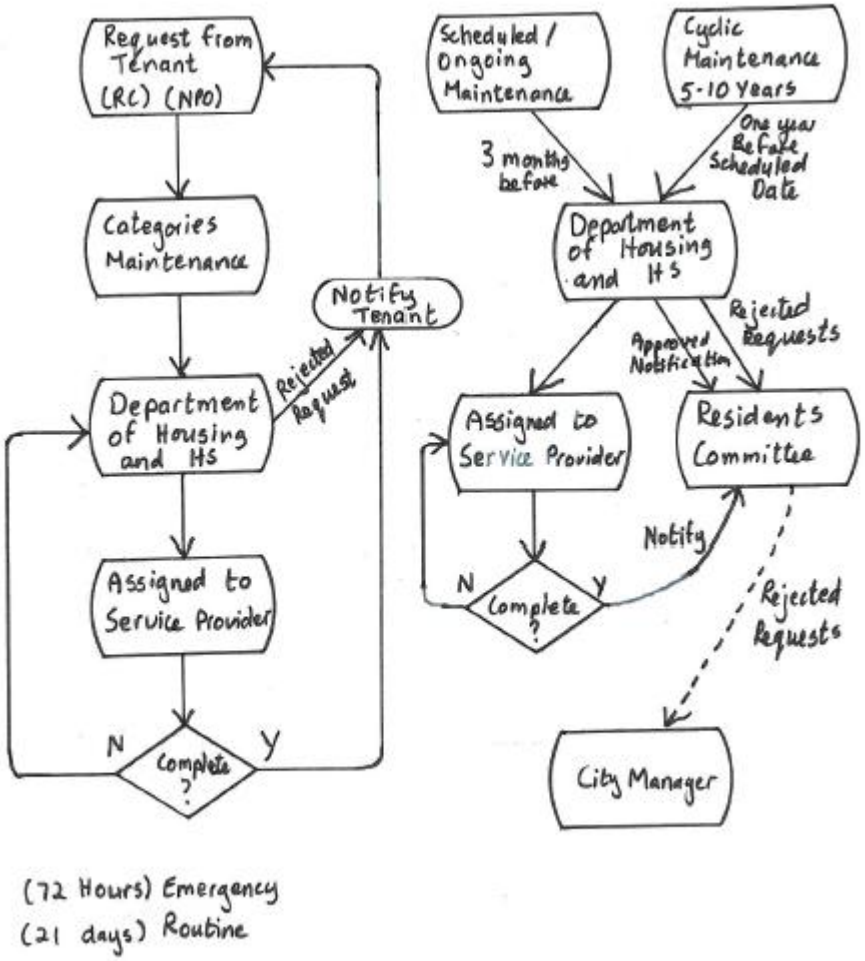


Figure 12: Possible information flows for the management of Kenneth Gardens Housing Estate maintenance both requested and scheduled

Currently a maintenance request takes a very long time (even although there are strict guideline times presented below). A maintenance request can involve as many as five inspections from the supervisor and maintenance inspectors both before and after the maintenance is complete. These inspections are all completed by staff appointed within the department of housing structures. In each case there is a claim for travel to and from the location, as well as the long period of time taken for so many inspections.

There are two information flows drawn in Figure 12. One represents routine and emergency maintenance that is based on a request from a tenant (or from the

residents' committee representing a tenant). The time frame is 21 days for routine maintenance and 72 hours for emergency maintenance. When the maintenance has been completed the tenant should be notified. If the request is rejected, the tenant should be notified with reasons why the request is rejected. Information regarding the status of the maintenance request should be easily available to the tenant at all times.

The second information flow represents scheduled or ongoing maintenance and cyclic maintenance (5 or 10 year cycle). The schedule needs to be planned ahead of time, in order to budget for maintenance requirements. As maintenance affects the entire complex, the proposed liaison is the residents' committee. What recourse is there when scheduled maintenance does not take place? The City Manager? The communication of rejected requests is important; there may be insufficient funding to support all requests, but a clear record of requests and scheduled maintenance which could not take place should be a matter of record for the Kenneth Gardens community and the Municipality.

5.5.5 Reflection on the framework after implementation in the main study

This framework is designed as a systemic framework. Systems thinking recognizes complexity and that often there are competing goals within a system. There are also social, cultural and cognitive elements which further influence the system in different ways. The importance of the social interaction between those involved is taken into consideration. Systems thinking therefore involves thinking about processes rather than separate structure, the interconnections rather than separate components and the relationships existing within the structures are taken into consideration.

The workshops implementing the framework were held from February to June 2016, amid increasing and violent protests regarding municipal service delivery throughout South Africa leading up to the municipal elections scheduled to take place in August 2016. What was occurring on a national level was reflected in the situation at Kenneth Gardens. These political and social conflicts were therefore a significant

factor for this study. Yet despite these pressures, the framework created an understanding of the factors influencing the management of Kenneth Gardens, as well as a possible way of making the management more effective. The framework became a communication tool through which issues could be discussed, which in this case was very valuable in creating a way for the communication between stakeholders to take place. Getting all stakeholders together for the final working session is attributed to the nature of the framework and that stakeholder experience with the framework meant that issues could be discussed as issues of Kenneth Gardens and not personal issues and agendas. The framework therefore is seen to have created a non-threatening environment for stakeholders to come together.

The elements in the framework were drawn together using CSP, critically choosing methods from different systems methodologies that support each other in order to bring understanding of a complex situation, the hypothesis being that mixing methods from different systems methodologies would create a more powerful framework. The interdependence of methodologies and how the different methods support each other was clearly demonstrated in the main study.

The rich picture brought an understanding regarding the complexity of issues and physical factors affecting the situation of concern. The rich picture gave participants a chance to reflect and think about the system issues rather than the few that they found the most important for them as an individual. Completing a CATWOE analysis from different perspectives also helped in broadening the participants' perspectives. In addition, the CATWOE starts to introduce the thinking regarding: who are the customers, the actors, the transformation process, the worldview, the owners and environment. This essentially starts to lay a basis for the WSS. Before working with the WSS, the CSH questions are used to again think more clearly about 'who, what and why' the issues we need to consider regarding the situation of concern.

Using the CSH questions very quickly showed areas where stakeholders had a similar view, and areas where there were different opinions and possible conflicts.

Using a set of questions created a distance from direct conflict that can sometimes occur in other more traditional forms of information gathering.

From these discussions it is possible to move forward to the WSS. The WSS assimilates the information into a form that can be easily used by software developers regarding the requirements for an IS.

The framework is designed to support the understanding of all stakeholders (that are not technical experts) and yet generate sufficient information for the understanding of requirements for an appropriate IS. Deriving a business architecture and information flow is a very strong basis on which to draw IS requirements. It is also significant that to support the identified business architecture and the information flow changes in the way things are done may need to take place. These possible changes are generated during the process of the application of the framework and include changes to the environment, or the work system that the information system is to support. As this is the context for which the framework was designed, it is good to see evidence of this in the main study.

There is an indication that the framework was of use in this situation of concern. In addition, stakeholders who attended the final working session were asked to complete a brief evaluation questionnaire (see Appendix H). This showed that stakeholders found the workshops useful and meaningful regarding the situation of concern. It is interesting to note that the method that was most appreciated by participants was the rich picture, as this gave them an appreciation of the complexity of social issues and how physical elements also influence the situation of concern.

From the researcher's perspective, the participants felt more comfortable with the rich picture, but the other methods in the framework brought more clarity regarding 'who what and why', and thereby support the understanding of the rich picture.

From this rich experience, the framework showed the potential of improving the understanding of software requirements by clients, in complex problems where possible changes in the work practices that support the information system are likely to take place.

5.6 Conclusion

The framework presented in this research was designed to bring clients to a better understanding of software requirements. In both the pilot and the main implementation of the framework there was clear evidence that those involved (the stakeholders) had:

- A clearer understanding of the complex problem and that there are a number of factors that influence the problem.
- The ability to represent the complexity within a rich picture.
- There are different perspectives from which the problem can be viewed.
- There is a possible information flow that can better support the management and decision making for Kenneth Gardens (and the Wellness Centre).
- There is a business architecture that can better support the information flows that can improve the situation of concern.

For stakeholders (or clients) with no business or IS background, it can be seen that understanding was generated through the framework application, without the stakeholders becoming concerned regarding technological requirements.

The framework in both the pilot and main study demonstrated the following:-

- Relevance, the framework was relevant to the situation of concern
- Completeness, the framework facilitated a more complete understanding of the situation of concern to emerge
- The emergent understanding was comprehensive in that it included the perspectives of different stakeholder groups
- Consistency was demonstrated where the same factors were raised through using different methods from each methodology consistent
- Appropriateness of the methods used to generate the emergence of understanding was evidenced in both the pilot and the main study.

Working with the Kenneth Gardens community, in both the pilot and the main study, was an incredibly rewarding experience. It was also rewarding to work with the Department of Housing and Human Settlements participants who actively became

involved in working towards a better way for the management of Kenneth Gardens. It is hoped that this research will make a difference to all stakeholders at Kenneth Gardens and the eThekwini Municipality. This is supported also by the reflections and learning from the implementation of the framework discussed in the next chapter.

Chapter 6: Findings of this Research

6.1 The third stage following ADR: reflection and learning

This third stage of ADR requires reflection on the goals of this research, and how they were achieved. The main goal of this research was to investigate the problem of a clients' understanding of IS development project requirements and to propose a way to address these problems. From an analysis of the literature and a deeper understanding of the nature of the problem, a systemic framework was developed.

The systemic framework was drawn together using methods from different systems methodologies. This required investigation into the theory of mixing methods, and the application of Critical Systems Practice in selecting the methods chosen for the systemic framework. This systemic framework was accepted and presented at ECIS 2015 (Wing, Andrew and Petkov, 2015) which is used here as evidence that the framework is competently built and, further, that the application of Critical Systems Practice and the mixing of methods was appropriate in the drawing together of the framework.

The validation of the framework is an application of design science where the framework is considered to be the artifact that has been designed. The framework is validated by first being applied ex ante in a pilot study. After reflection and adjustment to the framework it was applied ex post in a main study. In both cases, ADR as described by Sein *et al.* (2011) was used in the implementation and evaluation of the framework. The view of the stakeholders who participated in the studies, and the resulting demonstration of understanding generated through the application of the framework, is evidence for the validation of the framework.

The pilot and main implementation of the framework showed that the issues raised by Markus and Mao (2004) calling for the rich and meaningful participation of stakeholders and further extended by Alter (2009b) calling for project collaboration are addressed within the systemic framework presented here. The framework provides an effective technique through which deep communication between those

involved, affected and the software developers can be generated. The framework encompasses a 'whole' understanding of the problem and does not separate the social and technical systems. It was noted in this thesis that this separation and emphasis on the technical has often been cited as reason for developer bias in the requirements specification for an ISD project resulting therefore in inaccurate requirements. The framework presented here aims to overcome these problems by focusing on understanding the whole with no separation, thereby taking the ensemble view of the IT artifact (Orlikowski and Iacono, 2001; Sein *et al.*, 2011).

Both the pilot and the main study presented in this thesis demonstrated the effective application of the framework to a situation of concern, and the emergence of clearer understanding of requirements by clients. In each case the problem was complex and also presented many diverse stakeholders. The three methodologies chosen for the framework were chosen using multiparadigm multimethodology. The framework therefore covered a broad base of stakeholder interests from unitary (WSM) to pluralist (WSM and SSM) as well as pluralist and emancipatory (CSH). The success in the implementation of the framework in the pilot and main study, a pluralist project context, is attributed to the way in which the methods chosen complement each other and thereby facilitated the emergence of understanding.

6.2 Theoretical contributions

The theoretical contribution to the field of IS arising from this study is the provision of a systemic framework for better collaboration between clients and developers in IS requirements analysis. The need for this contribution to the field of IS was clearly presented from the analysis of existing literature as discussed in Chapter 2.

Further theoretical contribution is made to design science research in providing an instance of an artifact of design science that complies with the principles of ADR. The artifact of design science is the framework. The process of ADR has been theoretically enhanced by adding proper justification for the selection of the methods to be included in the framework on the basis of CST and more specifically its meta-methodology CSP (Jackson, 2003).

The theoretical contributions of this research fall within the category of theory for design and action, category five as described by Gregor (2006) in her analysis of theory types in information system research. Type five, theory for design and action states: "This type of theory says *how to do* something. It is about the principles of form and function, methods, and justificatory theoretical knowledge that are used in the development of IS" (Gregor, 2006: 628). This has been demonstrated in this thesis in the design of the framework.

6.3 Practical contributions

The thesis provides practical contribution to the field of IS, by showing how collaboration between clients and developers in IS requirements analysis can be improved through the proposed framework and its field implementation. This was clearly demonstrated in the field implementations of the framework. The framework provided a way for communication between the various stakeholders through using the framework as a technique and thereby creating an environment enabling participants to resolve the conflict and disagreements.

There is also a practical contribution to design science research in IS because to the best knowledge of the researcher there are no other previous reported cases of ADR being applied to a real problem in IS besides brief details of a case study in the original paper on ADR (see Sein *et al.*, 2011). Applying ADR in a field study is practically demonstrated in this thesis.

There is further practical contribution to systems thinking and CSP as it is clearly demonstrated how CSP can enhance ADR (a recent methodology in design science in information systems) in the process of selecting and justifying the methods chosen to be part of the framework. This therefore serves as a practical example and demonstration of CSP in use.

Another practical contribution is in demonstration of the mixing of methods used in this framework. It is clearly shown that a mix of methods can assist in addressing the complexity of a problem. The expected benefit from the application of each method in the framework was also demonstrated in its application to a real-world problem.

6.4 The fourth stage following ADR: formalization of learning

The formalization of learning involves taking the learning from this action design research project, and reflecting on whether what was learnt can be applied as general solution concepts for a generalized group of problems. This is described as the fourth stage of ADR (Sein *et al.*, 2011) drawing on the principle of generalized outcomes. This forms part of the theoretical contribution of the framework.

The framework itself is viewed as a design science artifact that is implemented in creating a solution to the problem of bringing clients into a clearer understanding of ISD requirements. As was presented in this research, the framework was designed for a specific class of problem described as complex wicked problems, where not only an IS had to be considered but also possible changes to the work systems that support the IS. The framework therefore is applied specifically as a systemic framework considering the interconnected nature of all issues. The learning from this framework application is that considering the social and technical aspects together as a whole allows an understanding of the problem to emerge which is a positive step toward preventing a technical bias in the requirements elicitation phase for ISD projects.

The result of the application of the framework is an understanding of a problem situation, where the following are produced: a rich picture, various CATWOE analyses, answers to CSH questions asked in both ‘as is’ and ‘ought to be’ modes, and WSSs that represent the ‘as is’ current situation, and a proposed ‘to be’ WSS. Derived from the discussion and interaction during the workshops that generate these diagrams is a proposed information flow diagram and the supporting business architecture. These results from the implementation of the framework can be used to generate the requirements for an ISD project. The framework is viewed as being generic enough to generate software requirements when applied in a different context.

6.5 Limitations of the study

This study has been applied to a real-world problem which is steeped in politics and strong feelings of frustration between stakeholder groups. The situation of concern demonstrated conflicting interests with issues of power and the possibility of coercion. In both the pilot study and the main study where the framework was applied, the situation of concern has no existing IS in place but there were some elements of work systems within which the work was being done. This framework brought a deeper understanding of the problem, and proposed changes in work practices that could support an IS. Would the framework be as effective when applied in a case study where there is already an existing information system? This question has not been answered by this research, although it is proposed that the framework could still achieve its objective of promoting clients' understanding of requirements.

The pilot and main study were entirely dependent on participants volunteering their time. This could have had a positive influence on the study, as all those that were present had expressed an interest in the problem. There is however a possibility that key stakeholders did not give their input as there was no compulsion to attend the workshops. Would this be different in the case of a corporate study where stakeholders are instructed by their employer to attend a workshop? It is proposed that the nature of the framework and the methods used would draw out even the most resistant stakeholder to actively participate.

Due to financial and time constraints, this study did not continue on to the development and implementation of an IS. The development and implementation of a complete new information system for Kenneth Gardens was outside the scope of this research.

6.6 Directions for future research

The systemic framework presented in this thesis has been theoretically and practically validated. To further explore the value of the framework its application in different settings would serve to further validate and possibly refine the framework.

Another direction would be to practically apply the framework to a situation of concern where there is already an existing IS and consider if this influences the effectiveness of the framework in any way or whether the current system in place is appropriate

6.7 Concluding remarks

The implementation of the proposed framework in a real-world problem enabled the demonstration of the benefits emerging from the framework. This further demonstrated that the theory used in creating the framework was valid. Each appropriate method included in the framework brought an understanding to the diverse dimensions of the problem and assisted in bringing stakeholders into a clearer understanding of requirements. Depth of understanding was gained in using all the methods in the framework.

The framework enables the formulation of Business Architecture and Information Architecture while formulating client requirements for an IT project and generates the desired WSS. The latter approach was recently demonstrated as very useful for formulating use cases, an important Object Oriented Analysis and Design technique (see Alter and Bolloju, 2016) which further indicates the relevance of this framework.

The researcher hopes that the proposed framework for improved client understanding of software requirements through better participation in projects will assist ISD practice.

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Appendix A: Evaluation questions, Pilot Study

Questions for evaluation of the framework during small group Interviews

1. Consider the rich picture developed from the workshops.
    - Are all the influences on the wellness centre shown? (any you could add)
    - How did you feel when asked to draw a rich picture (was there a difference before/after you had drawn it)?
    - Is the rich picture useful in developing an understanding of the problem? (New knowledge new information, does it help you to understand the complexity more)
2. Consider the possible information flow diagram developed from the rich picture.
    - Is this a feasible flow of information?
    - Would the information flow benefit the Wellness Centre?
    - Had you thought of the possible flow of information before?
3. Examine the work system snapshot (this was gathered from the discussions that took place during the workshops).
    - Is this a useful diagram the presents the wellness centre. (What is/isn't useful?)

Appendix B: Different CATWOE analysis for Kenneth Gardens Wellness Centre

Different descriptions (boundaries) for the wellness centre

	The Wellness Centre – a homeopathic clinic run on Wednesday Mornings
C	Patients
A	Senzokuhle Volunteers Homeopathic Doctor Homeopathic students (in service training) Food and Nutrition students (in service training) Donors
T	Sick people to healthy people
W	Providing a free health care facility will uplift a community in need
O	Senzokuhle Volunteers
E	Within Kenneth Gardens and the greater community. Operates illegally without an address or lease agreement.
Root Definition	A homeopathic clinic to bring healing to patients.

	The Wellness Centre – to promote general health and vitality for the greater Kenneth Gardens community
C	Patients The local community
A	Senzokuhle Volunteers Homeopathic Doctor Homeopathic students (in service training) Food and Nutrition students (in service training) Donors
T	Promote the wellness of the community, by being productive (e.g. sewing or beading workshops), raising funds, participating in and facilitating social activities
W	Providing a free health care facility, as well as a supporting skills centre will uplift a community in need.
O	Senzokuhle Volunteers supported by the Kenneth Gardens community
E	Within Kenneth Gardens and the greater community. Operates illegally without an address or lease agreement
Root Definition	A wellness centre owned by the community and Senzokuhle represents that community, to support the community by promoting health and wellness.

Appendix B - Different CATWOE analysis for Kenneth Gardens Wellness Centre (Continued)

	The Wellness Centre – to promote general health and vitality with the support of the Municipality
C	Patients The local community
A	Senzokuhle Volunteers Homeopathic Doctor Homeopathic students (in service training) Food and Nutrition students (in service training) Municipal officers Donors
T	Promote the wellness of the community, by facilitating a homeopathic clinic, a municipal clinic for chronic medication, a skills centre, and facilitating community events.
W	Providing a free health care facility, chronic medication, as well as a supporting skills centre will uplift a community in need.
O	Senzokuhle Volunteers supported by the Kenneth Gardens community and the municipality
E	Within Kenneth Gardens and the greater community. Operates legally facilitated by the municipality
Root Definition	A wellness centre supported by the municipality and run by Senzokuhle to support the community by promoting health and wellness.

Appendix C: WS Snapshot for Kenneth Gardens Wellness Centre (as is)

<table>
<tr><td colspan="3">Kenneth Gardens Wellness Centre – provides health care to those in need.</td></tr>
<tr><td>Customers</td><td colspan="2">Products & Services</td></tr>
<tr><td>• Kenneth Gardens community
• Umbilo/Glenwood community</td><td colspan="2">• Health Care (Homeopathic)
• Food and Nutrition advice
• Home Care of immobile/frail patients
• Facilitate beading, sewing etc. a skills center</td></tr>
<tr><td colspan="3">Major Activities and Processes</td></tr>
<tr><td colspan="3">• Volunteers (Senzokuhle) create a schedule of home Visits.
• Volunteers (Senzokuhle) create a schedule for clinic patients (Wednesday mornings) on a first come first served basis.
• Volunteers (Senzokuhle) assist with scheduling, translation, form filling and record keeping for the homeopathic clinic on Wednesdays.
• Patients complete initial visit form for Homeopathic doctor’s files.
• Volunteers (Senzokuhle) create a schedule of patients that need food, collect food from Carrot and Peas, and deliver to the patients.
• Doctor in charge of homeopathic clinic, collection of student schedules and logged time.
• Doctor in charge of homeopathic clinic, reviews diagnosis and proposed medication with students and dispenses medication.
• Doctor in charge of homeopathic clinic, files the patient record regarding the consultation and medicine dispensed.
• Doctor in charge of homeopathic clinic, completes referral letters for hospitals, and completes certificates for those absent from work.
• Food and nutrition students complete BMI analysis and give further nutritional advice to patients.
• Volunteers (Senzokuhle) motivate for, receive, manage and dispense donations
• Volunteers (Senzokuhle) identification of needs and facilitation of community socialization and events (a skills center)
• Volunteers (Senzokuhle) Negotiation with municipality/ other funders for the Wellness Centre</td></tr>
<tr><td>Participants</td><td>Information</td><td>Technologies</td></tr>
<tr><td>• Volunteers – Senzokuhle caregivers
• Doctor - homeopathy
• Students – homeopathy
• Students – food and nutrition
• Donors</td><td>• Patient records (record of each visit and medicine dispensed)
• Schedule of visits
• Record of donations received and related expenditure</td><td>• None, all written manually onto paper and filed.</td></tr>
</table>

Appendix D: WS Snapshot for Kenneth Gardens Wellness Centre (to be)

<table>
<tr><td colspan="3">Kenneth Gardens Wellness Centre – provides health care to those in need (to be)</td></tr>
<tr><td>Customers</td><td colspan="2">Products & Services</td></tr>
<tr><td>• Kenneth Gardens community
• Umbilo/Glenwood community</td><td colspan="2">• Health Care (Homeopathic)
• Food and Nutrition advice
• Home Care of immobile/frail patients
• Facilitate beading, sewing etc. a skills center</td></tr>
<tr><td colspan="3">Major Activities and Processes</td></tr>
<tr><td colspan="3">• Volunteers (Senzokuhle) create a schedule of home Visits.
• Volunteers (Senzokuhle) create a schedule for clinic patients (Wednesday mornings) on a first come first served basis.
• Volunteers (Senzokuhle) assist with scheduling, translation, form filling and record keeping for the homeopathic clinic on Wednesdays.
• Patients complete initial visit form for Homeopathic doctor’s files.
• Volunteers (Senzokuhle) create a schedule of patients that need food delivered.
• Students capture data during patient consult.
• Computer system collection of student schedules and logged time (Automated).
• Doctor in charge of homeopathic clinic, reviews diagnosis and proposed medication with students and dispenses medication.
• Doctor in charge of homeopathic clinic, completes referral letters for hospitals, and completes certificates for those absent from work.
• Food and nutrition students capture BMI analysis and give further nutritional advice to patients.
• Volunteers (Senzokuhle) motivate for, receive, manage and dispense donations.
• Record of donations available online (web page/and or Blogs).
• Volunteers (Senzokuhle) identification of needs and facilitation of community socialization and events (a skills center)
• Volunteers (Senzokuhle) Negotiation with municipality/ other funders for the Wellness Centre</td></tr>
<tr><td>Participants</td><td>Information</td><td>Technologies</td></tr>
<tr><td>• Volunteers – Senzokuhle caregivers
• Doctor - homeopathy
• Students – homeopathy
• Students – food and nutrition
• Donors</td><td>• Patient records (patient master data)
• Patient consultations (record of each visit and medicine dispensed)
• Schedule of visits (home care)
• Student schedules presented to DUT for log of in-service hours
Record of donations received and related expenditure</td><td>• Spreadsheets
• Database
• Email
• Web pages and/or Blogs
• Web based smart phone app</td></tr>
</table>

Appendix E: Answers to CSH questions in 'is' mode (Wellness Centre)

1. **Who is the intended beneficiary of the Kenneth Gardens Wellness Centre?**
   Kenneth Gardens community
   Umbilo community
   Community of Ward 32
   DUT Students (learning centre, in service training)

2. **Who is in control of the conditions of success of the Kenneth Gardens Wellness Centre?**
   Senzokuhle (Khanyi)
   DUT – UFC (Kira and Monique), and Homeopathy, Food and Nutrition
   Should be – Kenneth Gardens community (governing body). Needs to be a managing board to be negotiated with.

3. **Who is providing relevant knowledge and skills for the Kenneth Gardens Wellness Centre?**
   Glenridge, DUT Homeopathy and Food and nutrition. Senzokhule and volunteers.

4. **Who is representing the interests of those negatively affected by but not involved with the Kenneth Gardens Wellness Centre?**
   Attending the clinic is voluntary, therefore cannot identify anyone negatively affected.
   Political parties/groups represent those not involved.

5. **Who is the intended beneficiary of the Kenneth Gardens Wellness Centre?**
   Kenneth Gardens community
   Umbilo community
   Community of Ward 32
   DUT Students (learning centre, in service training)

6. **Who is in control of the conditions of success of the Kenneth Gardens Wellness Centre?**
   Senzokuhle (Khanyi)
   DUT – UFC (Kira and Monique), and Homeopathy, Food and Nutrition
   Should be – Kenneth Gardens community (governing body). Needs to be a managing board to be negotiated with.

Appendix E - Answers to CSH questions in 'is' mode (continued)

7. **Who is providing relevant knowledge and skills for the Kenneth Gardens Wellness Centre?**
   Glenridge, DUT Homeopathy and Food and nutrition. Senzokhule and volunteers.

8. **Who is representing the interests of those negatively affected by but not involved with the Kenneth Gardens Wellness Centre?**
   Attending the clinic is voluntary, therefore cannot identify anyone negatively affected.
   Political parties/groups represent those not involved.

9. **What is the purpose of the Kenneth Gardens Wellness Centre?**
   To help people in Kenneth Gardens who cannot get to the hospitals, money and transport. *Healing, wholeness, alternative medicine.*
   Provide health facility to the community. Teaching students. A dual role, symbiotic.

10. **What conditions of success are under the control of the Kenneth Gardens Wellness Centre?**
    Membership of Senzokuhle. Acceptance of volunteers. To provide care. *Patient care based within the community. Community based organization.*
    Ought to be: the wider Glenridge/Umbilo community

11. **What are relevant new knowledge and skills for the Kenneth Gardens Wellness Centre?**
    Volunteer Doctors to consult in the wellness clinic for the benefit of the community.
    Training of caregivers

Appendix F: Answers to CSH questions in 'ought to be' mode (Wellness Centre)

Social Roles (stakeholders)

1. *Beneficiary* (M). Who ought to be the intended beneficiary of the Kenneth Gardens Wellness Centre?
   Those that come to the Wellness Centre.
   Kenneth Gardens and larger Umbilo area.
   Community of ward 32.

2. *Decision Maker* (C). Who ought to be in control of the conditions of success of the Kenneth Gardens Wellness Centre?
   Senzokuhle. *With more input from local government and city council*.
   The community - every single person involved.

3. *Expert* (K). Who ought to be providing relevant knowledge and skills for the Kenneth Gardens Wellness Centre?
   Caregivers supported by the students. DUT is there to support.
   Legislation by the municipality that supports the use of the building. *Doctors and nurses. Municipal funding.*

4. *Witness* (L) affected. Who ought to be representing the interests of those negatively affected by but not involved with the Kenneth Gardens Wellness Centre?
   Political parties, ward committee members.
   Those negatively affected – those that feel excluded or are suspicious.
   Those that are working could be excluded as they cannot get to the wellness centre at the time when the centre is open.

Specific concerns (stakes)

5. *Purpose* (M). What ought to be the purpose of the Kenneth Gardens Wellness Centre?
   To help sick people. To p*rovide Healthcare in the community.*
   Nutritional advice. Educating the community on healthy living and wellness. Also the symbiotic relationship between the students and the patients. The students also learn from the patients.

6. *Resources* (C). What conditions of success ought to be under the control of the Kenneth Gardens Wellness Centre?
   Long term lease of the building for the purpose of community care. Prescribed medication for those on monthly chronic conditions. This is specifically for those that cannot get to Wentworth hospital for government funded medication. A sense of community needs to established to run the Centre effectively.

Appendix F - Answers to CSH questions in 'ought to be' mode (continued)

7. *Expertise* (K). What ought to be relevant new knowledge and skills for the Kenneth Gardens Wellness Centre?
   More professionals in more areas will contribute to the Centre and healthy living. Other specialist areas, for example psychology etc. For holistic wellbeing, and not only homeopathy. Outside stakeholders to bring in services that can support the wellness Centre.

8. Emancipation (L) Affected. What ought to be the opportunities for the interests of those negatively affected to have?
   Those negatively affected need to be identified (and to speak up)

Key problems (Stakeholding issues)

9. *Measure of improvement* (M). What ought to be the Kenneth Gardens Wellness Centre measure of success?
   Long term support. More volunteers and patients (and patients getting better) Describing this success in terms of the homeopathic clinic is limiting. Patients getting better is a stepping stone to the wellness of the community. The wellness of the community will be considered a measure of success. Health means psychological, social, spiritual, physical health. So there are four elements to wellness rather than just physical health.

10. What conditions of success ought to be outside the control of the Kenneth Gardens Wellness Centre decision maker?
    No response.

11. *Guarantor* (K). What ought to be regarded as assurances of success of the Kenneth Gardens Wellness Centre?
    Input from other stakeholders."The people shall govern the secret of success."

12. *Worldview* (L) Affected. What space ought to be available for reconciling differing worldviews expression and freedom from the worldview of the Kenneth Gardens Wellness Centre among those involved and affected?
    No response.

Appendix G: WS Snapshot 'what could be' for Kenneth Gardens (continued on 2 pages)

"what could be" Work system snapshot

This describes Kenneth Gardens as it could be. The products and services desired.

Customers	Products & Services
• Tenants • Potential tenants	• Low cost accommodation • Allocation/ reallocation • Maintenance • Services (water and electricity)

Major Activities and Processes

- Applicants complete application form for accommodation, filed and validated (all screening) by the allocation section
- Social worker (within department of housing) considers applications, assigns priority (according to age and disability), nominates priority allocations to the allocation section
- City hall nominates priority allocations to the allocation section
  Allocation section forwards allocations to department of housing for signing the lease agreement and processing the allocation
- Department of housing administrator processes lease agreement *(filing, signing, capture on HGR system)*
- Department of housing administrator processes termination of lease (*Tenant gives one month notice, remove from HGR system, inform allocations section of available flat)*
- Department of housing administrator processes transfer of lease *(substitution)*
- Department of housing manager monitors the payment of rental, refers outstanding rental to bad debts section

Emergency or routine maintenance

- Tenants lodge request for maintenance (complaints) to the supervisor via an SMS (this gives the supervisor a contact number to respond to with updates regarding the request) (*Should the department of housing administrator check if rental is up to date?)*
- Supervisor does a manual check regarding the request, creates a job card for the maintenance section (JDEdwards), and sends e-mail to maintenance). (Report to tenant via sms, job card number and estimated time that maintenance should take to respond)
- The job cards are scaled by the maintenance division according to priority and assigned to a service provider or quotation request. (SMS to tenant on expected time for completion or time required for quotation)
- Inspectors (within maintenance) are allocated to inspect both before and after completed work (using the job card). *Notify the department of housing when the job is complete.*
- Department of housing administrator send final sms regarding completion of job and termination of the job card.
  (the above takes care of specific maintenance requests by tenants)

Cyclic maintenance (maintenance that is scheduled on a cycle). These may also be requests (complaints) from tenants. To track and trace the requests (complaints) a similar web based system could be used.

- Supervisor to monitor grass and grounds (trees) and generate requests to department of housing.

- Supervisor to monitor exterior of flats and generate requests to department of housing
- Department of housing administrator to maintain schedule of windows and external painting.
- Department of housing manager receives extraordinary requests from tenants or the residents committee, requests are considered, processed/rejected, report decision back to tenant/residents committee.
- Department of housing manager monitors the payment of rental, refers outstanding rental to bad debts section
- Department of housing manager motivate for budget requests (capital budget) regarding cyclic maintenance.
- Department of housing manager to report back to the Kenneth Gardens community regarding these requests

For all of the above residents may approach the residents' committee to take their requests forward to department of housing.

- Senzokuhle (NPO) provides a wellness centre for home based care including a homeopathic and nutritional health care clinic on Wednesdays.
- Carrot and Peas (NPO) provides food for those that have none (3 days a week).

Participants	Information	Technologies
• Department of Housing and Human Settlements (management, administrators, supervisor/s, social worker) • Allocations Section • Tenants • Parks and grounds • Bad debts Section • Maintenance department • Service providers (electricity, water and those allocated work to do by maintenance section) • City hall, through management requests for temporary accommodation sent to administrators for action (requests for accommodation to be provided)	• Tenants applications • Tenants rental agreement (HGR system) • Tenants - all original documentation manually filed • Maintenance job cards • Verbal (telephonic) or complaints post box (requests?) • Residents committee file of minutes of meetings • Wellness Center, manual records, files, and log books.	• E-mails (outlook) • Deed searches (to ensure that applicants do not already own a house elsewhere • HGR (housing rental) • COIN (electricity billing) • JDE used for maintenance – job/works order created and tracked on JDE • Spreadsheets etc. • Data base of residents/flats • Maintenance requests associated with each flat • General requests regarding the grounds • Logging of requests associated with a flat, resident and timeline (easy logging) • Spreadsheet/database or web based system Different categories of logging, also loss of goods (criminal activity), health requests, food requests

Appendix H: Questionnaire completed after the final workshop for the Main Study

Please return this form to Jeanette Wing at the end of the working session. Thank you.

Please circle your representation: Municipality, Residents Committee, Senzokuhle, Carrot and Peas, IT, UFC, Homeopathy, Food and Nutrition, Sponsor, Youth

Strongly disagree **Strongly agree**

In all of the following KG refers to Kenneth Gardens

1. The rich picture shows the complexity of elements affecting the management of KG
   1 2 3 4 5

2. The work system snapshot "could be" accurately identifies the processes/activities for the management of KG
   1 2 3 4 5

3. As a result of the application of the framework, I have a better understanding of the complexity and issues regarding the management of KG
   1 2 3 4 5

The following questions are for those that attended workshops

4. The input that I gave in the workshop is reflected in the identified structures and information flows regarding KG
   1 2 3 4 5

5. My input was valuable in understanding the complexity that is within KG
   1 2 3 4 5

6. It was useful to consider the current situation and to then consider what could be
   1 2 3 4 5

7. The repetition of elements in different tools of the framework was useful e.g. describing Actors in CATWOE and Participants in the Work System Snapshot
   1 2 3 4 5

8. To what extent were the workshop objectives achieved*? "The use of methods within a framework to gain understanding of, and promoting improvement in the management of Kenneth Gardens, in terms of identifying a suitable structure, processes and supporting information".* (Please rate on a scale of 1 to 10).

1	2	3	4	5	6	7	8	9	10	

not at all completely

Please use the back of this page for any further comment. **THANK YOU.**