The contingent use of agile systems development methodologies

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Abstract

Over the years, organizations have seen fit to adopt the use of agile systems development methodologies (ASDMs) because of the benefits that they offer, such as flexibility and the ability to deliver products faster, in constantly changing environments. When ASDMs are used in projects, they are made to fit or be suitable for a project's unique aspects, such as its size, requirements, scope and outcomes. This is known as the contingent use of ASDMs.

Little is known about the contingent use of ASDMs in South African organizations. It is not known whether it is happening, its procedure and its success. It is important to know this because quality and control need to be maintained in systems produced. There is always a danger that the benefits of using a system development methodology (SDM) would be lost if ASDMs are highly adapted. This led to an investigation of three organizations in South Africa that use contingent ASDMs. With the help of semi-structured interviews, focus groups and documents, data was collected that was analysed, using the tool ATLAS.ti, and the analysis methods content and cross-case analysis.

It was found that some South African organizations in the telecommunications, consulting, technological, outsourcing and agricultural sectors use ASDMs in combination with the still popular waterfall SDM. Compatibility between the SDM and the project is a factor in some organizations. Scrum was cited to be the ASDM that was used in some of the organizations interviewed due to its maturity. They make ASDMs contingent by using aspects in the methods, such as Scrum, that are useful for their unique projects. These aspects are in some cases combined with other SDMs to form hybrid methodologies. Some organizations use criteria, such as project needs, outcomes, size and complexity to make ASDMs contingent. Some organizations have measures and facilities in place to manage, monitor, control and document the process used to make ASDMs contingent. They make use of contingent ASDMs as they have experienced more success with them and they will continue to do so.

Keywords

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I would love to thank GOD first for this research. For all the worries, the stresses about money and fears that I would not finish the research in time, I thank You for showing me that You will always take care of me and that I should always trust in You.

To my parents, thank you for the encouragement and for pushing me to always aim higher. Your unwavering faith in me motivates me to live up to and exceed your expectations for me. I aim to make sure that faith is not in vain. To my young brothers and sister, thank you for believing in me.

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List of Acronyms

ATLAS.ti – "Archiv für Technik, Lebenswelt und AlltagsSprache" [Archive for Technology, the Life World and Everyday Language] with text interpretation

SDM – Systems Development Methodologies

ASDM – Agile Systems Development Methodologies

IE – Information Engineering

XP – Extreme Programming

SDLC – Systems Development Life Cycle

ERP – Enterprise Resource Packages

RAD – Rapid Application Development

DSDM – Dynamic Systems Development Method

JAD – Joint Application Development

WISDM – Web Information Systems Development Methodology

WISDOM – Whitewater Interactive System Development with Object Modules

OOA – Object-oriented Analysis

ETHICS - Effective Technical and Human Implementation of Computer-based Work Systems

KADS – Knowledge Acquisition and Documentation Structuring

SSM – Soft Systems Methodology

ISAC – Information Systems work and Analysis of Change

PI – Process Innovation

PRINCE – Projects in Controlled Environments

ISO – International Organization for Standardization

CMM – Capability Maturity Model

FDD – Feature Driven Development

ASD – Adaptive Software Development

LD – Lean Development

RUP – Rational Unified Process

PP – Pragmatic Programming

CHAPTER ONE

RESEARCH INTRODUCTION

1.0   Introduction

The systems development space is constantly evolving. The procedure used to carry it out is unique to every organization. Organizations are increasingly adopting different systems development methodologies (SDMs) to stay competitive and successful (Avison and Fitzgerald, 2006). The recently developed agile systems development methodologies (ASDMs) are particularly useful. South African organizations are no different and they are using ASDMs as well (Noruwana and Tanner, 2012). These ASDMs are being implemented differently in each organization and rare publications exist that would show how this is being done for them to maintain consistent efficiency and effectiveness. This research study's main focus is to investigate this phenomenon and to document it.

In this chapter, the problem statement will be presented, as well as why it was necessary to carry out the investigation. The research aims and objectives necessary to act as a guideline and measure of the success of the investigation will be shown. The method used to collect the information that helped to solve the research problem will also be discussed. The chapters that form the research study will be briefly discussed.

1.1   Problem Statement and Motivation

Systems development methodologies (SDMs) are important as they are used as guidelines in the development of information systems. They were first introduced in order to bring better control and management to the development process. As more SDMs emerged, it was discovered that they were not ideal for contingent use. Contingent use of SDMs means that they should be able to fit any information systems project regardless of type, size and any uncertainties that are bound to emerge. The introduction of agile systems development methodologies (ASDMs) helped with the contingency problems of SDMs (Avison and Fitzgerald, 2006; Dictionary.com, 2011). Wang (2007) describes them as providing a procedure for systems development that can fit and deal with any unpredictable changes.

Despite ASDMs being introduced to fit any project, Burns and Deek (2010) state that information systems development practitioners often change SDMs to match the specific circumstances of their projects regardless of whether they are "heavy" or "agile" and that these changed SDMs often worked best. Hence, adaptation and tailoring of SDMs are often used. Tailoring is the process by which an SDM is selected, changed or blended with another while adaptation means "to change your (or a system's) behaviour because your (or the system's) situation or environment has changed" (Burns and Deek, 2010; Pahl, 2004:974).

There have been some efforts to make SDMs more contingent. For instance, Burns and Deek (2010) proposed a methodology tailoring model for generally making all types of SDMs contingent. Henderson-Sellers (2006), and Asadi and Ramsin (2009), used situational method engineering by assembling best practice method fragments from different SDMs to form an ideal and useful one that fits a unique project's circumstances.

The contingent use of ASDMs in South Africa is not well documented. In fact, evidence that actually tells us that ASDMs are being made contingent by South African organizations and its process are rare. Only an international perspective exists that states that this happens for every project (Burns and Deek, 2010). We do not know whether this is true for South Africa as well. We also do not know how ASDMs are made contingent and whether they have been successful in South Africa.

We need to know what is going on in South Africa because we need to know how it differs from the international context and why, so that informed decisions can be implemented successfully. In this way the research could add to the academic knowledge base. Publishing these details could also ensure that the process is learned and explained, and that quality and control is maintained through the use of standardization so that the benefits of using SDMs for high quality products are not lost (Keenan, 2004). Conboy and Fitzgerald (2010) also concur that companies are looking for best practices on how contingency is occurring in practice so that it could help them with their own efforts in that area.

1.2 Research Aims and Objectives

This section briefly discusses the aims and objectives that the research study endeavoured to achieve in order to solve the problem posed in the previous section. The main aim of this

research was to study the contingent use of ASDMs in South African companies. In order to achieve this aim, the following aspects were investigated.

- The current use of ASDMs by three South African companies
- Do practitioners make ASDMs contingent and why, or why not?
- How do they make ASDMs contingent? Adding, omitting or ignoring some aspects and why?
- How successful are ASDMs that have been made contingent?

1.3   Research Method

The research conducted is an *interpretive study* and some of the methods that are applicable under this paradigm were used. Since the study is qualitative in nature, case studies were used on three South African companies that use ASDMs. This was done because a rich and detailed insight into the practical use of ASDMs by companies was needed to be derived. Case studies are also ideal for situations where "few previous studies have been carried out" according to Benbasat *et al.* (1987). Using three case studies allowed for some comparisons and differences between them that are easily identified.

The majority of the data collected was derived from semi-structured interviews with practitioners in the three companies chosen. Semi-structured interviews were essential to derive information that may not be immediately clear. Focus groups and individual interviews were conducted with different developers, project managers, business analysts, data modellers, IT managers and a Scrum master in order to gain an in-depth understanding of the contingent use of ASDMs. Documents of company profiles, SDMs and contingent approaches for ASDMs were also collected.

To carry out data processing, ATLAS.ti was used with its various tools, such as coding, query analysis and network diagrams (ATLAS.ti, 2012). Qualitative data was derived from the semi-structured interviews and content and cross-case analyses were performed. From these analyses, propositions were formulated.

1.4 Research Chapters

This dissertation contains the following chapters and the discussions that follow as shown in Figure 1.1.
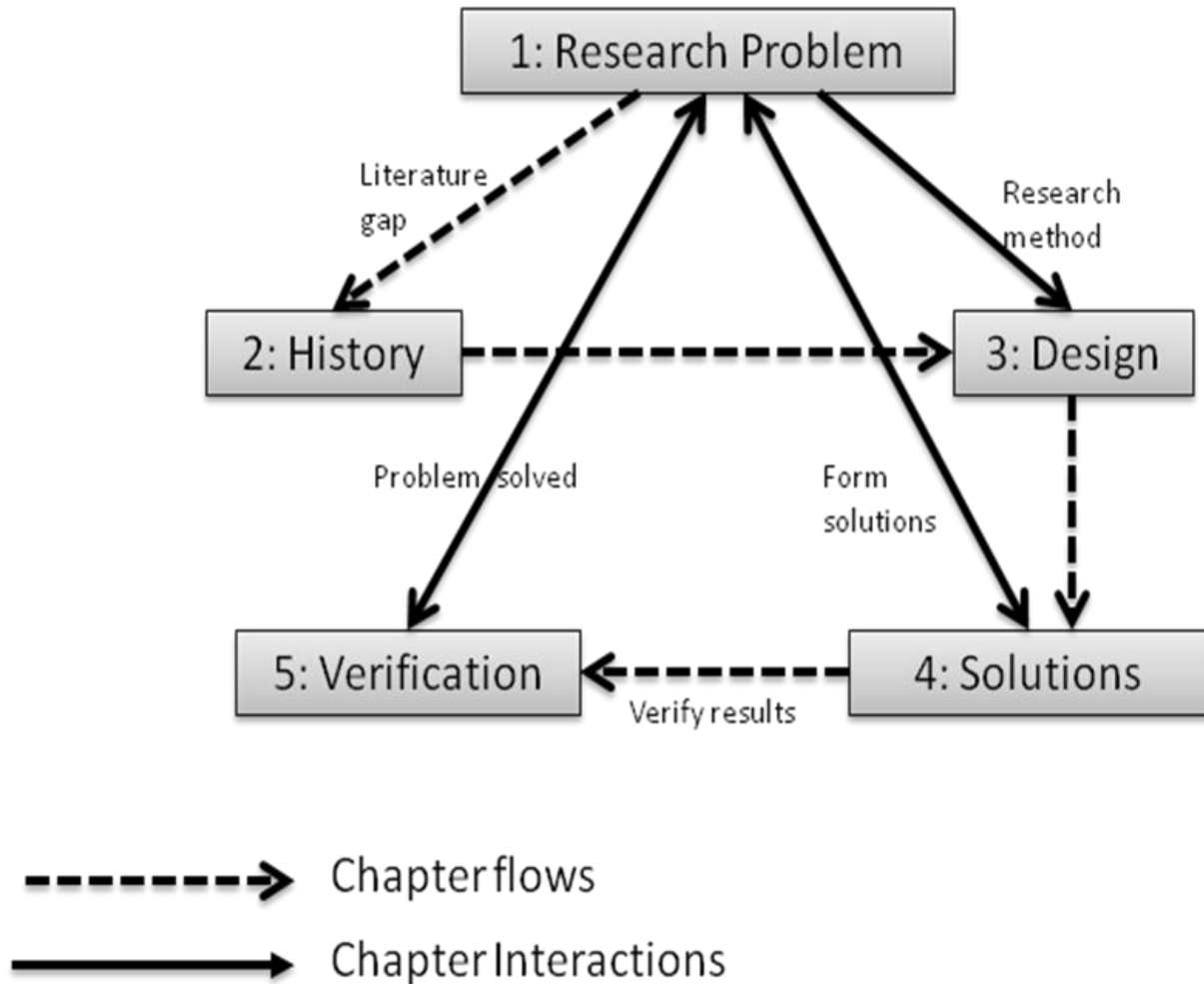
Figure 1.1: Chapter Interaction

Chapter 1: Research introduction

An introduction of the research topic is given in the first chapter. The problem statement and motivation for the research are discussed, as well as its aims and objectives, questions and how the research was carried out. The chapter summary concludes the chapter and introduces the next one.

Chapter 2: Agile systems development methodologies and contingent use

In Chapter two, the background of systems development methodologies (SDMs) is given, before agile systems development methodologies (ASDMs) are discussed. The history, commonly used approaches, benefits, problems and the usage of agile systems development methodologies are discussed. The phenomenon of contingent use is discussed, and its application to agile systems development methodologies is pointed out. The gap in the relevant literature is shown in this chapter.

Chapter 3: Research method and design

Chapter three discusses the research paradigm within which the study is done and the research methods that were used to collect and analyse data. The methods are discussed according to their advantages and disadvantages. Those applicable to the research are chosen and reasons are given as to why they were necessary for use.

Chapter 4: Data analysis and results

The chapter starts off by giving the overviews of the companies that were interviewed, the experiences of the people, the systems development methodologies that they use, their contingency approaches and their thoughts on the use of agile systems development methodologies in their organizations. Thereafter, the propositions formed from each organization were compiled. Revised propositions were formed across all the organizations interviewed, showing their similarities and differences by using content and cross analysis.

Chapter 5: Research conclusion and future work

The chapter concludes the research study and it shows how the problem was solved. Research contributions, future work and conclusions are also discussed.

1.5   Research Limitations

Few limitations were encountered in the study. The limitations in no way change the results of the study but if they had not been encountered, the research would have had more detail.

The problem was the lack of documentation by the systems development team. They do not document what contingency changes they make in detail. What were collected were general

statements. Some were not willing to give any documentation at all, others were willing but the information was not very useful, while others do not have any documentation at all. The organization that did not provide any documentation had just adopted ASDMs this year so that was a stumbling block.

Chapter Summary

The research study conducted was introduced in this chapter. Why it was necessary to conduct the research was discussed in the problem statement and motivation. To carry out the investigation, research aims and objectives were discussed, including the questions that would help to solve the problem. The method that was used to collect the data was focus groups and interviews in three companies in South Africa. ATLAS.ti was used to analyse the data. The layout of the dissertation was presented.

Now that the problem has been identified, it is necessary to discuss the history of the research topic, which is the contingent use of agile systems development methodologies in South Africa. The next chapter will cover that and the gap in the literature will be shown.

CHAPTER TWO

AGILE SYTEMS DEVELOPMENT METHODOLOGIES AND CONTINGENT USE
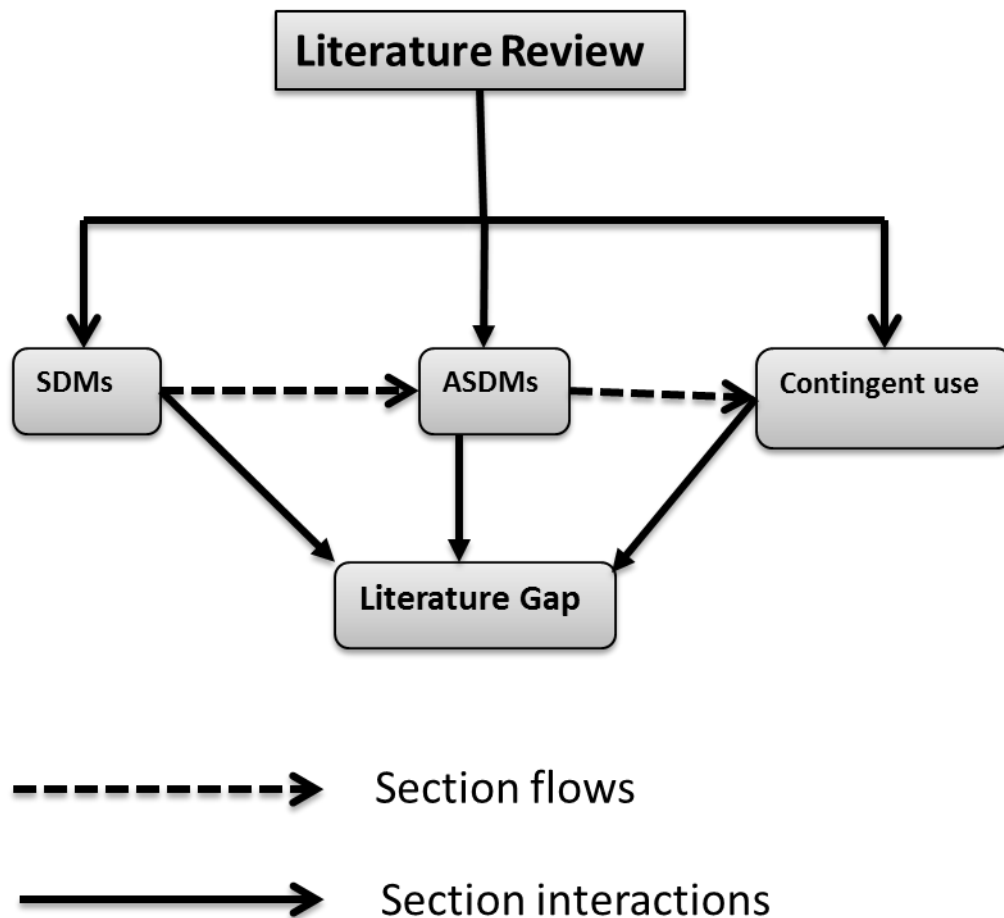
Figure 2.1: Literature Review Structure

2.0   Introduction

In the previous chapter, the problem that needs to be solved and why it needs to be solved were discussed. Before the investigation can start, it is necessary to know the origins of all systems development methodologies in order to appreciate the point in time at which they are and how agile systems development methodologies fit into the picture.

This chapter will therefore discuss how SDMs came to exist, their history, classifications, their use, benefits and problems. The same will be done for ASDMs. Contingent use of ASDMs will then be discussed leading to the gaps in the literature being discussed at the end of the chapter as shown by Figure 2.1.

2.1   System Development Methodologies (SDMs)

Systems development methodologies (SDMs) can be used in any sphere or domain of information systems development regardless of whether it is in the medical profession or engineering. It has been known to be used together with project management implementation to reduce the risks associated with software development (Maguire, 2002).

Avison and Fitzgerald (2006:568) define SDMs as a set of prescribed methods for information systems development or portions of it, which is based on logic and a specific "philosophy". "*The recommended means often contain a definition of phases, procedures, activities, rules, techniques, documentations, tools and guidance*".

Huisman and Iivari (2006) define a SDM as a combination of a systems development approach, process, method and technique. Figure 2.2 represents a graphical illustration of this definition. The systems development approach defines the philosophical view that guides it, such as "goals that it achieves, principles, beliefs, concepts" and drivers of its "interpretations and actions" (Huisman and Iivari, 2006: 32). Philosophical views of a SDM could be structured or object-oriented. The systems development process model gives an indication of the flow of steps that a system would go through as it is developed throughout its life cycle. A process model chosen could be linear or spiral.
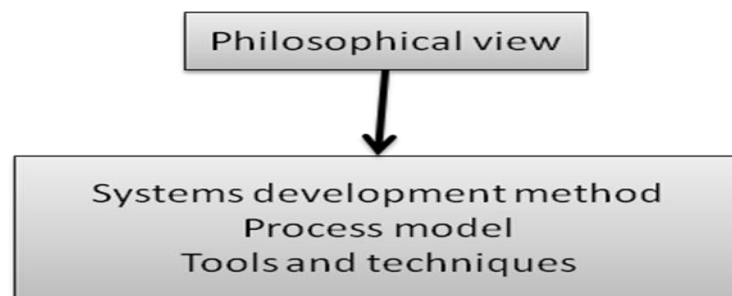
Figure 2.2: Definition of a SDM

A systems development method such as Information Engineering (IE) and Extreme Programming (XP) provide a standard and precise way of carrying out a phase of system development by using a consistent "set of guidelines, activities, techniques, and tools based on a particular philosophy and the target system". A systems development technique is regarded by Huisman and Iivari (2006:32) as a "procedure, possibly with a prescribed notation, to perform a development activity", for example for the construction of entity relationship diagrams.

The definition that will be used in the study as SDMs are discussed is a combination of the two definitions mentioned earlier by Avison and Fitzgerald (2006), and Huisman and Iivari (2006).

> *A SDM is therefore a standardized means to conduct information systems development consisting of a method, process, technique, phases, rules, tools, guidelines, activities, documentation, procedures and an underlying philosophy that glues all the concepts together and distinguishes it from other SDMs making it uniquely identifiable.*

2.1.1 History of SDMs

To understand and appreciate the current state of SDMs, it is necessary to know where they came from in order to know what inspired their emergence. The history of SDMs will be based on the work of Avison and Fitzgerald (2003).

2.1.1.1 Pre-methodology Era

In this era, no formal SDMs were used. This period is referred to as the "pre-methodology era". It is thought to exist between the 1960s and 1970s with the emphasis being on programming skills and solving technical problems. This resulted in developers not understanding or helping a business with its processes, needs of users not being understood and overall poor control of the whole development process.

2.1.1.2 Early methodology Era

This era was between the late 1970s and early 1980s. Because the previous era was thought to be lacking in standards and formality, phases and stages were introduced as part of the development process to achieve that. The result of all these changes was how the popular, well known and highly criticized Systems Development Life Cycle (SDLC) or waterfall model came to be. The SDLC, however, brought its own set of limitations, such as not meeting the 'real' needs of a

business, instability, inflexibility, offering no user satisfaction and an extensive generation of documentation.

2.1.1.3 Methodology Era

Because developers now knew what the role of a SDM was supposed to be in an organization, more of them emerged and were formed to suit whatever needs were lacking. They knew, for instance, that they needed a better end product or standardized process through the use of a SDM. What also emerged during this era was the categorization of the SDMs into categories, such as structured, data-oriented, prototyping and object-oriented categories or a combination of them.

2.1.1.4 Post-methodology Era

The post-methodology era started in the late 1990s and continues into the present and is characterized by a review or reassessment of the SDMs currently in use by "researchers and practitioners". This is because issues, such as the complexities of the SDMs, the expensive tools they recommend, not being contingent on a project's size and type, and inflexibility, are still persisting today, hence the relevance of the research study. Adopting a particular methodology does not mean that the results advertised with it will be the same as when it is put into practice by a business. The era of reassessment has resulted in the following four directions that developers are turning to.

2.1.1.4.1 Ad hoc development

This direction is viewed as a return to the pre-methodology era where no formal SDM was used. The chosen approach for development depends on the developers and what they feel will work for them and the project. Experience is a major factor for what SDM or aspects of SDMs will be used. Even though "flexibility and interpretation" of a SDM cannot be avoided, some "support for developers, training, control and maintenance of the development process" is needed Avison and Fitzgerald (2006:587).

2.1.1.4.2 Further developments in the methodology arena

There are some developments taking place where SDMs are still being developed and perfected. Avison and Fitzgerald (2006) state that even though object-oriented techniques and SDMs, seem to be dominating over process and entity modelling, there are still no significant differences. This

is because any technique or SDM can take over at any moment as is the norm where new alternatives are suggested and then ignored while others make an impact.

2.1.1.4.3 Contingency

Most SDMs provide a prescribed procedure for carrying out development in an explicit or implicit ideal type but such a situation rarely exists in practice. Contingency approaches are therefore used in development that takes into account the tools and techniques that are ideal and that can be adapted depending on the prevailing situation. According to Avison and Fitzgerald (2006:587), situations are uniquely different in their "types, objectives, organizations and environments, the users and developers, and their respective skills". The problem with contingency approaches arises when the advantages of standardization are not reaped and many skills are required to different types of approaches. Furthermore, practitioners are supposed to have the expertise and skills to make the best decisions, and that is often impossible. Some combinations of approaches have been impossible to achieve due to contradictory philosophies (Avison and Fitzgerald, 2006).

2.1.1.4.4 External development

The final direction for development is the use of packages and outsourcing. Packages are being bought on the market to suit organizational needs, especially with the emergence of Enterprise Resource Packages (ERPs). Alternatively, outsourcing is used to transfer the responsibility of choosing an appropriate SDM to use to a third party, who will be responsible for making sure that product effectiveness and quality are delivered (Avison and Fitzgerald, 2006).

The research study focus will be on the contingency movement that developers are turning to in the era of reassessment.

2.1.2   Classifications of SDMs

There are estimated to be about a thousand SDMs around the information systems development sphere according to Jayaratna (1994). We need to classify them in order to avoid confusion. SDMs can be classified according to the philosophical approaches to development that they use. The philosophical approaches to information systems development include process-oriented, rapid development, data-oriented, object-oriented, people and organizational-oriented SDMs (Avison and Fitzgerald, 2006; Iivari and Maansaari, 1999).

2.1.2.1 Systems Development Life Cycle (SDLC)

As was discussed in the history of SDMs, the SDLC (System Development Life Cycle) was the earliest methodology that was formalized by the development community. Ruparelia (2010) considers the SDLC to be a procedure that guides the development of an application, system or software in terms of its structure from its birth until its maintenance and review. Models, such as the waterfall, V and W fall into this category. Figure 2.3 represents the SDLC (Waterfall model).
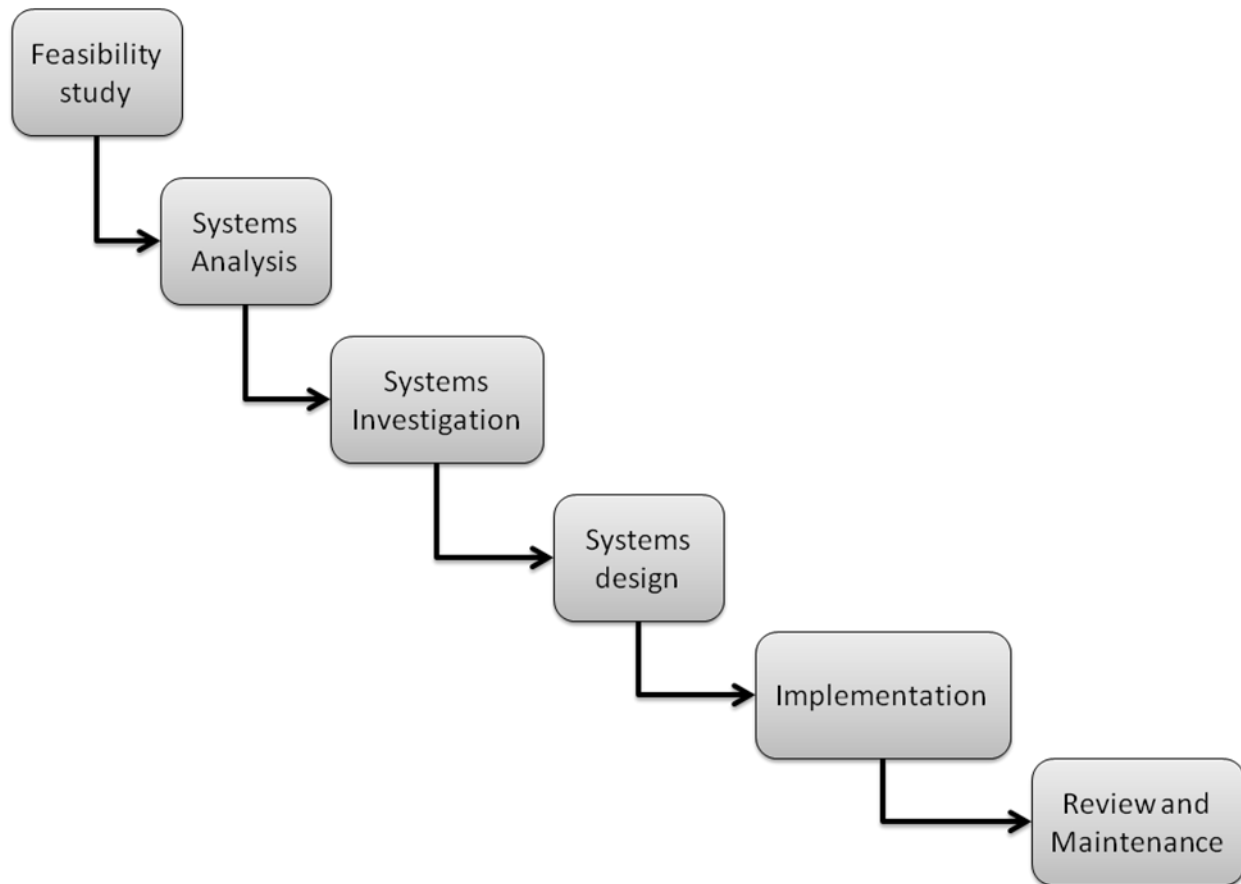
Figure 2.3: SDLC

2.1.2.2 Process-Oriented SDMs

Avison and Fitzgerald (2006) use the word process-oriented to distinguish SDMs that place significant focus and emphasis on the processes that are conducted when developing information systems. Process-oriented methodologies use techniques, such as functional decomposition, structured English, decision tables and trees to bring the structure in the processes. SDMs found

under this category include STRADIS (Gane and Sarson, 1979), YSM (Yourdon Inc, 1993) and JSD (Jackson, 1975).

2.1.2.3 Rapid Application Development Methodologies

The RAD (Martin, 1991) emphasises the fast delivery of information systems. The approach involves an initial investigation, requirements definition, design, development and testing. The end product/prototype is submitted to the end users and other interested and essential stakeholders who make the changes necessary, if at all, whereafter implementation and maintenance take place (Ruparelia, 2010). RAD SDMs include the agile family (Extreme Programming (Beck, 2000), Scrum (Schwaber and Beedle, 2002), Lean Development (Charette, 2002), Dynamic Systems Development Method (DSDM) (DSDM Consortium, 1994)) and Web Information Systems Development Methodology (WISDM) (Vidgen *et al*., 2002).

2.1.2.4 Data-oriented Methodologies

The focus of data-oriented SDMs is on data as the most important aspect of information systems. They could include data and process-oriented approaches mixed into one SDM. Examples of methodologies that fall under this category include SSADM (Weaver, 1993), IE (Martin and Finkelstein, 1981) and Welti ERP development (Welti, 1999).

2.1.2.5 Object-oriented Methodologies

Object-oriented analysis (OOA) (Coad and Yourdon, 1991) and RUP (Jacobson, 2000) are some of the methodologies that fall under this category. They use objects, which are a combination of both data and processes as an approach to develop information systems. The classes of OOA ensure increased resilience to change, as old code can be reused as much as necessary. OOA has an added advantage through its use of abstraction, which allows it to only adopt aspects that are important to solving a problem (Capretz, 2003).

2.1.2.6 People-oriented Methodologies

At the heart of people-oriented methodologies is, as the name suggests, people who participate in the development of information systems and software. These methodologies make sure that they represent expertise and know-how of the people in the organization who are affected by a new information system. Examples of people-oriented methodologies include ETHICS (Mumford, 1995) and KADS (Wielinga *et al.*, 1993; De Greef and Breuker, 1992).

2.1.2.7 Organizational-oriented Methodologies

Organizational-oriented methodologies are those that view the development of an information system as a whole, therefore adopting systems thinking, as opposed to the scientific paradigm, which breaks it down into bits and pieces. The systems thinking is used in social and management sciences where the human aspect is added. It is complicated for the human aspect to be broken down to be examined individually when each plays a part in the whole. In other words, there is no black and white but grey and they are all connected and mixed into one (Avison and Fitzgerald, 2006). The SDMs in this category include SSM (Checkland, 2000), ISAC (Lundeberg *et al.*, 1982) and PI (Davenport, 1993)

This research study focuses on RAD SDMs and in particular on agile methodologies.

2.1.3   Advantages and Disadvantages of SDMs

As is the norm in information systems, every technology, tool, technique and even SDMs has an advantage and disadvantage. Systems development in the early days was haphazard and formality was needed for benchmarking and standards. As the benefits of the first methodology were not enough, more were formed that could offer what was needed according to the prevalent situations. Therefore, the trend that is seen in new and recent methodologies is a more flexible and user-oriented process.

2.1.3.1 Advantages

SDMs help developers to solve the complexities that pose a hindrance to the development process, since tasks are broken down into manageable and smaller parts that are easy to handle (Avison and Fitzgerald, 2006; Klopper *et al.*, 2007). The smaller and easier tasks also help to reduce risks that are a major problem in information systems projects, since SDMs ensure transparency, visibility and control over the whole process. Control and management are also facilitated by the SDM framework that can be used as a guideline, especially for specific times, such as when to use tools and resources in the development process and where (Klopper *et al.*, 2007).

Standardized SDMs are ideal, as the phases that allow the development team to review progress made, and to determine what still needs to be done, are well known and better understood, especially when used often. Standardization is a very important quality to have in a SDM, as it

makes sure that system specifications are complete, known by the development team, users and those in computer operations (Avison and Fitzgerald, 2006; Klopper *et al.*, 2007).

Guidance is possible, not only for the development process but also for the maintenance, evaluation and tuning, with the use of phases (Rowlands, 2006). Missed system delivery dates and lower benefits are prevented, tasks are planned and high costs reduced through the use of phases (Avison and Fitzgerald, 2006). The use of tools at appropriate SDM phases helps to increase the level of productivity and documentation, thereby enhancing quality (Capretz, 2003).

SDMs increase the quality of the software and systems developed, as they are tried and tested. In addition, legal protection is provided for all parties involved in the development process, for instance software developed for the German national and regional authorities must be in line with the V model (Klopper *et al*., 2007; Avison and Fitzgerald, 2006).

Training and education for users of a system is provided as part of a SDM which helps when deploying the created system across the organization (Avison and Fitzgerald, 2006). Organizations using SDMs are provided with an opportunity to be acknowledged by certifications such as ISO, CMM and TMM (Klopper *et al*., 2007).

These are only a small portion of what the SDMs could do for the development process if they are used properly and in the right setting. Of course choosing the right SDM according to the situation also plays a major role because they cannot all work for all situational problems.

2.1.3.2 Disadvantages

As with every technology that emerges in information systems, SDMs also have many issues associated with them. These issues have led to the emergence of more SDMs, a complete abandonment of them due to their failure to provide flexible development solutions or a re-defining of SDMs to suit any needs eminent (Thermistocleous *et al*., 2004).

Even though all SDMs have weaknesses, there seem to be more of them on the traditional life cycle and its models, such as the waterfall SDM as compared to other SDMs. For a SDM such as RAD, its weaknesses have more to do with the results not being as expected if they are not used as they should, while the traditional life cycle and its models' problems seem to originate from its processes, the way the SDM actually works.

According to CMS (2005), the waterfall model, for instance is said to be slow, costly, and not flexible because of its structure and tight controls. There is little room for iteration and progress forward, so if requirements and specifications are not identified and defined early on in the process, chances are that they will not be represented in the final product. This means that the tasks would have to be taken care of in the maintenance phase and some critical applications put on hold. Excessive documentation is always a sore spot for the SDLC (Avison and Fitzgerald, 2006).

The spiral model on the other hand has few weaknesses and its critiques are not as harsh as those of the SDLC. Because the spiral model can be adapted to each project, complexity could be a problem if all that has been done in the project were to be reused in another that is similar in nature to it. So ultimately all the projects created using the spiral model are very unique. If an inexperienced project manager is used, that could pose a problem for the project, as the spiral model is complex and requires experienced staff. There have been no controls that have been established by the spiral model when advancing through the cycles, which could result in extra work when the next cycle is about to be tackled. There are also no set deadlines as the cycles have no clear termination resulting in risks of not meeting deadlines of time and budgets (CMS, 2005).

All these traditional SDM disadvantages have led to the introduction of Agile Systems Development Methodologies (ASDMs) because according to Wang (2007), they provide a more flexible process for developing information systems that can fit and deal with any unpredictable changes. A flexible development process is ideal because Noruwana and Tanner (2012) state that in modern business environments, complex and competitive environments exist. Therefore, for them to perform consistently at their optimal level, flexibility should be prevalent. Apart from the flexibility aspect, other factors such as the low success rate of traditional SDMs, less productivity and low developer satisfaction have contributed to the emergence of ASDMs (Vinekar *et al.*, 2006).

Despite all the issues with the SDMs pointed out in this section, every methodology has a unique situation that it can apply to and benefit it immensely. Therefore, a compatibility match between a methodology and situation should be done before a project can be endeavoured. Apart from matching SDMs to situations, other issues receiving attention include situational (method)

engineering, frameworks for choosing methodologies and contingency use, which will be discussed later on.

2.1.4 SDM usage

Due to the disadvantages discussed, the usage of SDMs in information systems development has been largely ad hoc. Some companies have used them successfully while others experience problems. Ever since 2002, researchers have conducted interviews, and used surveys and questionnaires that have found out that the majority of developers do not use the SDMs to the letter. Aspects, such as experience of the practitioners, perception of certain SDMs by users and different project types determine what SDMs will be used for development and in what way.

For instance, Jones (2003) and his colleagues at Software Productivity Research gathered data on twelve thousand software projects between 1984 and 2003. They had the intention of conducting assessments and creating benchmarks for software development quality and productivity. They found out that small development projects usually use informal approaches. Also discovered was that no one development method was deployed or used in the same way in an organization. Over 40 different methods were used for gathering requirements, 50 variants for carrying out software design, 700 for programming languages and over 30 forms of testing. With all these variations in methods, this suggests that very few developers use a SDM as prescribed, rather they adapt it to suit the situations they face (Jones, 2003).

There are considerable variations in software engineering due to the significant dependency on practitioners. A practitioner is a person and like everyone else is prone to suffer from bias such as being comfortable with a specific SDM. In the same way since software products are developed in the real world, they are bound to be affected by the circumstance or environment in which they are found. Because of these variations, guidance rules are difficult to formalise, so much so that people form their own ideas for "practice using their own experience, hearsay, general folklore and myths" (Dawson *et al.*, 2004:1).

A case study research carried out on three organizations, large, small and medium, revealed that the development environment there is largely ad-hoc. Methods were considered to be important but only after being modified to suit individual projects. The most methods used were in-house. Other factors that determined what SDMs to use as discovered by the investigation were speed,

control and flexibility. Traditionally SDMs were viewed in a negative light by the case organizations overall, as they were considered not to be very useful. The organizations chosen were from Ireland and had been chosen after a survey on them had been carried out first (Kiely and Fitzgerald, 2005).

The survey by Bygstad *et al.* (2008) of the Norwegian IT industry revealed that the majority of practitioners do not use formal methodologies except for techniques and tools at a percentage of 57% while only 8% do. According to the results, there have not been very significant changes in SDM use, indicating that developers and practitioners are sticking to what works for them and are reluctant to change anything.

Also adding to the complexity or difficulty is the variety of products that are developed in software engineering. No circumstances under which software products are developed are the same, therefore many variations take place in practice, as found out by Jones (2003). SDMs that fit a project could play an important role in reducing the risks involved. If the SDM is well fitted, other problems of complexity and unstable requirements can be dealt with as well. Using an inappropriate methodology, however, increases the project's risks by a very high margin, followed by lack of customer involvement (Tiwana and Keil, 2004).

There are considerable variations and diversity in systems development approaches used for information systems development because there are over 1, 000 methodologies that offer their own perceptions as to what is a best practice and tool to use for development. Despite all these best practices and tools introduced by SDMs meant to reduce project failures, system failures still continue to happen (Jeyaraj and Sauter, 2007).

From a South African perspective, Noruwana and Tanner (2012) state that the same problems that are faced by overseas countries, such as the USA are being faced here and there is a leaning towards the use of ASDMs instead of traditional SDMs. Ferreira and Cohen (2008) also agree that ASDMs are gaining popularity in South Africa, mainly because the high rate of project failures is blamed on traditional SDMs and their inability to cope with changes in dynamic and diverse environments.

All in all, the studies on the use of SDMs suggest that significant variation and changes are taking place in practice, despite the prescribed procedure. This is because there are different

types of projects, products and diversity to information systems development. Sometimes, practitioner experience determines what SDM will be used and in what way. It could either be as prescribed, ad hoc, made contingent or in-house. Once a SDM used is seen to be working for developers, they stick to it. All these efforts are made in order to reduce project failures and to deliver more value to customers.

2.2   Agile Systems Development Methodologies (ASDMs)

As has been discussed at the beginning of the chapter, SDMs have gone through many changes to get to the point where they are. So much so that developers have identified what works and what does not. Traditional SDMs were thought to be rigid and not very suitable for small- to-mid- sized software development efforts, hence the emergence of ASDMs, which allowed that. ASDMs are becoming increasingly popular in industry and academic paradigms, probably because of their promises of reduced costs, higher productivity, quality, and better business satisfaction. They are ideal for market-driven industries that require short development times and deployment (Mishra and Mishra, 2011).

Sohaib and Khan (2010) further add that ASDMs are meant to facilitate quick system development, analysis and design. They are iterative, emphasise group work, and promote open communication between customers and the developers, as well as early delivery of products.

An ASDM is a "flexible software development process that adapts to changes instead of adhering to a rigorous one" (Wang, 2007:16). ASDMs are described as being a philosophy rather than a process and their techniques and concepts are not completely new but have been used for years, even by traditional software techniques, such as refactoring and test-driven design. It is also stated that ASDMs should be seen as a strategy for carrying out a project with less development tasks and immediate results produced timely with minimal costs. This is completely contrary to traditional SDMs (Wang, 2007).

Devedžić and Milenković (2011) describe ASDMs as a group of light development methods meant to increase the time taken to deliver a product to the market and to integrate new requirements, decrease development time, while ensuring product quality and flexibility, and an increase in an organization's rate of response, while reducing overheads incurred during development. The key issues of ASDMs include; short development cycles, continuous

involvement of customers, clear and clean code, pair programming, and a constant development rhythm.

Some examples of ASDMs in use include Extreme Programming (XP), Scrum, Crystal family, Feature Driven Development, Dynamic Systems Development Methodology (DSDM), Adaptive Software Development (ASD), Lean Development (LD), Agile version of the Rational Unified Process (RUP) and Pragmatic Programming (PP) (Wang, 2007).

2.2.1 History of ASDMs

As was discussed earlier, ASDMS were developed in reaction to the dissatisfaction with traditional SDMs, such as lack of flexibility. ASDMs first appeared on the scene in 1995. They have the reputation of being "code-and-fix approaches", which is not entirely true. All the SDMs found under it are based on "practices of program design, coding and testing believed to enhance software development flexibility and productivity" (Ramsin and Paige, 2008:7). It is believed ASDMs do use detailed procedures but it keeps them as light as necessary.

Theunissen *et al.* (2005) concur that it was indeed in the mid-1990s that ASDMs emerged. According to Jiang and Eberlein (2009) the roots of ASDMs can be traced to the traditional development disciplines. For instance, the concepts of iteration and incremental development used by ASDMs can be traced as far back as the 1930s when an employee at Bell labs used them to improve product quality. In fact, Strode (2005) stated that ASDMs were derived from existing SDMs and techniques.

The first ASDMs to emerge were SCRUM and Dynamic Systems Development Method (DSDM) in 1995, Pragmatic Programming (PP) in 1999, Adaptive Software Development (ASD) and Extreme Programming (XP) in 2000, Feature Driven Development (FDD) and the Crystal Family in 2002, and Lean Development (LD) in 2003. This is illustrated in Figure 2.4**.**
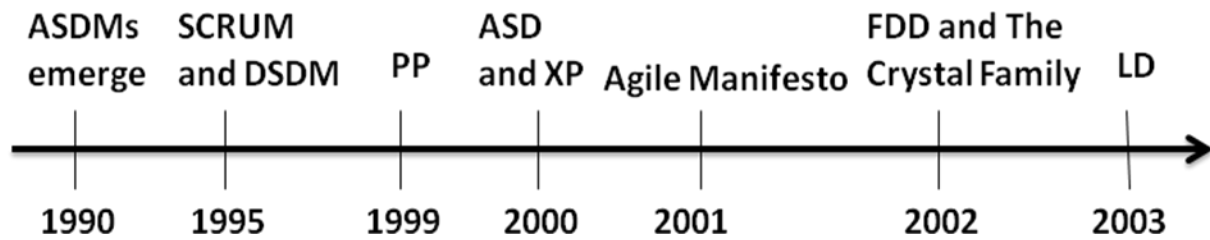
Figure 2.4: ASDMs Timeline

Then all those who supported the ASDMs met in 2001 to formalize common principles among them with the end result being the Agile Alliance and the Agile Manifesto (Beck *et al.*, 2001). Theunissen *et al.* (2005) state that since the formation of the Agile Alliance, more ASDMs have been adopted by developers as it fulfilled the software development needs at that time, such as to develop at internet speed, to take advantage of opportunities and dealing with volatile requirements.

2.2.2 Types of ASDMs

There are several types of ASDMs that share the same approach. They include Extreme Programming (XP), Scrum, Feature Driven Development (FDD), Dynamic Systems Development Method (DSDM), Adaptive Software Development (ASD), The Crystal Family, Lean Development (LD), Agile versions of the RUP, Pragmatic programming (PP) and Whitewater Interactive System Development with Object Modules (WISDOM). XP, Scrum, FDD, DSDM and the Crystal family will be discussed, as they are popularly used and well documented.

2.2.2.1 Extreme Programming (XP)

Extreme Programming (XP) is said to be the most well-known ASDM. It was developed at Chrysler by Kent Beck, as he was working on a payroll project as part of a 15 member team. The creator continued to work and redefine the SDM until it was appreciated and integrated by everybody else in 2000 and 2001 (Livermore, 2008). Although XP was originally formulated by Kent Beck, Ron Jeffries and Martin Fowler collaborated with him. It is the most well "defined and attractive" SDM to use due to its twelve practices, such as pair programming. It is called "extreme" because its "good practices" should be used to the extreme (Wang, 2007:18).

XP is ideal for situations where the requirements have not been fully identified or described. It is iterative, uses incremental and evolutionary development, and put together with continual and intensive involvement of the users, requirements can be finalized and agreed upon timeously. The final system derived is a true representation of what the end users want. XP changes the traditional role of a customer or user in that they are so involved in the whole project from start to finish which is not usually the case (Livermore, 2008; Dyck and Majchrzak, 2012).

In the meetings with the customers, requirements are agreed upon between the user and developers in what is known as the planning game. The result is the user stories which can be implemented as part of the system (Wang, 2007; Angioni *et al.*, 2006). The developers then work in pairs in what is known as pair programming (Livermore, 2008; Dyck and Majchrzak, 2012) and they can choose what tasks to be responsible for. Each task could take up to one to two weeks of iterations and it is deemed completed when it has gone through tests by the developers and users, and accepted. Also found on the team according to Angioni *et al.* (2006) is someone known as a tracker who checks on the status and progress of the tasks in terms of the days taken on them or left, and what could be delaying their implementation, if at all. This is done so that it can be known whether the time frames attached to the tasks to be completed in the planning game were realistic or not. Wang (2007) states that new user stories do arise during the process. If an implemented task is accepted, it is integrated into the final software. The code that is integrated is collectively owned by all the programmers involved in the project (Livermore, 2008).

Other principles involved in the use of XP include the use of metaphors, which represent a united understanding of how the system will function, architectural spikes, which explore possible solutions to a difficulty in the form of a program, release planning, code refactoring and a work week of not more than 40 hours (Livermore, 2008).

2.2.2.2 Scrum

Scrum software development was originated by Ken Schwaber and Beedle in 2002. It is regarded as a procedure for managing information systems that are complex, involve risk, have volatile requirements and require planning. It is extends and improves OOA approach. The name of the SDM is derived from the game of rugby – a short name for scrimmage – where the team members pass the ball to one another in an attempt to advance it near the goal field. In the same

way, Scrum tries to move a project along by using communication and a number of sprints, which should not last for more than thirty days. The series of sprints go through several iterations to derive a software product that can be seen and touched so as to be evaluated by the stakeholders and any responses taken care of as appropriate (Wang, 2007; Livermore, 2008; Vlaanderen *et al.*, 2011).

Scrum places considerable emphasis on the management of the development process rather than on coding procedures; hence it is ideal for volatile business requirements. It can work for small and large projects since they can be broken down into smaller projects with their own individual Scrum teams. Integration is later used to put all the teams' work together to complete the whole project (Livermore, 2008). Dyck and Majchrzak (2012) regard Scrum as a SDM for teams that are interested in learning, thus being in agreement with Wang (2007) who states that the team's creativity in this SDM is fully encouraged and developed. It therefore encourages flexibility and adaptability. According to Sugumaran *et al.* (2007), the developers in Scrum can start with any task or change it along the way at any time if so desired, so there is no sequence defined with only the planning and closure being agreed upon (Vlaanderen *et al*., 2011).

2.2.2.3 Feature Driven Development (FDD)

This is an ASDM first developed by Jeff De Luca and Peter Coad. It was first used for a bank project in Singapore that benefitted from its easy to use iterative development process and provision for a reporting system for the management of an organization (Livermore, 2008; Wang, 2007). Wang (2007) regards FDD as a model-driven, iterative SDM that is ideal for information systems with many small changes and it is a guideline for development. FDD helps to discover and implement system requirements. It is considered more straight forward than XP because, for instance, it can incorporate features of ASDMs, such as Scrum or any other recognized and established best approach. For instance, it can use pair programming and stand-up meetings (Ge *at al.*, 2006; Sugumaran *et al.*, 2007; Livermore, 2008). An interesting aspect highlighted by Wang (2007) regarding FDD is that implemented results can be seen within two weeks or less.

FDD has five phases:

1.   Develop an overall model (DOM) – A chief architect leads and guides the members in this task

2.   Build a features list (BFL) – It helps to identify the features that can offer support to the requirements

3.   Plan by feature (PBF) – A development plan is derived

4.   Design by feature (DBF) – It produces the feature design package

5.   Build by feature (BBF) – A completed functioning product is derived (Ge *et al*., 2006).

FDD has a release manager who monitors all the progress going on in the project and reports to whoever is important and relevant, such as the stakeholders. If more programmers are needed in the project, then they are added (Wang, 2007).

2.2.2.4 Dynamic Systems Development Method (DSDM)

It is an ASDM proposed by Jennifer Stapleton and it is a "game-changing, open-ended, non-proprietary and non-prescriptive agile project development model for developing business software within tight timeframes" (Wang, 2007:19). It tries to eliminate or reduce well known problems associated with development such as going over budget, not meeting deadlines, no user participation and management commitment and it is ideal for small- to- midsize projects (Wang, 2007; Sugumaran *et al*., 2007).

According to Wang (2007) DSDM has five phases, namely; - feasibility study, business study, functional model iteration, design and build iteration, and implementation. The third to fifth phases have to do with iteration. Workshops are used in phases 2 and 3 to derive user input. DSDM can be applied over a variety of projects. Like XP, DSDM also has principles of which nine define it as follows:

1. Active user involvement is imperative.
2. Design groups are empowered to make system development decisions.
3. Frequent and regular delivery of components is a priority.
4. The primary acceptance criterion for a system or component is its fitness for business purposes.

5. The business solution is the goal, and iterative and incremental development is necessary to converge on that solution.

6. All changes made during development are reversible.

7. Initial requirements are set at a high level.

8. Testing is integrated throughout the life cycle.

9. Collaboration and cooperation between all project participants is essential (Wang, 2007: 19-20).

2.2.2.5 The Crystal family

The Crystal family is a SDM comprising of several SDMs under it, namely; - Crystal clear, Crystal yellow and Crystal orange. Its originator is said to be Alistair Cockburn (Cockburn, 2004). This family of SDMs deals with projects that are critical or not, for instance Crystal clear is meant for small teams of 1 – 6 people where an organization would not suffer if the project failed (Jones, 2003). The word, "crystal" according to Wang (2007:20) "refers to the many facets in a gemstone", which could be many "techniques, tools, standards and roles" used in a project.

It is people-oriented and communication-centred. Crystal methods believe that people have significant influence when it comes to software development projects much more than techniques or procedures. It is made up of method fragments that have been combined by different teams to fit their unique projects. The larger the project, the more the number of elements to use, more communication among the development team, consequences of faulty released software and executive influence that hamper the project process (Livermore, 2008).

Wang (2007) states that when a new project is being endeavoured using the Crystal family, various practices should be used so as to derive maximum management. In all this, people should not be forgotten, especially if success is hoped to be achieved. With effective communication and short delivery times, the Crystal family reduces paperwork, overheads, and bureaucracy, thereby minimizing the cost of the project. Other important aspects are as follows:

- Creativity and communication collaborate during the development process;
- Maintainability and sustainability are essential;
- The more the requirements, the more strict the "process discipline" should be; and
- Cultural differences are properly considered (Wang, 2007:20).

ASDMs can also be combined to derive benefits of the combined approaches, such as XBreed, which combines XP practices and Scrum to derive components that can be reused when developing multiple projects (Wang, 2007).

All the ASDMs discussed above use the concepts of iteration, and incremental development and are very suitable for small projects. XP and DSDM have principles that are similar to each other making it easy to use and combine concepts from different ASDMs that are useful. The differences among them include Scrum's use of sprints and a solid management for unpredictable risks. The XP principles also make it unique especially its use of pair programming. FDD users use it because management is kept abreast of new changes in a timely manner and it is thought to be a more straight forward guideline than XP. DSDM on the other hand is more business oriented and it tries to eliminate known problems associated with development, such as going over budget. The Crystal family's strong point on the other hand is its ability to combine different methodology elements that could be applicable to a project, either small or large. All in all, what is important to the project team to achieve should be considered first and then an appropriate ASDM chosen accordingly afterwards.

The advantages and disadvantages of ASDMs will now be discussed

2.2.3   Advantages and Disadvantages of ASDMs

Table 2.1 below summarises the advantages and disadvantages of ASDMs according to the different authors or sources.

Advantages	Disadvantages
Ideal for unclear or changing requirements (Mishra and Mishra, 2011; Dyck and Majchrzak, 2012; Ge *et al*., 2006).	No formal support for refactoring and customization (Sugumaran *et al.,* 2007).
Incremental and iterative development useful for volatile needs (Sugumaran *et al.*, 2007).	Changing from the SDLC environment to ASDMs is challenging (Laanti *et al*., 2011).
Covers quality, change and configuration management (Dyck and Majchrzak, 2012)	ASDMs need experienced personnel as inexperience could add to their failure

	(Conboy *et al.* (2011).
Lower costs, better productivity, higher agility and flexibility have been experienced (Mishra and Mishra (2011).	Inadequate documentation processes could lead to difficult process monitoring (Kajko-Mattsson *et al.*, 2006).
The presence of customers helps with getting feedback quickly (Mishra and Mishra, 2011)	A lot of training is required before the adoption of ASDMs (Livermore, 2007)
The tasks selected and implemented allow the project to be successful and are delivered quickly (Mishra and Mishra, 2011).	Demanding for introvert developers, as it requires engaging with users (Conboy *et al.*, 2011)
Less documentation is derived due to precise and specific needs (Mishra and Mishra, 2011).	Challenging when applied to large and complex projects (Mishra and Mishra, 2011).
Transparency is high and can be seen, as the people responsible for certain tasks are known beforehand (Mishra & Mishra, 2011).	Kajko-Mattsson *et al.* (2006) state that ASDMs end products fulfil immediate individual needs of the customer only.
Control is prevalent in a small and coherent team as complexity and risk are less (Mishra and Mishra, 2011).	Project management and documentation disciplines are not adequately covered (Dyck & Majchrzak, 2012; Sugumaran *et al.*, 2007).
Feelings of effectiveness, happiness and early detection of defects (Laanti *et al.*, 2011)	No certifications have been set up (Sugumaran *et al.*, 2007).

Table 2.1: ASDM advantages and disadvantages

When ASDMs were introduced or formally accepted into the development sphere, they were thought to have solved the problems of the traditional SDMs such as flexibility. However, as can be seen from the disadvantages discussed, problems still exist. This has led to the contingent use of ASDMs so that developers are able to fit them to the projects in which they endeavour. This is in line with Burns and Deek's (2010) research that SDMs are made contingent regardless of whether they are "heavy" or "agile".

2.2.4 ASDM usage

According to Noruwana and Tanner (2012), ASDMs are very popular and their use and adoption are continuing. The problem is that little literature is being derived on the challenges that South African developers are facing when using ASDMs. The successes of the projects that use ASDMs are also not known. Nevertheless what is known is that a longer period of time is needed to precisely measure the success of ASDM use. Noruwana and Tanner (2012) cited issues, such as organizational culture, resistance to change and pair programming, no ASDM structured process and the introduction to unfamiliar roles as contributing to the challenges faced when adopting ASDMs in organizations across South Africa.

Despite the known benefits of ASDMs, Ferreira and Cohen (2008) state that empirical research is sparse, both in South Africa and abroad, as concentration is more on the explanation side, especially on pair programming. To contribute to the empirical data in South Africa Ferreira and Cohen (2008) carried out research using 59 development projects that used ASDM practices (iterative development, continuous integration, collective ownership, test-driven design and feedback). The results were strongly positive and showed that stakeholders were satisfied with the development process and the outcome of the projects.

Surveys carried out about ASDM experiences in 2003 globally by an Australian company revealed that 88% of the organizations involved said that improved productivity was seen. 84% experienced improved quality of their software products, 49% stated that costs were seen to be reduced, 46% stated that development costs were not reduced or increased while using ASDMs, 83% revealed that executive satisfaction had increased and 48% like ASDMs because they react to change and do not follow a strict and planned path (Sutharshan and Maj, 2011).

A survey done by Microsoft in 2006 showed that participants valued ASDMs for their communication and co-ordination strategies and quick and speedy delivery of products as their top two benefits (Sutharshan and Maj, 2011).

Laanti *et al.* (2011) acknowledge that the strength of empirical evidence on the usage of agile methods is relatively low and scarce. They discovered that 76% of ASDMs being used is almost exclusively focused on XP and the remaining percentage is for the other methods.

Some of the challenges identified by the 17 companies studied revealed that through the use of ASDMs, developers felt that the use of concepts such as stand-up meetings, on site customer and continuous integration exposed their deficiencies publicly if for instance they are not making progress or have weak programming skills. Another challenge found was that ASDMs required developers to fulfil a variety of roles, such as programming, testers, architects, customer and quality assurance expert. The use of ASDMs requires increased social interaction among developers and customers, having business knowledge, understanding the value and principles that underlie them, and recruiting people with experience for their use (Conboy *et al.*, 2011).

ASDMs are increasingly becoming popular and their usage has divided the development community into "agilists and traditionalists". Like Conboy *et al.* (2011), they also point out that challenges will be encountered when moving from a traditional development environment to an agile one (Nerur *et al.*, 2005).

A survey carried out in Europe and the USA showed that 14% of companies are already using ASDMs. 49% were found to be aware of ASDMs and are interested in using them. There has been little empirical evidence on ASDM use but there has been a steady increase on research papers being done with 1 article published in 2001 and 16 in 2005 (Dybå and Dingsøyr, 2008).

Breivold et al. (2010) reveal that many of the claims concerning ASDMs and architecture are not supported by science; therefore, more empirical studies are needed in the future to know the complete advantages and disadvantages. Otherwise what are available are expert opinions. A study on nine US companies, according to Breivold et al. (2010), revealed that developers tend to use traditional SDMs when the customers and products are mature and more complex but the opposite is true for ASDMs.

According to interviews carried out by Overhage and Schlanderer (2012) with experts with experience and knowledge on Scrum and traditional methods, it was found that they had more confidence in and expertise on Scrum than on traditional methods. This was despite them having worked with Scrum for 4.5 years and 23.4 years with traditional methods. The experts also believe that customer requirements were better met in Scrum, they learnt more in it and there was more satisfaction with the projects' outcomes overall. There is transparency and increased collaboration therefore that made ASDMs ideal for them (Overhage and Schlanderer, 2012).

Table 2.2 is a summary of the current use of ASDMs according to the different authors over the years.

Authors	ASDMs usage
Nerur *et al.*, 2005	Popular use of ASDMs but challenging when moving from traditional SDMs
Ferreira and Cohen, 2008	Little empirical research in South Africa but there are more positive perceptions about them
Dybå and Dingsøyr, 2008	In Europe and the USA14% of companies are already using ASDMs, 49% were aware of ASDMs and are interested in using them. There is an increase in literature on ASDMs from 1 to 16 articles in 2001 and 2005 respectively.
Breivold *et al.,* 2010	ASDMs are used for small and not complex projects
Sutharshan and Maj, 2011	Improved productivity, quality and reduction of costs were seen from the use of ASDMs. Communication was also improved.
Laanti *et al.*, 2011	XP is the most used ASDM
Conboy *et al.*, 2011	More skills required from the use of ASDMs such as increased social interaction and business knowledge
Noruwana and Tanner, 2012	ASDMs are popular in South Africa but more time is needed to measure their success and overcome pertinent challenges
Overhage and Schlanderer, 2012	Transparency and increased collaboration in ASDMs

Table 2.2: ASDM usage

2.3   Contingency

As has been discussed in the earlier sections, traditional SDMs were seen not to fulfil the needs of the information systems development community, thus leading to the emergence of ASDMs. Because the traditional SDMs were seen to be rigid and inflexible, the ASDMs that emerged were thought to be light and flexible. But the ASDMs also came with their own set of problems as has been discussed in the sections on their disadvantages and usage. Therefore, contingent use is currently happening to ASDMs that are already light and flexible. Contingent use of SDMs means that they should be able to fit an information systems project regardless of type, size and any uncertainties that are bound to emerge (Avison and Fitzgerald, 2006; Dictionary, 2011).

Most traditional SDMs were made and created so that they could be applied to any type of project whether it is big or small. Since one SDM is supposed to fit any project, it becomes a problem when a small project is being done according to the way a big one would be as the method is still the same. Since they are not contingent, they end up offering complex ways of carrying out a project that is simple and clear, as they require a lot of detail that is unnecessary. No specifications are available, for instance, if a project is small is to be carried, out such as the aspects that need to be removed or added. Therefore, developers end up making the SDM contingent for their use in a particular project. Projects differ with regard to type, purpose, objectives, the organization and its environment, the users and developers. Contingent use of SDMs therefore helps to make sure that a SDM fits each unique project engaged in (Avison and Fitzgerald, 2006).

According to Burns and Deek (2010), research has shown that information systems development practitioners often make SDMs contingent to match the specific circumstances of their projects regardless of whether they are "heavy" or "agile" and that these changed SDMs often worked best. Meso and Jain (2006) also concur that regardless of what SDM is used and how good it has been shown to be, in practice, they are all adapted. Burns and Deek (2010) state that recent research has shown that the best SDMs to use practically have been shown to be those that have been selected specially, blended or tailored.

2.3.1   Contingency Methods

To make SDMs suitable for contingent use, contingency models have been developed, adapted and tailored and will be discussed in the following sections.

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2.3.1.1 Adaptation

According to Aydin *et al*. (2004:128), adaptation gives an indication of "a modification according to changing requirements". "To adapt means to change your (or a system's) behaviour because your (or the system's) situation or environment has changed", according to Pahl (2004:974). This environment consists of technical and organizational aspects where there is a computer system running software but with stakeholders involved who have their own needs from it. Pahl (2004) states that evolution and development are different from adaptation in that the former is change that has to do with improvement while the later has to do with growth and increase. Adaptiveness encompasses maintenance, change, improvement, growth and flexibility.

2.3.1.2 Tailored Approach

According to Burns and Deek (2010), SDM tailoring is the process by which a SDM is selected, tailored or blended with another. They discuss two ways of tailoring techniques, which include contingency factors approach and situational method engineering.

2.3.1.2.1 Contingency Factors Approach

The contingency factors approach requires that the specific details of the situation or project be known and used as a basis for choosing a SDM that would be appropriate for it. This requires developers to be familiar with "every contingent methodology or have contingency built in as part of the methodology itself", according to Burns and Deek (2010:2). The following are some of the contingency approaches that have been suggested and used by Zhu (2002) and Avison and Fitzgerald (2006).

2.3.1.2.1.1 Zhu's Contingency Approaches

Three contingency approaches were discussed by Zhu (2002) as follows; -

1. **Contingency at the onset –** This type of approach consists of choosing a SDM or a combination of SDMs to use for a project before it has started and using it throughout the project process (Zhu, 2002).

2. **Contingency with a fixed pattern –** This is a consequence of "contingency at the onset". It considers complexities inherent in projects because of a mix of "human, social, organizational and technical difficulties" (Zhu, 2002:5-6). It recognizes that SDMs

cannot be chosen from the beginning but at "each individual stage of a project". An example of this is the Multi-view SDM.

3. **Contingency along development dynamics** – This factor acknowledges that some issues that affect information systems development do not occur predictably, therefore as and when they emerge or crop up, they should be dealt with uniquely instead of in the step-by-step procedure already described (Zhu, 2002).

2.3.1.2.1.2   Avison and Fitzgerald's Multiview

Multiview is an exploratory contingent SDM (Wood-Harper *et al.*, 1985). It takes into account the computer specialists involved in the project, their skills, the users and the unique situation of the project according to Avison and Fitzgerald (2006). It is considered to be flexible and 'multi-view' because it includes various perspectives and stages. It suggests to the developers the techniques and tools to select and use according to different situations.   These tools and techniques are chosen at different stages of the development process (Avison and Wood-Harper, 2003).

Its stages include an analysis of human activity, information, design of socio-technical aspects, design of the human-computer interface and technical aspects. These five stages cover aspects that are necessary for the complete carrying out of a project from its analysis to its design, including technical and human terms. The "stages move from the general to the specific, conceptual to hard fact, and from issue to task". The outputs from the stages become inputs to the next or significant outputs for the SDM (Avison and Fitzgerald, 2006:538).

Multiview deals with computer-related questions as well as people and business functions. The analysis of the human-activity stage derives a definition of the requirements. The resulting requirements will then be used to form the technical and human views of the system in the second and third stages of information and socio-technical analyses. People are involved in this process because it is believed that with their involvement, use and acceptance of the system will be enriched and expedited. The fourth stage deals with the technical requirements of the user interface. The final stage, technical design, designs the technical requirements of the system such as databases, control and maintenance (Avison and Fitzgerald, 2006).

An illustration of the Multiview SDM is shown in Figure 2.5 (Avison and Fitzgerald, 2006).

1. **Human Activity** – How is the information System supposed to further the aims of the organisation using it?

2. **Information** – How can it be fitted into the working lives of the people in the organisation using it?

3. **Socio-technical** – How can the individuals concerned best relate to the computer in terms of operating it and using the output from it?

4. **Human-computer Interface** – What information processing function is the system to perform?

5. **Technical** – What is the technical specifications of a system that will come close enough to meeting the identified requirements

Figure 2.5: The Multiview SDM

Burns and Deek (2010) have deemed the contingency approach as not very successful in practice.

2.3.1.2.2 Situational Method Engineering

In situational method engineering or simply method engineering, a new methodology is created, using a collection of method of fragments that have already been defined and tested, from other known methodologies to suit a particular situation and project (Asadi and Ramsin, 2009; Henderson-Sellers, 2006; Burns and Deek, 2010).

Rahimian and Ramsin (2008) present some of the ways in which method engineering can be done, namely as follows;

1. Ad hoc – It entails developing a new methodology from scratch.

2. Paradigm-based – "Instantiating, abstracting or adapting" a chosen methodology's meta-model to suit the situation or what is required in the project.

3. Extension-based – Extending and improving a chosen existing methodology by adding new creative ideas.

4. Assembly-based – Using method fragments in a repository to assemble a methodology that is useful.

Since every situation is difficult to plan for, Burns and Deek (2010) state that method engineering has several shortcomings, such as some method fragments missing.

2.3.1.2.3 Yusof et al.'s Hybrid SDM

Yusof *et al.* (2011) also present a hybrid methodology known as CuQuP (Complexity, Uncertainty, Quality and Phase) based on factors complexity level, uncertainty level, quality criteria and methodology phase. The complexity and uncertainty levels (high or low) are combined to form a weight that is then combined with the quality level weight to determine the scope of the SDM to use. Each methodology is assigned a score according to the weight and the one with the highest score is chosen to be used. The methodology was used by the Malaysian army operation information systems and was found to be successful despite the data gathering activities being cumbersome (Yusof *et al.*, 2011).

2.3.1.2.4 Burns and Deek's Tailoring Model

Burns and Deek (2010) developed a model that could be used to tailor methodologies that are common and are thought to have the best practices. The phases Describe, Problem Solve and Prescribe are used.

In the describe phase, the problem with the highest priority is used to choose the SDM to use for solving a problem, such as traditional or agile. The problem solve phase then derives techniques and tools that would best solve the problem or fulfil the project's needs. The last phase is where the solution to the problem is implemented using the SDM chosen or its fragments only after they have been arranged appropriately.

The process then cycles back to the describe phase and the next problem with the next highest priority is chosen and the SDM chosen that would be applicable to solve it then on to problem solve and prescribe and so on (Burns and Deek, 2010).

2.3.1.3 Ahmar's Rule-based expert system

Ahmar (2010) formulated a rule–based expert system that can choose a methodology for a developer to use for a particular project. Object-oriented modelling and a graphical user interface are used. The expert system acts as a human expert using criteria such as project time, clarity of user requirements and system complexity. For instance, projects with a short duration could use a SDM such as XP, that is meant to speed up development and unclear requirements would use prototyping. Therefore, the way the expert system works is to get input from the user by deriving the criteria that are prevalent in respect of the project (e.g. clarity of requirements), its value (high, moderate, low), confirming and then displaying the SDMs that could be appropriate (Prototyping) including priorities, explanation and ranks (Ahmar, 2010).

According to Burns and Deek (2010) these contingency methods have not been very successful in the industry as ad hoc tailoring is more popular.

2.3.2   ASDMs Contingent Use

Fitzgerald *et al.* (2003) state that it has been a widely accepted fact, in the information systems development community, that SDMs need to be made contingent according to situations unique to all projects. However, there has not been formal guidance to show developers how best to do this, i.e. whether to remove or change a certain step and which one in particular. They acknowledge that there is a big gap between what the formal development process is and what is being done in practice.

This is in line with Burn and Deek's (2010) research telling us that tailoring is occurring whether it is in regard to traditional SDMs or ASDMs. They are all made contingent by different developers and organizations to suit their needs. Scant literature exists to show us how it is done and that regardless of the suitability of a methodology, they are being made contingent.

A discussion of the ASDMs that were made contingent, as well as some proposed approaches follows.

2.3.2.1 ASDM contingent use in practice

Some instances, though few, where ASDMs were made contingent were found, that proved that contingency does occur in practice.

2.3.2.1.1 DSDM Contingent Use

Aydin *et al.*'s (2004) research is based on an organization that has a team for method adaptation, thus the aspects of ASDMs made contingent were found. The ASDM used in the organization that was investigated is DSDM. The project managers were taught by experts or coaches who had extensive knowledge and experience in DSDM use. They were taught how to make DSDM contingent, properly based on informed decisions and the degree to which they could do so. The experts' roles were to coach the project managers on how to make DSDM contingent while the project managers had to carry out the actual execution (Aydin *et al*., 2004).

The coaches first had to learn the characteristics of the project and thereafter find out how the aspects of DSDM could be used optimally to benefit the project. At the beginning of using DSDM in the department, they had used it as prescribed but as they got comfortable with it, they added and clarified some aspects, such as controls, milestones and suggestions.

2.3.2.1.2 XP Contingent Use

Cao *et al*. (2004) discuss how an organization used in their case study made XP contingent so that it could work for their large and complex project. They identified aspects of XP and some of its principles and made them contingent accordingly. The following work is based on their research.

Designing up-front

XP principles require that the design for a system not be done up-front due to changing requirements but the organization, FinApp, changed this and created an upfront architectural design to deal with complexity and the large-scale nature of the project. This helped them to add security, a strong backbone, reliable requirements and a reduction in development time when new functions emerged.

Short release cycles with a layered approach

Despite this being important, FinApp adapted it to suit their situation so their iteration duration was not fixed but dependent on the inherent structure of the phases and work items.

Surrogate customer engagement

Access to on-site customers is sometimes difficult so they are replaced by product managers, business analysts and other relevant people. This is done because a large project has more complexity that could require more experience and expertise of a wide range of people. Furthermore, the customers who could be available are usually not the final end-users of the system.

Flexible pair programming

This is often seen as a good principle but not very realistic for all situations, therefore FinApp uses it in a more flexible way. During analysis, design, development and unit testing, pairs are used but during coding, they do it solo, mainly due to developers' clashing personalities but nevertheless, it is used whenever possible.

Identifying and managing developers

Motivated and experienced developers are seen as contributing to the success of projects so they are carefully hired, and rewarded with incentives to make them work even more efficiently.

Reuse with forward refactoring

In XP, refactoring is regarded as a tool to make the design of the code better without changing its functionality. In FinApp, forward refactoring is used, which develops new features by using existing code.

Controlled empowerment –organizational structure

Extended hierarchical organizational structures are seen as high contributors to unresponsive environments so they are changed by transferring the decision making during the project down to the people doing the actual work, thereby empowering them.

Only the above principles were adjusted as they were regarded as essential in order to make XP work for a large and complex project, such as FinApp.

2.3.2.2 Proposed ASDM contingent approaches

Research has been done on what approaches could be appropriate in order to make ASDMs contingent for use in practice. Several methods have been proposed by different authors on how to make different types of ASDMs contingent with some being general and others specific.

2.3.2.2.1 Keenan's ASDMs tailoring Method

Keenan (2004) developed an approach that could be used to tailor ASDMs and it consists of the following strategies;-

1. Comprehensive Process Framework – is provided, such as Ratified Unified process (RUP) that encompasses all possible aspects of a project from its beginning until the end and the most appropriate for the situation chosen.
2. Definition of Process templates – these should correspond to types of projects for instance the Crystal family of methodologies and thereafter choosing one that suits the project context and tailoring it as appropriate.
3. Definition of a process – it is done by combining ideas and techniques from best practices and developer experience.

Keenan (2004) says that the first two strategies suggest static tailoring of ASDMs but later during the development process, they can be adjusted as necessary to obtain the best results.

2.3.2.2.2 Chella *et al.*'s ASDM method engineering

Chella *et al*. (2004) also attempted to create their own blend of ASDM by way of method engineering fragments. They wanted to tailor a design process called Process for Agent Societies Specification and Implementation (PASSI) to make it more agile. They therefore followed the strategies of the Agile Manifesto, considered the sequence of activities of XP (Planning, Design, Coding, and Testing) and thereafter the method fragments of PASSI that could be reused or adapted were identified. The method fragments identified were put together with the requirements of the new SDM, and the new agile PASSI was assembled (Chella *et al.*, 2004).

2.3.2.2.3 Rahimian and Ramsin's Blended ASDM

Rahimian and Ramsin (2008:2) also proposed a new ASDM to be used for mobile software development that uses a hybrid method engineering approach based on a "pre-defined set of

requirements and knowledge derived from existing methodologies and process patterns/metamodels". Ideas from ASD and New Product Development (NPD) are used. ASDMs were chosen because of their suitability for the development of mobile applications but due to the different aspects of mobile devices and networks, the ASDMs needed to be adjusted.

Their hybrid methodology design is created as a top-down iterative-incremental procedure with the following tasks:

1. Prioritization of requirements – it is done at the beginning of the process and then again after an iteration. The priorities of the requirements are identified and given ranks, depending on their impact on the project and as the design process goes on, priorities change to those with finer-grained aspects.

2. Iterative design engine – The following are performed at each iteration:

- Selection of design approaches – instantiating an available process, creating complementary artefacts, using an available process pattern or merging features, ideas and techniques from already available SDMs;

- Application of the selected design approach;

- Revision, refinement and restructuring of the ASDM to suit the changes in an iteration;

- Specification of the level of abstraction for the next iteration; and

- Revision and refinement of requirements in terms of priorities and the level of abstraction to be used for the next iteration.

In the first iteration, the SDM was detailed through the use of "generic patterns for risk-based, architecture-centric and test-based development". The second iteration focused on "market consciousness" with activities derived from NPD reusable parts while the third iteration used ideas from ASD's quality-rich assurance measures thereby improving the ability of the process to be reusable. In the last iteration they added prototyping to the process to deal with any technology risks that could be prevalent (Rahimian and Ramsin, 2008:5).

2.3.2.2.4 Cao *et al.*'s Framework for ASDM adaptation

Literature from the past has not focused greatly on the adaptation of ASDMs so they developed a framework that could help with this. The framework is based on how the adaptation of ASDMs

had been done by four organizations and their respective projects. The developed conceptual framework is based on adapting Adaptive Structuration Theory (AST). AST "examines organizational changes facilitated by different types of structures provided by advanced technologies, tasks and organizational environments, as well as structures that actually emerge in social action" (Cao *et al*., 2009:333).

Adaptation of ASDMs has been largely conducted based on practice instead of taking theory into consideration as well. And in practice, they state that top management must recognize how important their role is in adopting and adapting agile methods as well as their success in an organization. The framework also shows that different influences on the structure has an impact on the "appropriation of ASDMs" and it emphasizes that ASDMs are adapted and "appropriated" according to a project, the organizational and development context of the project (Cao *et al*., 2009).

2.3.3 Critique of Current Literature

As has been discussed in the previous sections, ASDMs emerged as an alternative to the inadequacy of some of the traditional SDMs. To help further with adding some standards to the contingent use of SDMs in general, contingency methods were introduced as they are already being used in the development community (Burns and Deek, 2010; Fitzgerald *et al.*, 2003). However, their introduction still did not help as the most dominant contingent method according to Burns and Deek (2010) for fitting ASDMs to different projects was largely ad hoc and rare publications were found on its documentation.

The literature found on the actual contingency of ASDMs is old compared to the research carried out by Burns and Deek (2010) and their findings. For instance, the adaptation of DSDM discussed was conducted in 2004 by Aydin *et al*. (2004). In addition, their method of adaptation depends on the team that carries out the adaptation for the developers. It needs more resources in terms of a group of experts, project managers and developers. If the developers could know how to actually make DSDM more contingent, it could be very helpful and less costly.

Aydin *et al.* (2004) do point out that empirical studies on ASDMs are needed so that we can derive some lessons to be learnt from, especially as to what goes on in practice. They state that

the reasons why empirical evidence is lacking could be that practitioners do not use formal processes to adapt ASDMs as has already been outlined by Burns and Deek (2010).

The research carried out by Cao *et al.* (2009) though more recent than that of Aydin *et al.* (2004), does not point out what happens to some other aspects of XP that are also important, such as continuous code integration and metaphors, the use of architectural spikes, coding conventions and other principles.

Keenan's tailoring method for ASDMs is too general and the first two static strategies should not be so, because that is the time period when aspects, such as requirements are still uncertain.

The procedure used by Chella *et al.* (2004) is not specific or detailed as the aspects in XP that were added to their new agile PASSI were not disclosed. The same can be said for Rahimian and Ramsin (2008), and Cao *et al.* (2009) as they do not specifically say which aspects of which ASDMs are added or left out in their blended ASDM and ASDM framework, respectively.

Because of the abovementioned weaknesses and the fact that a South African perspective is missing on the contingent use of ASDMs, the gap needs to be filled. Even though overseas research has shown that ad hoc contingent use of ASDMs is happening, little literature has been published on exactly how it is actually being done, let alone in South Africa.

Burns and Deek (2010) state that this could be because contingency methods are largely informal and tacit, making them hard to "acquire and transfer". So despite knowing that the most used contingency method is ad hoc, there is no "formal, industry accepted, widely used system development tailoring model". Therefore, it cannot be learned or explained (Burns and Deek, 2010:3). It is necessary to find out if this is the case in South Africa as well.

 More empirical data needs to be added when it comes to South Africa and the contingent use of ASDMs since this could add to the academic database. Having knowledge of the contingent use of ASDMs and the reasons behind them could help in maintaining quality and standards. Keenan (2004:1) states that maintaining quality could be achieved by developing software with a "well-defined and understood process".

Conboy and Fitzgerald (2010) also concur that companies are looking for best practices on how contingency is occurring in practice so that it could help them with their own efforts in that area.

Bajec *et al*. (2007) state that researchers and practitioners both agree that if the software development methods available could be contingent to the situations that are found in projects, it would greatly increase their use in real life. Otherwise empirical evidence would increase on them being on paper only and not in practice.

Despite the benefits that contingent use might bring to a project, there is a danger of losing the benefits of standardization and if such a situation were to be prevalent then significant skills and experience would be required to handle the SDMs (Avison and Fitzgerald, 2006).

Chapter Summary

The history that has ruled information systems development (ISD) to the point where ASDMs came into play was discussed. Developers are still not happy with the state of ISD despite the introduction of the flexible ASDMs, therefore they continue to make them contingent. Not enough literature exists that tells us how this contingent use is taking place and as we have seen, a structured and standardized process is needed so that quality can be measured and improved.

The literature available does tell us about what is going on in practice but the problem is that it is old, and not detailed and specific. The other methods discussed are not comprehensive enough that they can be used and applied practically, as they admit that more research is needed on them, some were based on one organization and a perspective is lacking from South Africa (Cao *et al*., 2004; Rahimian and Ramsin, 2008; Cao *et al*., 2009).

We now know the classifications and types, histories of SDMs and ASDMs, why contingency continues to happen and its methods, some examples of contingent use and some suggested ways to make ASDMs contingent. What needs to be investigated is what is taking place with regard to the contingent use of ASDMs in South Africa.

The next chapter will give an indication of the research method that will be employed in the research study on the journey to finding the answers sought. The reasons for the use of the methods that will be used will be discussed, as well as their history. The design of the research will also be discussed.

CHAPTER THREE

RESEARCH METHOD AND DESIGN

3.0   Introduction

We now know about the relevant literature that applies to the research topic under discussion, its current state and its importance. Before data can be collected and analysed, it is necessary to have knowledge of the underlying philosophy and paradigms, which the research is part of in order to appreciate the procedures it uses, their significance and how its quality can be evaluated (Oates, 2006).

In this chapter, we will learn about the different research philosophies that exist in research and single out what applies to the current study and why it was important to be used to derive the solution to the problem. Under the research paradigms, the research methods and data collection methods applicable to them will be discussed. The ways of analysing data collected will lastly be discussed at the end of the chapter.

3.1   Research Paradigms

Oates (2006) defines a paradigm as a collection of perceptions that have been widely accepted and agreed upon on some aspects found in the real world. It gives an indication of the real world in which individuals find themselves, how they fit into it, and the possible connections to that world and its aspects (Guba and Lincoln, 1994). It is a common understanding of how to carry out research and derive data, and every paradigm has a different way of doing this.

It also acts as a reference point for researchers and those who use their research outputs. It allows a certain research to be linked to others of the same kind and for it to be judged according to the appropriate criteria. Key terms and the relationships among them are also defined (Hughes, 2002). There are three types of philosophical paradigms: positivism, interpretivism and critical. These three paradigms will be discussed next, followed by a discussion of the paradigm applicable in this study.

3.1.1 Positivism Paradigm

Oates (2006) refers to this paradigm as the most traditional, probably because it is the oldest and most well- known of all. It is predominantly used in the natural sciences and highly regarded as the most relevant and proper type of research. Most issues in pure sciences can be "measured, evaluated and monitored" according to Burke (2007). It was later adopted by the social sciences and can now be found there as well. It aims to predict common patterns of human behaviour irrespective of its history or culture (Burke, 2007). The notion behind it is that the world is orderly and that it can be "investigated objectively". Under positivism, it is believed that difficult things can be divided into simpler and easier to deal with aspects and if an experiment was carried out to find a solution to a problem, the results of it would be the same when done by different researchers.

Its characteristics include objectivity and hypothesis testing while its quality can be measured by the level of objectivity on the part of the researcher as well as the reliability of the research (Oates, 2006). According to Golafshani (2003:598), the reliability of the research is "the extent to which results are consistent over time, and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable". Some of its data collection methods used include experiments and surveys that could be analysed using statistical tests (Psychology Press, 2004; Davison, 1998).

3.1.2 Interpretive Paradigm

According to Burke (2007), this paradigm focuses on understanding and making sense of how the world or a situation works, depending on "tangible and intangible variables present". According to Oates (2006:292), the interpretive paradigm tries to understand the "social context of an information system: the social processes by which it is developed and construed by people and through which it influences, and is influenced by, its social setting". Unlike the traditional paradigm, the interpretive paradigm does not endeavour to prove or disprove a hypothesis but tries to identify, explore and explain how all the factors in a particular social setting are related and inter-related. So basically sense is tried to be made from the human being's view of the world, how those same views change over time and are differ from one group to another.

Some characteristics of this paradigm according to Oates (2006) include different people having different views or perceptions of the truth, the conveying of that truth to others in a way that can

be understood, the researcher not being neutral, a study of people in their normal reality and different understandings of the truth (Oates, 2006). The degree of objectivity of the researcher and reliability of the findings are some of the ways quality can be measured in this paradigm.

3.1.3 Critical Paradigm

Oates (2006:296) defines critical research as that which "identifies power relations, conflicts and contradictions, and empowering people to eliminate them as sources of alienation and domination". It is a criticism of all social restrictions and status quos and it helps for them to be known to all (Klein and Myers, 1999). It is similar to the interpretive paradigm in terms of the "social reality" being interpreted individually by different people but disagrees with its inability to "analyze the patterns of power and control that regulate and legitimize particular ways of seeing our world" (Oates, 2006:296).

Its characteristics include the emancipation of people from oppressive thinking, challenging of all that is traditional even though the researchers realise that they may not necessarily have the ability to do so due to restrictions socially, culturally, political, natural laws or resources. (Klein and Myers, 1999). It aims to remove unfairness or assumptions that have been taken for granted. The quality of research is based on fairness (e.g. equal access) and the degree to which the informants were empowered (Oates, 2006). It uses case studies and action research as some of its choices for collecting data that can be analysed using statistical tests or content analysis (Truex, 1996; Myers, 1997).

3.1.4 Research Paradigm applicable to the study

The research topic falls under the interpretive paradigm. Also procedures used to make ASDMs contingent and what influences them will be explored and explained in order to gain a deeper understanding of and insight into the research.

The interpretive paradigm is also essential in research that is carried out in information management, which encompasses people and cultural contexts. It also allows for the discovery of rich historical information, different social norms and why there are various types of behaviours (Burke, 2007).

3.2   Interpretive Research Methods

The following are the methods or strategies used in the interpretive paradigm to carry out research: ethnographies, case studies and action research. They are discussed in the following sections.

3.2.1   Case studies

A case study is defined as an "empirical study that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Oates, 2006:142). It focuses on one aspect to derive rich information and insight, its processes and complex relationships. This aspect could be an organization, a department, a decision, process or individual. Case studies are characterized by different sources and methods, detailed investigations and studying phenomena in their natural settings. Palmquist (1997) states that the case study method is ideal for modern real-life contexts that allow for putting ideas to practice and expanding processes.

The following are the types of case studies that can be applicable;-

3.2.1.1 Exploratory case study

It is applicable where the case study is needed to derive "questions or hypotheses" that would be useful for another research to be carried out thereafter as theories are deficient and more knowledge is required (Oates, 2006; Le Roux, 2003).

3.2.1.2 Descriptive case study

It is detailed in its analysing of a phenomenon and its context. According to Le Roux (2003) its main aim is to describe what process or practice is going on.

3.2.1.3 Explanatory case study

It explains the reasons behind events that have happened or the results that were derived. The past is a major source of information to explain what is currently happening (Le Roux, 2003).

3.2.1.4 Illustrative case study

This type of case study helps to bring forth any recent and possible practices that are being used by certain companies (Le Roux, 2003).

3.2.1.5 Experimental case study

A researcher in experimental case studies would find out from an organization that is newly using some processes and tools, the problems and benefits that they have experienced (Le Roux, 2003).

3.2.2   Action Research

This research method is used by professionals who would like to find new approaches that would improve their current practices. It is characterised by concentrating on issues that are practical, emphasizes change and it works hand-in-hand with practitioners. Its stages include a diagnosis of the problem situation, taking action, evaluating the results and a reflection on whether new action needs to be taken if new knowledge has not been discovered and practical outcomes have not been achieved (Oates, 2006).

3.2.3   Ethnography

It describes people and their cultures. The characteristics of ethnography include the researcher spending time in the field that he/she is investigating in its natural or real setting without disturbing it, being the research instrument. According to McCauley *et al.* (2000), ethnography is mostly used by researchers who need a deeper understanding of the practices used during normal operations of work. It gathers information and reports on the observations for analysing culture to understand everyday life for the subjects (McCauley *et al*., 2000).

It can also use interviews, personal notes, and observation as its data collection methods. Types of ethnography include holistic ethnography, where the researcher is required to empathize and identify with his/her subjects or group, semiotic ethnography, where symbolic forms used by people are analysed according to a culture and finally critical ethnography, which tries to derive the hidden aspect behind the language and symbols prevalent (Oates, 2006). Ethnography strategies are deemed successful when the researchers have understood what the people they are studying are doing and the reasons why.

3.2.4   Research method used in the study

Explanatory case studies will be used in the research because a rich and detailed insight into the practical use of contingent ASDMs by companies will be derived. They are also ideal for situations where previous studies have not been conducted according to Benbasat *et al.* (1987).

They provide new and valuable insights to be seen and documented in information systems, especially those that occur in practice. The processes and links in those organizations will be studied in depth and using three case studies will allow some comparisons among them to find out how different they are from each other. In addition, multiple-case studies are essential for researchers that have the intention of offering a description, theory forming and testing (Benbasat *et al*., 1987). They are also essential because they answer the questions why and how. We want to know why companies make ASDMs more contingent, how they do it and with what results (Murphy, 2007).

Investigating ASDM contingent use in their real-life context will give the research insight into the factors that affect them, such as "issues, politics, processes and their relationships" so that it can be explained how and why certain outcomes might occur in a particular situation. The knowledge derived from the case studies could also be used in other similar situations: thus it makes it ideal to use as the research strategy of choice.

3.2.4.1 Selecting cases

In this research, the author did not have a set criterion for choosing cases to study. However, the organizations that were contacted to take part in the study were well established and known, profitable, had different environments and must have been using ASDMs. Emails were sent out to companies and people known to be working in organizations that use systems development methodologies and agile systems developments in particular.

From there, three organizations were chosen that came from different environments; telecommunications, agricultural, and consultancy, outsourcing and technology environments. It was ideal to have different companies to see how they use ASDMs for their purposes. Their rich histories range from 1901 to the present. A description of each case study will be presented in the next chapter.

The case studies fitted the needs of the research.

3.3   Data Collection Methods

The data collection methods that could be used in case studies are interviews, focus groups, observation, questionnaires and examining documents. These data collection methods will be discussed next, followed by a discussion of the data collection methods applicable in this study.

3.3.1   Interviews

Oates (2006) describes interviews as being some form of conversation between people about aspects that are not part of normal conversation and not normally spoken about. The conversation takes place after making a plan to meet and agreeing on an agenda where the researcher is trying to find out the answers to the questions in the topic of interest. The interviewee knows that whatever will be discussed in the interview will be made public unless specified. The types of interviews are as follows:

3.3.1.1 Structured interviews

In this type, there is engaging in a conversation but only answering questions that have been already identified for every interviewee in the same order and way. It is more of a questionnaire with the difference being that the researcher writes down the answers (Oates, 2006; Hancock *et al.,* 1998).

3.3.1.2 Semi-structured interviews

These interviews have some flexibility where structured questions are asked but if something additional of importance is brought up by the interviewee that the interviewer had not prepared for, it can be added in what are called open-ended questions (Hancock *et al.,* 1998).

3.3.1.3 Unstructured interviews

The control is on the part of the respondents and they may talk about anything that they want to talk about with the researcher recording everything. Because little structure is evident here, the questions are formed as the respondent answers (Hancock *et al*., 1998).

3.3.2   Focus groups

Focus groups are a data collection method that was previously used in market research but the public sector is increasingly adopting it as well, according to Hancock *et al.* (1998). They are useful for planning and evaluation of services. According to Powell and Single (1996:499), it is

an in-depth interview where "individuals are selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research". It depends on interacting with the interviewees to derive rich-detailed data that is diverse from different levels of experience.

According Powell and Single (1996), focus groups are applicable when a researcher wants to elicit answers to research questions, existing knowledge on a subject is scarce and additional data is needed to ensure validity. A focus group consists of 6-10 people to allow everyone to participate and interact.

3.3.3 Observations

To observe is to watch someone or something and pay extra attention to them or it. It is in different forms such as "seeing, hearing, noting, analysing, forming theories, making inferences, and imposing meaning" (Oates, 2006:202). This research method is usually useful when it is necessary to report on what people are doing rather than why they do what they do or how they react when questioned (Oates, 2006). It acts as a silent acknowledgement or verification of processes used that have already been obtained through interviews or any other means (Hancock *et al*., 1998).

A researcher could carry out an observation covertly where the people are not aware that they are being observed or overtly, then they know they are being observed.

3.3.4 Questionnaires

These are "pre-defined sets of questions" that have been combined in a "pre-determined order". When the respondents answer the pre-defined questions, they provide the researcher with data that can be analysed and interpreted. The researcher can make out "patterns or generalizations" from the received responses. Questionnaires can be filled out by people in their own time or the researcher can record the results, which is similar to a structured interview. The questions must be open-ended (Oates, 2006).

3.3.5 Documents

Documents can also be an alternative source of data and can be derived from found documents or researcher generated documents. The former already exist even before a researcher endeavours

to do his/her research, while the latter are put together for the purpose of the research to be carried out and they would not have existed otherwise (Oates, 2006).

3.3.6 Data collection method used in this study

Semi-structured interviews and focus groups were used in the research. Interviews were used as the primary data collection method. Interviews were used in order to obtain detailed information from interviewees and if some important aspects emerged, they could be incorporated in the research. Interviews are ideal as complex and open-ended questions can be asked, emotions, experiences and feelings that cannot be derived from questionnaires or observations can be explored and "sensitive issues and privileged information that respondents might not be willing to write about on paper for a researcher that they have not" met can be investigated (Oates, 2006:187). Furthermore, open-ended questions allow the interviewer to derive the opinion of the respondent as well, according to Patton (1990), since they can give an indication of the world that they live in for it to be understood by and explained to others.

Focus groups were used to assist, to supplement the information already collected from interviews, and to have more and better understanding of the research (Morgan, 1996).

3.3.7 Conducting the interviews and focus groups

When organizations were contacted to take part in the semi-structured interviews and focus groups, and they agreed to take part, a time and date that was convenient to them was allocated. The telecommunications organization with the earliest time chosen was interviewed first at their offices in Pretoria on 7 September 2012. The contact, a former North-West University student, who had set up the meeting arranged for the developers to be interviewed by the researcher.

When the researcher arrived, the contact showed the interviewer the venue and introduced the interviewees. The laptop was switched on to record the sound of the voices in the room. A developer and a project manager were interviewed at the same time by using a focus group. When a question was asked, the developer and project manager were each given an opportunity to say something. If the researcher got an answer from the developer, the project manager was also supposed to give his own answer, as the roles that they each played in systems development were different.

Since the organization had recently adopted the use of ASDMs, the contact arranged for other departments to be interviewed as well to get different opinions and aspects. An appointment was not made with them but they agreed to participate in the focus group interview. There were a range of job titles that the researcher thought could add different opinions to the research but having only recently adopted ASDMs was a hindering factor. The focus group interviews were carried out on the same day in all the departments on a Friday as that is when they are free.

In the third department, interviews were carried out individually with a developer and a Scrum Master. They had also recently adopted ASDMs but they had already used them in their small projects and their level of adoption was higher than that of the first two focus groups interviewed in the same organization. Their input was valuable.

The second organization was in the consultancy, technological and outsourcing environment and only one person was interviewed on 12 September 2012. The interview was conducted in a coffee shop in the Johannesburg CBD. The researcher chose the date since the project manager was open to suggestions on the date. The manager chose the location as he was working near the coffee shop. The researcher arrived early and set up the laptop to record the interview and then the interviewee arrived. Since the organization had been using ASDMs for a period of time, the interview lasted longer and more information was derived. The contact who had arranged for the interviewee to take part in the interview was a recruiter who had visited the North-West University during the career fairs.

The third interview was conducted at the headquarters of the agricultural company in Klerksdorp on 18 September 2012. The IT manager was the contact who agreed to the interview and he arranged the date and time to meet with the developers in his office.

In Table 3.1, the set of questions used to conduct the research are presented. The research questions that were posed in the first chapter are shown on the right-hand side. The actual questions are in the middle and the motivation for each question is shown on the left-hand side.

Aims and objectives	Interview questions	What to achieve with the question
Background information	What is your role in systems development?	Role of interviewee in IS dept

Background information	How long have you been in the systems development field?	Experience in systems development
Background information	What is the total number of people in your organization's IT department?	Number of people in the IS department
The current use of ASDMs in South Africa by three companies	• Do you use traditional System Development Methodologies (SDMs)? Which ones? • Name all SDMs in use? • Do you use ASDMs? If yes, when did you adopt them? • What is the commonly used ASDM in your company/organization? Why do you use it? • What are the benefits that you have experienced while using ASDMs? • What are the problems that you have experienced while using ASDMs? • Why do you think the benefits and problems stated are as they are? • How do you choose the type of SDM, traditional	• The traditional SDMs still in use • The traditional SDMs still in use • To find out if they use ASDMs and their experience with them • What ASDM method they use and why they use it • Benefits of ASDMs • Shortcomings of ASDMs • What contributes to the problems and benefits of ASDMs • Procedure used for choosing a particular SDM.

	or Agile?	
	• Do you match the project and ASDM when choosing a SDM to use for a project or does any ASDM suffice? If yes, how?	• To find out if they have an ASDM that they use for all projects or if different projects use different ASDM methods
Do practitioners make ASDMs contingent and why, or why not?	• Do you think ASDMs should be made contingent to suit the project or vice versa?	• Is making an ASDM contingent necessary
	• Have you made the ASDMs contingent to suit the project or company/organization?	• Have they made ASDMs contingent
	• Have the contingency changes been major or significant?	• The magnitude of making an ASDM contingent
How do they make ASDMs contingent?	• How do you make ASDMs contingent for use for a particular project? Do you add some aspects that you think are missing and should have been part of it? Do you omit or ignore some aspects? Why?	• How does the contingency of an ASDM take place
	• Does the way you make an ASDM contingent depend on the project?	• If the contingency procedure differs according to a project

	• How do you make an ASDM contingent in detail? Give an example	• A detailed contingency plan
	• Why do you make the ASDMs contingent that way?	• Reason for the way they carry out the contingency
	• Do you monitor and manage the procedure used to make ASDMs contingent?	• If the contingency procedure is strict or flexible allowing for creativity and if they manage it as well
How successful are ASDMs that have been made contingent	• What is the percentage of projects that have been developed in your department that have used adapted ASDMs?	• To know the number of projects that have used contingent ASDMs
	• How successful have contingent ASDMs been for your company?	• If the contingent ASDMs have made a difference or contribution to more successful projects
	• What are your expectations for the use of contingent ASDMs in your department for the next two years?	• Where to for ASDM contingent use in your organization
	• Where do you think ASDM contingent use is generally headed in the years to come in South Africa?	• What is the future for ASDM contingent use in South Africa

Table 3.1: Interview Questions

3.4   Qualitative Data Analysis

According to Oates (2006), qualitative data is that which is not numeric in nature, such as words, text and audio, that is derived from interview recordings, tapes, researchers, company documents and websites that has been generated by case studies and action research. Analysis on the other hand, according to Rabiece (2004:657), is the "interplay between researchers and data, acknowledging that there is an extent of subjective selection and interpretation of the generated data". In order to prevent and reduce bias on the part of the researcher, it is necessary to carry out data analysis in a "systematic, sequential, and verifiable" way and consistently. This is because evidence is conveyed to other researchers to show its reliability and objectivity. It is suggested that evidence and proof be conveyed to other researchers using a clear process of data analysis that they can understand and verify.

The following are some of the ways that qualitative data can be analysed especially that data derived from interviews;

- **Content Analysis** – According to Psychology Press (2004), it reduces qualitative data into numerical data**.** Lillis (1999) states that content analysis makes use of a process that derives meaningful data from text. It is used to analyse any form of communication that needs to be analysed. It requires analysing qualitative data collected in the process to find out if any issues or results are dominant, frequent or regular in their structures and patterns, how they relate to each other and what emphasis is placed on the data – latent or overt (Ratcliff, 2004). It does this by using sampling and then coding units or ranking them according to frequency (Psychology Press, 2004). The frequency of these patterns provides the researcher with a way to formulate intentions and meanings (Truex, 1996). These meanings can then be used to solve the research problem that is being discussed. This analytic method is useful when textual data is being analysed**.**
- **Conversation Analysis** – This is ideal for analysing data that was derived from interviewing a person who is a subject of the research as the name implies. The method is grounded in hermeneutics, which is the theory of interpretation (Forster, 2007). It does not presume that meanings exist in a certain conversation and for them to be determined; the researcher must immerse himself/herself into the work and lives of his subjects to get them (Truex, 1996).

- **Discourse Analysis** – This is a method that builds on content and conversation analysis and carries on from where they left off (Truex, 1996). It uses "iterative hermeneutic circles" to discover the meanings that are found in the data collected and that are useful for drawing conclusions (Truex, 1996).

- **Logical Analysis/matrix analysis** – This method uses flow diagrams, charts, pictures and written descriptions to analyse data logically (Ratcliff, 2004).

- **Cross-case analysis** – According to Eisenhardt (1989), cross-case analysis compares data in many diverse ways in order to prevent the drawing of false, premature or biased research conclusions. To carry out cross-case analysis, it is suggested that categories should first be identified that could be derived from the research problem, such as performance, and then looking for within-case similarities together with cross-case differences. Another way suggested is to establish the similarities and differences among the case studies as this could help the researcher to identify even those that are subtle because finding similarities in cases that seem too different and vice versa can offer some "sophisticated understandings", such as "new categories and concepts" (Eisenhardt, 1989).

Kim (1981:62) identifies two potential cross-case approaches: case-survey and case-comparison. The case-survey requires that isolated factors in case studies be worthy of "substantive attention" and that the whole case study should be large enough to use cross-case analysis. Case-comparison on the other hand occurs after cross-survey has taken place and it does its comparisons by "coding the single factors and establishing cross-case patterns".

Since cross-case analysis forces the researcher to look at the data from different angles than those first implied especially when analysed through "structured and diverse lenses", the chances of "accurate and reliable theory" that is in line with data are greatly improved. Also the "probability that the researcher will capture the novel findings which may exist in the data" is enhanced (Eisenhardt, 1989:541).

3.4.1 Analysis method used in this study

The qualitative data analysis methods and tools that were used include ATLAS.ti, content and cross-case analysis.

3.4.1.1 ATLAS.ti

A piece of software known as ATLAS.ti was used to analyse the qualitative interview and focus groups data collected. ATLAS.ti is a well-known tool that analyses qualitative data that is used by different universities and businesses. The semi-structured interviews and focus group interviews were recorded using a laptop and Windows 7's sound recorder. The interviews were then transcribed using ATLAS.ti. It was essential to use it because of its ability to make the process of transcribing interview data easier and it made sure that the text and audio data corresponded. The interviews and focus groups were all analysed in the same way (Reed and Payton, 1997). After the interview data was transcribed, codes were formed. Coding is essential to attach meaning to the data. They are handles that group related information. They are short pieces of data that reference other related information for the purpose of comparisons.

After the coding was done, tools for forming theories were used to derive data, in particular the query tool and network diagrams. The query tool is useful when combining the quotations text from different codes that were created. It combines codes that differ or are the same across different transcripts, making it easy to form final propositions. Network diagrams are diagrams or networks that help with the exploration of data and visualisation of ideas and findings. The networks are made up of codes and they are used for the purpose of "enhancing the retrieval of quotations". ATLAS.ti helped to carry out cross-content and content analysis.

3.4.1.2 Content Analysis

Content analysis is ideal when empirical data is needed to be derived in a research that has textual data. It allows seeing what is dominant and important in its frequency of occurrence in the research data collected. These important issues that emerge allow the accurate drawing of conclusions and meanings that are true and show the true nature of the situation, therefore content analysis is ideal. It was used to derive propositions for each individual organization that were applicable to it.

3.4.1.3 Cross-case analysis

Cross-case analysis was necessary to find out the similarities and differences between the different organizations that were studied. The purpose of using three different organizations that use ASDMs is to find out how they make them more contingent to fit their needs. Cross-case analysis helped to find out rich data, such as how different or similar the ways or procedures they use to carry out their contingency strategies were. The propositions that were formed from each organization using content analysis were analysed again, using cross-case analysis to find out how similar and different organizations were.

Chapter Summary

The research methods and designs that were discussed are important as they allow the researcher to know the sphere in which the research being carried out falls. If it is known, for instance, that the quality of the research is judged by the degree of objectivity prevalent, then the researcher should endeavour to make sure that he/she is as objective as possible and show the thought process he/she used to get to the conclusion that he/she reached upon. The research being carried out is interpretive in nature, will use case studies of three organizations in South Africa as a research strategy and interviews will be carried out to collect data. Since textual data will be derived, qualitative data analysis will be done in the form of content and cross-case analysis. ATLAS.ti will be a tool that will help with the analysis as well.

The following chapter will look at how the actual analysis was carried out on the collected interview data and its results.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

4.0   Introduction

The previous chapter showed the design of the research, and why case studies, focus groups and semi-structured interviews were used. The method of analysis was also discussed.

The data analysis method described in the previous chapter will be applied in this chapter. An overview of the company interviewed will be given to introduce the interviewed organization. Thereafter, the history and current SDM usage will be discussed. It will show how ASDMs are made contingent in these organizations. The propositions from each individual case study will be presented next. The chapter concludes with a cross-case analysis that will derive final propositions across all the case studies.

4.1   Research aims and objectives

The research aims and objectives of the research study were to have a better understanding of the contingent use of ASDMs in South Africa. In order to help solve this problem, research questions were formulated. This section, therefore, will revisit the research questions and its sub-questions in order to understand the procedure used to solve them.

1. *The current use of ASDMs in South Africa by three companies*

   To investigate this, the author identified all the SDMs that were being used in the three organizations, including ASDMs. The date of adoption of the ASDMs, the types of ASDM used and the reasons for their usage were investigated. The benefits and problems that were experienced while using them were also important. Other aspects included how an individual SDM was chosen for a particular project and if there had to be compatibility between the two.

   1) *Do practitioners make ASDMs contingent and why, or why not?*

To find out if the ASDMs had been made contingent, the organizations were asked if it is essential to carry out contingency on ASDMs, and if so, to discuss the reasons for this decision. If they had actually changed an ASDM to suit or fit a project, the magnitude of the contingency was investigated.

2) *How do they make ASDMs contingent? Adding, omitting or ignoring some aspects and why?*

The way in which the three organizations carry out the contingency of ASDMs was investigated, as well as reasons why they do it that way and if the procedure they use is monitored and managed in order not to lose the concept and standards that make an SDM agile.

3) *How successful are ASDMs that have been made contingent?*

The size of the projects that had already used contingent ASDMs was established, as well as if they had been successfully implemented. Finally, the direction of contingent ASDMs in the three organizations and South Africa generally were discussed.

4.2   Results

In this study, three organizations were chosen to participate in the study conducted in September 2012. The results of the interviews are discussed at the end of each case study in the form of propositions. At the end of the chapter, final propositions will be compiled that will show the similarities and differences among all the case studies when it pertains to the contingent use of ASDMs in South Africa in these companies.

4.2.1   Case Study 1: Organization A

The first case study, denoted 'Organization A', will be discussed in this section. The fact that it is one of the most popular companies in telecommunications in South Africa made it ideal. The representatives for the interviews conducted were from across three IT departments in the same Organization A. The Organization has several departments that handle their own systems development independently, three of which were interviewed in the networking, data warehousing and service fulfilment solution environments. The interviewee roles and experience are shown in Table 4.1. The letter A is for the organization, the middle number (1 for instance) is for the department and the last number (1 for instance) is that of the interviewee. Hence, the name A11.

Name	Role	Experience in Role
A11	Project Manager	26 years
A12	Developer	10 years
A21	Developer	3 years
A22	Developer	9 years
A23	SAP Business Objects	4 years
A24	Data Modeller	5 years
A25	Business Analyst	5 years
A26	SAP Business Objects	4 years
A27	Data Analytics	2 years
A28	Business Intelligence	3 years
A31	Developer	15 years
A32	Scrum Master	1 year

Table 4.1: Organization A's roles and experiences

Two focus groups were conducted in departments 1 and 2, and two individual interviews in department 3. In the focus groups, a question would be asked and any of the interviewees could answer. As can be seen from Table 4.1**,** the range of experience of the participants in the systems development field ranged from 1 to 26 years. The interviews and focus groups lasted between 16 and 25 minutes, depending on the elaboration of answers from the interviewees. As has been discussed, the interview questions were semi-structured and some were not consistent or the same across all the interviews. If the interviewee brought up something that was relevant, it was explored further by the author.

The background information of the company will be discussed first, followed by its ASDM used, contingency approach, and then the propositions.

4.2.1.1 Overview

Organization A is a leading telecommunications services provider in South Africa and on the African continent and it is a Forbes Top 2000 company. It was established in 1991. They provide integrated communication solutions to both enterprise and consumer customers. They have over 4 million telephone access lines in service and 99.9% of them are connected to digital exchanges. They offer business, residential and payphone customers a wide range of services and products, which include fixed-line subscriptions, internet services, e-commerce, mobile communication and other services.

The company was established in 1878 as a telephone company that later grew to include internet-based networking. In 2003, it was listed on the Johannesburg Stock Exchange (JSE). In 2007 it acquired a stake in a Pan-African Internet Service Provider and finally in 2010 it launched its own mobile network.

4.2.1.2 History with SDMs

Organization A has been using an in-house SDM for a long time that is based on the Waterfall SDM. This in-house SDM used is called Solution Value Chain (SVC). Like the Waterfall SDM, it has features of analysis, design, development and deployment. The difference is that the SVC is not regarded as a sequence of events but rather a value chain that provides guidance and a choice of deliverables from a list. It is not bound by time and the deliverables must be depicted on the project management plan. In support of Organization A's service excellence goals, SVC satisfies quality, audit and control objectives. All the interviewees acknowledged that the SVC was the SDM that they have been using for some time.

The following quotes are derived from the transcripts from Organization A in support of the SDM being used.

> **A12**: *"We actually have our own ah in-house ah... methodology we call it SVC, what is it (asking the project manager)? Solution Value Chain (Project Manager agreeing with him about the full name of SVC). It is very much based on the Waterfall method. It's a customized one, it does have all those things, the analysis, the detailed design, your development, implementation, post implementation, it's basically based on that".*

A28: *"The Company sort of has a waterfall type of methodology of doing things".*

A31: "*Waterfall model (SVC) being evolved into an Agile SDM".*
A32: *"Previously we made use of the SVC (Solution Value Chain)".*

An illustration of the SVC is shown in Figure 4.1.
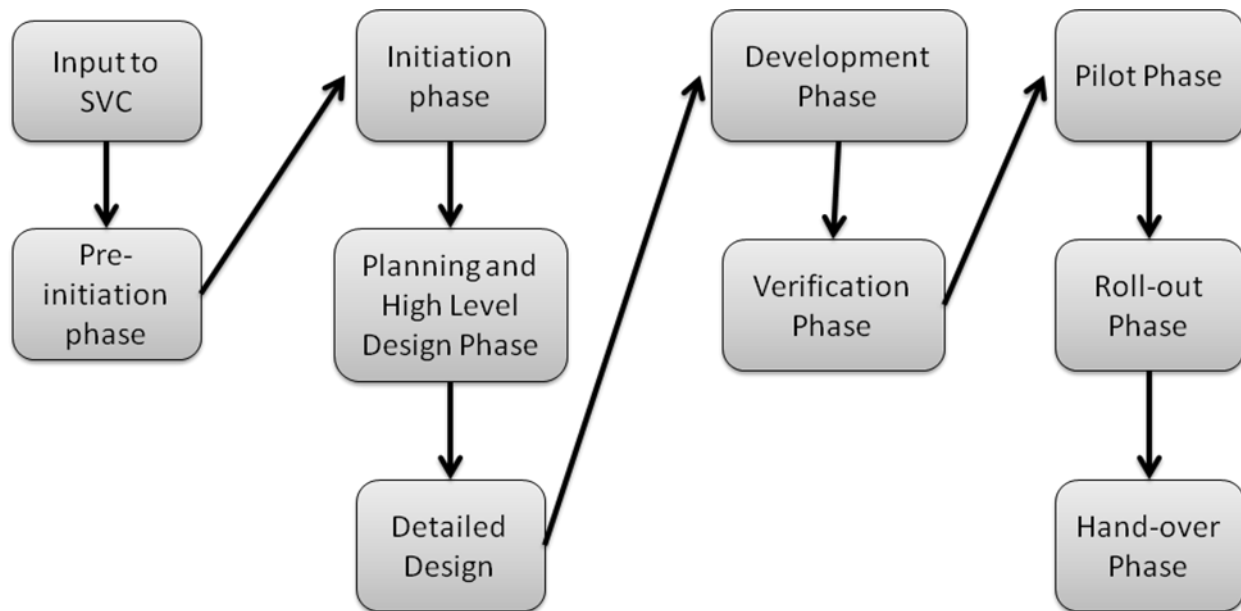
Figure 4.1: Organization A's in-house model

As can be seen in Figure 4.1, the SVC is process oriented with the typical steps, such as initiation, planning, design, development and deployment in linear mode. The tools and techniques used include documentation and prototyping.

4.2.1.3 Current SDM

Organization A is predominantly still using the SVC as a framework and control mechanism but transiting it to be more agile. The change from SVC to Agile SVC is being made because Organization A has seen the need to adapt rapidly to changing technology and customer needs.

The need to make the transition was as a result of a necessity to move forward, and an executive level decision in order for Organization A to remain competitive in the market. IT was becoming expensive for the company and not successful, so to release products quicker and prevent waste, they turned to ASDMs. Following that decision, everyone in the organization involved in

65

systems development was trained in ASDMs, and some form of ASDM was adopted at the beginning of February, 2012. These conclusions were based on the following quotes from the interview transcripts;

> **A11**: *"...IT was too expensive in this company. I mean, umm... it's too expensive and it's not successful enough. Umm... And that led us to basically that we need to release things quicker, and we need to prevent waste and such.... Yah, yah, earlier this year".*
>
> *"To change the direction, that is very difficult, I mean for a start, so I mean, ahh... we went through training periods, I think, so quite a few of our people were trained and that kinda thing on agile development and then we have been encouraged to start looking at them and I think now at this stage, um we are ahh... from the executive team we've support for that. I think some of the big systems are still basically using a waterfall approach".*
>
> **A12**:*" ...We are still finding our feet in the agile world, ahh space. We only went for training this year. So we still, we can say there's, we are still in the, the, what do u call it? First approach, still in the waterfall method transiting to the agile methodology so at this point we trying to bridge the gap"... We still resisting, eh, some of us eh...we are still stuck on the SVC because that's how we were taught at school and yah it works best for us and yah...to go agile was an executive decision"*
>
> **A28:** *"The Company sort of has a waterfall type of methodology of doing things. And, but lately they are trying to adopt the agile manner of doing things...*
> **A24:** *"They are trying to move away from waterfall type of methodology... We are using it, but trying to move into it. We don't have a tool".*
> **A27**: *"Everybody was sent for agile training. Yah (Everybody agrees)....But Waterfall is the one that we are using....Well now we are still using the waterfall... We've got a board up".*
>
> **A31:** ....*"Waterfall model (SVC) being evolved into an Agile SDM....Beginning of 2012".*
> *"It became a necessity and from Executive level the decision was made to use it going forward in order for* us to remain competitive in the market".

A32:"*Previously we made use of the SVC (Solution Value Chain)... February 2012...The need to adapt to rapidly changing technology and customer needs.*"

The IT departments interviewed had various levels of adoption of ASDMs at the time of the interview in September 2012. Two departments, A1 and A3, were in the process of developing and conducting projects using ASDMs, albeit different types of it. A2 had not yet carried out a project using ASDMs. They have an option to use them or not but they all admitted that they are gradually starting to adopt them individually. The SDMs used across all the departments in Organization A include the SVC, Scrum, XP and Kanban. They adopted the specific ASDMs, as they believe they will help them to achieve their targets. The supporting evidence is as follows;

A11: "*But I think the two systems that we have under us at the moment, u know, is Cramer and that we have started with the, an agile, I don't know, and we can, and we are actually, we were in the middle of a release at this stage. And our release is ending at the end of October, and we have started making plans for our next release*".

"*I can say that the way we are intending to go agile in the Netplan project at the moment is, is that we have taken what we have been taught in the courses of Scrum and all these things, and we are going to use different parts of those things to make the ahh project successful....Scrum, yah*".

A12:" *So Scrum is basically the one that where you meet in the mornings, isn't it...But Scrum yah... sounds like the one. You see we were just from training. It's one of the things we use as one of the approaches*".

A28: "*From the business intelligence side of things, the way we implement our agile way of doing things is relatively different...We don't have Scrum boards or anything like that. What happens......?*"

A21: "*After attending the course. I think as individuals, we took it upon ourselves to start bit by bit*".

A24: "*But it's not a formal thing*".

A21: "*There was never a formal thing, that this is how we are gonna work*".

A31: "*Scrum and Kanban... Currently there is no right or wrong way to do this. It is still*

in the early phases... In terms of projects none, we are busy with a big project that makes
use of agile. Although all other work has started to migrate towards agile approaches.
It's safe to say that 70% of our work from day to day is currently making use of Agile".
A32: *XP, Scrum and Kanban.... Large projects there are none so far, they have only*
kicked off a few months ago. Smaller projects there are about 65-75% currently using
Agile.....we have a set list of methods and techniques and we are currently testing which
ones work the best for us as a team".

All of the ASDMs used in Organization A were familiar except Kanban. Kanban is an adaptable process tool that has few restraints as to what you can do during development. Its only emphasis is the need to visualize the workflow, limit WIP (Work In Progress) and measure lead time.

- Visualise the Workflow – requires that the project work be broken down into units that are written down on cards, put on a wall and on the appropriate column. For instance, the phases of what has to be done such as requirements, development, test and such, should all have columns where one can put the cards that are applicable to show the progress of the work

- Limit WIP – the specific number of items that should be in "progress at each workflow state" should be limited

- Measure the lead time – the lead time is the "average time to complete one item" and it should be "as small and predictable as possible" (Kniberg, 2009:6).

4.2.1.4 Contingency Approach
Organization A had not finalized the contingency approach for ASDMs as they are still in the process of transition and adoption. The contingency approach is more ad hoc at the moment to suit projects being done. Some departments are actively jumping on the ASDM wagon while others are slowly getting used to them.

Department A1

Since A1 had already started using ASDMs for some projects and SVC for others, they could offer some insight as to the contingent use of ASDMs at this point. The project manager said that

they are using Scrum for some projects and have made it contingent to suit the project. They regard Scrum as more of a guideline that provides a direction that you should follow and pick aspects that are usable for a particular project and its requirements, and leave out those that are not. The project manager further admitted that since different projects run in different ways, the contingency procedure would also differ, depending on the requirements. These were the same sentiments echoed by the developer from the same department.

The changes made to Scrum have not been significant so far as they are sticking to what ASDMs were meant for, namely flexibility, and they are following the footsteps of the guidelines. They do not document the contingency procedures or monitor them yet. For now they are monitoring their project progress and picking up mistakes through the use of daily Scrums and weekly meetings as the following quotes suggest;

> **A11**: *"Now the nice thing or the difficult thing maybe for agile is that umm.., is that it's not one size fits all basically. So, so everyone must really find how they are going to implement it in a new environment. I mean, from our side, we have actually looked at, at what we've been taught in the agile thing and I think, it's got, it's very much from an a plan perspective, it's going to be a hybrid of what they teach".*

> *"Well to me the nice thing about agile is that it is a guideline. Umm, it's something that says, you know what? This is the general direction you should be following and then you need to pick things that you work for you basically. So definitely, we should. Even though we have a guideline, we still have documents that have to be delivered for projects you know that I think we will change, I mean, different projects will run in different ways depending on the requirements. So if we say, we are following an agile approach, I'm sure with that agile approach, will not be the same for every project we do".*

> *I can say that the way we are intending to go agile in the Netplan project at the moment is, is that we have taken what we have been taught in the courses of Scrum and all these things, and we are going to use different parts of those things to make the ahh project successful.....time will tell, you know. I think we need to get into it at the moment and see what happens and if things need to changed, then we will change them".*

> **A12**: *"There comes cases whereby you have to change the agile to suit the project.....Yes*

we have, in our own way, not illegal but make it to suit the project....So we would say the changes have not been major as we stick to what agile has been meant for and followed in the footsteps of the guidelines to suit our projects. Within our team, we will be monitoring through our daily scrums, weekly meetings, say ok, this thing is working for us. Ok, that's one way of monitoring within a smaller scope. Within a bigger scope, we have a Project officer that will monitor within a scope of the whole company"

Department A2

This department has the option to use ASDMs or not. Their ASDM adoption and transition is slow and it depends on individuals. They are using Scrum. Those individuals who decide to use ASDMs are also making them contingent individually. The informality of the use of Scrum means that they do not document anything at all, as it is not required of them, therefore they have no contingency approach so far. They cited the company's culture as a hindrance to the adoption of ASDMs in their department. For instance, some people do not want to make the transition from the SVC to Scrum and would not show up for the weekly stand-up meetings. The following quotations support these conclusions;

> **A28**: *"From the business intelligence side of things, the way we implement our agile way of doing things is relatively different...We don't have Scrum boards or anything like that....... we don't use agile in a formal way. We take bits and pieces".*
> **A21**: *"After attending the course. I think as individuals, we took it upon ourselves to start bit by bit".*
> **A27:** *"I think each person adapts it".*
> **A24**: *"The other trial for me is changing the old culture to working in a new way. So most of the guys, you can see that they don't adapt easily. It's like you, for me it's like a culture change. It's sort of, especially when you work in a team. You as a person, you wanna work the agile way and then another member of the team doesn't wanna work in the agile way. So changing the culture for me is the problem".*
> **A23:** *"People's perceptions".*
> **A24:** *"Unless if we make a formal sort of thing that says this is the way we gonna work. Maybe that will work".*

A26: *"But you know what the problem is? After that, not everybody has grasped what agile is all about, working the agile way is all about. So anyway by everyone not being on the same, at par, we will always be lagging behind". On the Agent project, we are working the agile way. We meet every day for 15 minutes, stand-up sessions and all that. But here is the catch, not everybody attends the meetings".*

A27: *"But it's arguable to say that everyone has been on a, the course about what agile is and we are all supposed to know what it is, what it's like. But like* **A24** *said its culture".*

A25: *"You can't change the culture. Like for instance, you wanna do something and you just wanna have a meeting with someone. So you are a whole group of people, you make the meeting and nobody shows up for the meeting. And the other people are not even necessary, you just need that one person. Because that person is not used to this new way of working, but when you meet 2 weeks, get a meeting and you do it quickly. If you just say look let's talk and you just get this done".*

A24: *"The challenge is to try and bypass some of the processes. People still wanna stick to waterfall model and that's the problem".*

Department A3

The department chose the Scrum, XP and Kanban for their contingency capabilities and they are in the process of developing a contingent approach, therefore at the moment it is a mix and match process. A3's contingency changes so far have not been significant but they do have a set list of methods and techniques that they are testing to see which ones would work for them as a team or not. What they are doing now to make Scrum, XP and Kanban contingent is to look at the size, scope and complexity of the project to determine what methods would be applicable. If it is a very large project, XP would be chosen along with Scrum and Kanban, and if it is a small project that would take a few weeks, then XP would suffice and if it is only a week, a few Scrum sessions would be used. They are using this process, as it is the best practice for their environment, since as time goes by, they can best determine what their needs would be.

To monitor the contingent changes they are currently implementing, no standard policy or procedure exists but each team is responsible for its own approaches. The developer said that

they make use of notes to monitor contingency and that it is relatively easy to carry out contingency using ASDMs. For now they are using Kanban to make the work visual, Scrum to convey and communicate every morning and XP to guide their sprint sessions. No large projects have used ASDMs yet but 65-75% of smaller projects are using them. The following quotations support the discussion above;

A31: *"Previously we only used the waterfall model for all development, now that is replaced by Agile within all sections. So we do not match the methodology anymore but we do match methods used within the methodology for each project....With agile, contingency is very easy, therefore we adapt the methodology according to our needs. That is why we chose agile. The methodology should be contingent....We are in the process of developing a contingent approach....we are still trying to find our feet and determine what is going to work and what won't work....We use a combination of Scrum, Kanban and XP and only select the methods used in each of these to suit our needs".*

"Currently there is no right or wrong way to do this. It is still in the early phases but the biggest focus we have is using Kanban to make the work visual, Scrum to convey and communicate every morning and XP to guide our sprint sessions. The biggest headache is documentation and to deliver the minimal amount of paperwork that has the most value....Currently we make notes etc. and determine which are the best practices going forward".

A32: *"The methodology chosen should be able to fit all the projects that you want to embark on. This means that you should have a contingent methodology in place for all your future projects....We are in the process of developing a contingent approach that we will use in the future....we have a set list of methods and techniques and we are currently testing which ones work the best for us as a team".*

"The size, scope and complexity of the project determines what methods will be used. If it is a very large project XP will be chosen along with scrum and Kanban, if it is a small project that will take a few weeks then XP will suffice, if it is only a week a few Scrum sessions will be used. So a number of factors determine what we choose".

"We look at what our needs will be in the future by looking at past projects and possible future ones. We the look at what was important and what challenges we faced during those projects. Then once that is done we look at the methods we have available in this case the whole Agile arsenal and determine what will work going forward.....currently each team is responsible for their own approaches".

Therefore, Organization A has not established a contingency approach for ASDMs as of yet, as it has newly adopted them and is slowly transitioning to work and strive in an agile environment and manner.

4.2.1.5 Thoughts on ASDMs use

Apart from a few issues with ASDMs, most of the responses were very positive because all the expectations from the departments interviewed were for them to make Organization A better than what it is now. The advantages and disadvantages of ASDMs listed by Organization A are set out in Table 4.2**.**

ASDM Advantages	ASDM Disadvantages
Results can be seen quicker **A11**: *"So I think the benefit that we have seen is ahh... results are going to the business quicker basically".*	Resistance to Change and sticking to old culture **A12:** *"I think one other challenge is the resistance. There is a lot of resistance. Now change is always not easy. To transit from the national waterfall to agile, I think it's a problem itself".*
Communication and reporting improved **A12***: "And even the communication itself, we have actually benefitted coz now with this Scrum approach we get to meet more often you know than wait for the.... timeous*	Complexity of company because of interconnected systems **A11:** *"The other thing that I think ahh...umm, we are struggling with is because of Organization A being such a big*

meetings to get the feedback and stuff. Just communication is actually been improved and the reporting also".	*company. We have all of the systems, not all, but almost all of the systems are integrated and somehow interlinked with one another. So to do something that affects just my system, it's easy to use the agile approach. If you do something that affects a system there, and a system there and a system there, then it becomes more complex".*
Easy to use and implement **A28:"...***So when they get involved, you know, just like 2 days, they see it and we gonna do it like this, and they try it out. It's easier".*	It requires thinking **A11**: *"I think the thing about agile is that you have to think about things. The waterfall, you don't have to think about anything, these are the rules you follow, these are the documents you deliver and that's it".*
Work is done faster and better **A32:** *"A lot easier to use and implements. Work gets done faster and better".*	Requires everyone to think and react in an agile manner **A31**:*" People are still reluctant to use it as it is a new approach, and people have a problem with adopting the agile mind-set".* **A32: "***Getting everyone to think and react in an agile manner".*
Better quality in a shorter amount of time **A31:** *"Better quality in a shorter amount of time".*	Confusing as it is like having a business user over your head **A28**: ..."*it's almost like having a business user over your head every time you work.*

	Coz you gonna do something and you then you have to discuss, is this what you want?"
	Uncertain users bring more problems **A28:**"*And then if they don't get their requirements set, you can actually get nothing done"* **A26**: *Sometimes it was actually down to the user not knowing what they want*

Table 4.2: Organization A's ASDM advantages and disadvantages

The expectations that the interviewees had for their respective departments in Organization A in terms of ASDM use are shown in Table 4.3.

A1	A2	A3
Ability to deliver work faster **A11**:"*My expectation is that we are going to be able to deliver work to the business faster".*	To make everything better and faster **A27:** "*Like in a perfect world, to make everything better and faster".*	People working in a better environment **A32:** "*Have people working in a better environment"*
More adaptability **A12:** "*And more adaptable, we are going to be more adaptable coz as things stand, we are not adaptable".*		Ability to adapt to changes better **A32:**...*"and begin able to adapt to changes much better than is currently the case".*
More and easier alignment between business and IT		To have a good basis SDM with guidelines with everyone on board

A12:*"There will be more alignment between business and IT".*		**A31:**"*To have a good basis methodology intact along with guidelines to use the methodology. To get everyone on board".*

Table 4.3: Organization A's departmental expectations

4.2.1.6 Organization A's Propositions

Propositions are formed for the purpose of their consideration and it can be verified by positivistic research in follow-up studies. The propositions have been formed based on the information derived from the interviews conducted. The propositions formed are based on the three departments interviewed, namely A1, A2 and A3, and on their similarities and differences through the use of content and cross-departmental analysis. The departments used to form a proposition will be shown in brackets at the end of the proposition. The propositions formed are based on the use of SDMs, contingent ASDMs and their success. The propositions were based on the telecommunication organization interviewed and they could indicate what is going on in industries similar to it in South Africa, as it is a leader in its field.

A discussion of the findings is presented with supporting evidence and the all propositions applicable to the organization are provided as follows;-

Organization A's in-house model, which is similar to the Waterfall SDM is the methodology that is being used in Organization A for small and large projects. It is currently being evolved into an agile SDM, which can be easily adapted to future projects. Scrum is the methodology being used in Organization A across the department. It is believed to help the organization to adapt to rapidly changing technology and customer needs. Other ASDMs used are XP and Kanban

ASDMs were adopted in Organization A earlier this year in order to reduce costs incurred by Information Technology and to improve the success rate of projects as shown below;

> **A11:***...*"*IT was too expensive in this company. I mean, umm... it's too expensive and it's not successful enough. Umm... And that led us to basically that we need to release things*

quicker, and we need to prevent waste and such. So those two driving factors, I think have led the company to look at the agile development".

Employees were taken for training on ASDMs before they could be used in Organization A. This was to ensure that they all knew how to use them for the success of their projects and their organization as a whole;

> **A12: ..."***You see we were just from training..."*
> **A27**: *"Everybody was sent for agile training...."*

Organization A's in-house model is still being used to develop systems while the culture and processes are transiting to the agile mindset. Some in Organization A have the option of choosing ASDMs or their in-house model, thus the adoption is not yet formal for them while others are using both at the same time. For those using them already, they start ASDMs on small projects first. The level of complexity in an organization also affects the speed of adoption of ASDMs as shown below;

> **A11**:*..."almost all of the systems are integrated and somehow interlinked with one another"...So to do something that affects just my system, it's easy to use the agile approach. If you do something that affects a system there, and a system there and a system there, then it becomes more complex"*
> **A12**: *"It's safe to say we are currently using the waterfall methodology; we are only transiting to agile now....at this point we trying to bridge the gap".*
>
> **A24: "***But it's not a formal thing...They are trying to move away from waterfall type of methodology".*
> **A27**:*...." we have been given the option to use agile. We are supposed to use it but..."*
>
> **A32: "***Large projects there are none so far, they have only kicked off a few months ago. Smaller projects there are about 65-75% currently using Agile".*

Organization A matches the project with the SDM so that they can achieve the project objectives or requirements thereby ensuring success. The in-house model used to be used for all projects,

regardless of requirements but now with the adoption of ASDMs, they are matching each unique project with the methods that would be compatible with it. Organization A also uses the volume of documentation required by clients to choose an SDM to use. If a lot of documentation is required, then the in-house model would be used. If less documentation is required, then ASDMs would be used ;-

> **A12**: *"So, in some cases I should think you... even if you don't want to go agile, even if you don't want to go waterfall methodology, but the company culture, the executive direction will dictate that to you. , I would say... it's more of an executive decision. It gives direction to our approach...We match, we take a project and we say do we go agile or we go SVC".*

> **A27: "***Depending on how much documentation they want. Because with agile we only give them one or two pages and if they want more or a bunch of pages, then it's gonna need a little more, life cycle, it will take forever".*

> **A31:** *"Previously we only used the waterfall model for all development, now that is replaced by Agile within all sections. So we do not match the methodology anymore but we do match methods used within the methodology for each project".*
> **A32:** *"Currently there is no formal approach. It is still a mix and match process...but the matching comes in to play when using numerous agile approaches, i.e. we won't necessarily implement XP, Scrum and Kanban on each project. In smaller projects we will only make use of scrum sessions for example".*

Organization A has made ASDMs contingent to fit its projects and it will continue to do so for the success of its projects. ASDMs were chosen specifically because they make contingency easy to carry out and they fit Organization A's needs;-

> **A11**: ..."*if things need to changed, then we will change them".*
> **A12**: ..."*There comes cases whereby you have to change the agile to suit the project".*
> **A31:** *"With agile, contingency is very easy, therefore we adapt the methodology according to our needs. That is why we chose agile. The methodology should be*

contingent".

A32: *"The methodology chosen should be able to fit all the projects that you want to embark on. This means that you should have a contingent methodology in place for all your future projects".*

Different projects run in different ways, depending on the requirements, thus the contingency criterion also differs. Organization A is in the process of making an ASDM contingent approach that can be used for all future projects to maintain standardization and quality. For now, if a small project takes weeks, XP is used. If a project takes exactly a week, Scrum sessions are used. If it is a large project, Scrum and Kanban are used together;-

A11:....*"Umm, basically I would say we look at the size of the project, you know the complexity of the interfaces with other projects and the dependencies in terms of other projects' timelines".*

A32: *"The size, scope and complexity of the project determines what methods will be used. If it is a very large project XP will be chosen along with Scrum and Kanban, if it is a small project that will take a few weeks then XP will suffice, if it is only a week a few Scrum sessions will be used. So a number of factors determine what we choose".*

Organization A is making its ASDMs contingent by using aspects, bits and pieces of them to suit its unique and different projects' needs and to make them successful. Kanban is used to make the work visual, Scrum for communication purposes (i.e. when to meet, how regularly, how to conduct the meetings and the duration thereof) and XP to conduct the sprint sessions;-

A11:....*"it's going to be a hybrid of what they teach....you need to pick things that you work for you basically I'm sure with that agile approach, will not be the same for every project we do and we are going to use different parts of those things to make the ahh project successful...I'm very lazy so I will do as little as possible for as long it is successful".*

A28:*"Like I said we don't use agile in a formal way. We take bits and pieces...."*

A31:"*We use a combination of Scrum, Kanban and XP and only select the methods used in each of these to suit our needs. Currently there is no right or wrong way to do this. It's still in the early phases but the biggest focus we have is using Kanban to make the work visual, scrum to convey an communicate every morning and XP to guide our sprint sessions*".

A32:"*The size, scope and complexity of the project determines what methods will be used....So a number of factors determine what we choose*".

Organization A does not document contingency changes made to ASDMs as it regards it as a guideline that gives direction. In the future, they might develop some standards but the changes so far have not been significant;-

A12: "*Well, even if we documented those, it is not within our space....So we would say the changes have not been major as we stick to what agile has been meant for and followed in the footsteps of the guidelines to suit our projects*"

A31: "*Currently no, we are still trying to find our feet and determine what is going to work and what won't work*".

A32: "*So far not really, we have a set list of methods and techniques and we are currently testing which ones work the best for us as a team*".

Organization A has a Project Management Office (PMO) to monitor the quality of work that is delivered and how successful it is. They look at what was delivered before and after the adoption of an SDM. Otherwise, individuals monitor themselves through making notes, and have daily Scrums and weekly meetings to record best practices for future use;-

A12:...*"there is also a project office that maintain quality. It is not within our space to monitor the success or failure of agile itself...we monitor our own work within ourselves but overall, the success of the methodology itself, we can say ok, it works for us but the company can say no...within our team, we will be monitoring through our daily scrums, weekly meetings...Within a bigger scope, we have a Project officer that will monitor...the*

whole company".

A31: *"Yes, currently we make notes etc. and determine which are the best practices going forward".*

A32: **"***Yes, currently each team is responsible for their own approaches".*

Proposition 1

ASDMs are used in some of the Telecommunication companies because results are seen quicker, communication and reporting are improved, they are easy to use and implement, work is done faster and quality is seen within a short space of time [**A11, A12, A28, A31 and A32**].

Proposition 2

ASDMs are difficult to adopt and implement in some Telecommunication organizations because of culture, resistance to change, complexity of the company, too much effort required, an agile mindset needed, confusing and uncertain users bring in more problems [**A11, A12, A26, A28, A31 and A32**].

Proposition 3

Some Telecommunication companies have an in-house methodology based on the Waterfall methodology that they use to develop information systems projects [**A1, A2 and A3**].

Proposition 4

The in-house methodology used in the Telecommunication organization is being evolved into an agile SDM **[A3].**

Proposition 5

Scrum is the commonly used ASDM in some South African Telecommunication companies **[A1, A2 and A3].**

Proposition 6

Some Telecommunication companies in South Africa adopt ASDMs because of pressures in the organization **[A11].**

Proposition 7

Before adopting ASDMs, employees are trained on their use in some Telecommunication companies **[A12 and A27].**

Proposition 8

Some Telecommunication companies adopt ASDMs slowly to allow for the transition of the employees' mindsets and culture to the agile way of thinking **[A11, A12, A24, A27 and A32].**

Proposition 9

Compatibility between the project and SDM, documentation required by the customer and the level of influence of the executives are some of the factors that determine what SDM will be used for a project in some Telecommunication companies **[A12, A27, A31 and A32].**

Proposition 10

Some Telecommunication companies in South Africa state that ASDMs should be made contingent and it is easier to do so with them **[A11, A12, A31 and A32].**

Proposition 11

The criteria for making ASDMs contingent depends on an individual project's size, scope, complexity and dependencies on other project timelines in some Telecommunication companies **[A11 and A32].**

Proposition 12

Some Telecommunication companies in South Africa make ASDMs contingent by using aspects in the methods that are useful for their project's success **[A11, A28, A31 and A32].**

Proposition 13

Some Telecommunication companies do not document their contingency changes in detail if they are not major **[A11, A31 and A32].**

Proposition 14

Some Telecommunication companies in South Africa make use of a Project Management Office (PMO), notes and themselves to monitor project quality and how successful an SDM is in an organization, and to control the procedure used to make ASDMs contingent **[A12, A31 and A32].**

Proposition 15

Some Telecommunication organizations expect the ability to work faster, more adaptability, easier alignment with the business and a unified agile mindset from the future use of contingent ASDMs [**A11, A12, A27, A31 and A32**]

4.2.2 Case Study 2: Organization B

The second case study that will be discussed in this section was denoted 'Organization B'. Only one representative was interviewed, a consultant for Organization B, who has the experience of being a project manager, business analyst and a Scrum master; all in the past six years in several banking environments. The interviewee will be known as B11, "B" for the organization, "1" for the department and "1" for the interviewee. Organization B was chosen because it is an international company and it is well known in the consultancy and technological sector. The interview was carried out mid-September 2012, it was semi-structured and it lasted for 42 minutes.

4.2.2.1 Organization B Overview

Organization B is a global management consulting, technology services and outsourcing company. It has over 257, 000 people who serve clients in more than 120 countries. It combines unparalleled experience, comprehensive capabilities and extensive research on successful companies worldwide. It works hand in hand with companies and governments to enable it to achieve high performance.

Organization B's roots can be traced as far back as the 1950's when the first computer was being created for commercial use in the United States of America. It first built its reputation as a technology consultant and systems integrator. By the late 1980s, it had started offering a new level of business integration solutions to its customers, which included aligning technologies, processes and people. It had continued to better the organization and the clients it serves.

In 1989, Organization B had been formally established when a group of partners from various consulting divisions formed one company. By 2000, it had expanded to 46 countries and it became a public company in 2001 and got listed on the New York Stock Exchange. At the moment it helps clients to enter new markets, increase revenues in existing markets, improve operational performance and deliver its products and services more effectively and efficiently. Its clients include 92 of the Fortune Global 100. It is also a leader in the Fortune Global 500.

4.2.2.2 Organization B's history with SDMs

Organization B has its own in-house methodology, which it calls Organization B's delivery methodology. It started being used in the 1970s and 1980s. As time went by, it was refined and adapted to keep up with changing business requirements. Apart from its own in-house methodology, Organization B also makes use of ASDMs and it has been doing so for many years. It is known in South Africa for being a pioneer of ASDMs.

> **B11**: *"Organization B's delivery methodology... they have their own in house development methodology which has been refined over for many years... It started in the 70s, 80s. And has been adapted over the years to keep up with requirements. So we do have a delivery methodology that we use".*

4.2.2.3 Organization B's current SDM

Organization B is still using its own in-house methodology that it has refined over time in accordance with requirements, in collaboration with ASDMs. It has been useful and successful; therefore it continues to use it. Typically, when taking on a client project, it will adopt the client's in-house methodology, whether it be traditional waterfall or agile. What is found in the SDM is the "academic" or "theoretical" way one should implement or make use of ASDMs. If the client was lacking an in-house SDM, the organization would suggest to them a traditional or agile methodology according to the "academic" or "theoretical" context based on the content in

Organization B's delivery methodology. The in-house delivery methodology is a massive library full of best practices and industry standards; it is one of the organization's biggest selling points when carrying out work for clients.

> **B11**:"*So, so what you will find is, when a new project is started, the client will say, listen you need to deliver this, this is how we prefer to handle the delivery of software solutions and how can you fit into it. And then also sometimes Organization B will say, we will dictate how to handle the methodology will take place. Coz they will take over the project as a whole. Sometimes Organization B wholly owns the project and sometimes they take part of it. When you form part of it, it's difficult to dictate the methodology. When you own the project, it's much easier to say this is how we should go about it. But in the instances where Organization B would use agile, I think it's just where it would suit the project".*

The ASDM used in the South African branch of Organization B is Scrum for small projects. This is because Organization B finds it to have a high level of maturity, it is well defined, it has a high level of adoption and it can integrate easily with the Waterfall SDM. They sometimes use a combination of the waterfall methodology and Scrum to deliver large projects (Appendix A**).**

> **B11**: *"Yah and we use Scrum. And the reason why they use Scrum a lot is because I think it's the most defined, the most involved methodology. It's more mature, that's the word. The others are not at the level of maturity that Scrum is at. Also the level of adoption in Scrum is very very high. And also what you can see is Scrum and your traditional waterfall, they can sort of overlap in sense that you can have waterfall using the principles of Scrum to ensure delivery".*

Lean methodologies have been used outside of South Africa by other branches of Organization B. They are used because they offer cost reduction, eco-efficiency, better financial performance, and employee morale and brand image.

4.2.2.4 Organization B's Contingency Approach

Sometimes, Organization B has control over a project and at other times, it does not. In cases where it does not have control and the client is the one who dictates the SDM to use, they do it

according to the client's wishes. However, when they have the choice to choose a SDM or they are in charge of the whole project, they would use ASDMs only when they would fit or suit a project.

> **B11**:...*"When you own the project, it's much easier to say this is how we should go about it. But in the instances where Organization B would use agile, I think it's just where it would suit the project".*

For smaller projects with smaller timelines, smaller work items and a timeframe of a month or less, ASDMs are used. For larger projects that would take more than 3 months to run, they would use the Waterfall SDM, as it would have a bigger investment and they would want to make the analysis and design better. The detailed analysis and design are appropriate in order to get a full understanding of the requirements. From there on, they would build, using Scrum and use its iterations to deliver releases quicker for the client to approve. In not following the Waterfall SDM to the letter, they prevent not going into development after 6 months when a high possibility exists that the user might change his/her mind about what he/she really wants.

> **B11: "***So, how do we choose it? So, for smaller projects, smaller timelines, smaller work items, something that would take maximum a month to do, we run that in agile. For a bigger project that would take typically 3 months to a year to run or longer, we would more than likely use the ahh...traditional because it becomes a much bigger investment. So you wanna make the analysis better and make sure that you have a full understanding of what is to be delivered. Once we got into that, like I said, we would go into our iterative sort of releases where we would develop stuff and release stuff. We wouldn't just create an entire design and only start building 6 months into the project".*

Therefore the contingency criteria that they use are project size, requirements and outcomes. They do make ASDMs contingent but the changes have not been major yet. The way they carry out their contingency is by only using aspects that are applicable to the project they would be working on. Some changes are made as the project evolves. Small projects do not require so much contingency but large projects require a lot of additions and subtractions. Organization B's contingency approach is shown in Appendix A.

B11: *I think for me a methodology doesn't dictate whether a project is successful or not. And if you've got a person who's very good project manager and can understand the methodologies makes the project successful...we will decide based on the needs and outcomes of the project, what methodology we will use. So we would typically look at a project and say listen we need to follow typical design of traditional waterfall. And then use the iterative Scrum for releases".*

"Minor. There's no major changes coz you can't take Scrum which takes 2 to 4 weeks long. You can't make a sprint 26 weeks long. So we might change our sprints to be 6 weeks long or 2 weeks. We've met our daily standards, we've met our product backlog and we've managed to get results. Maybe we've taken design and build and put together to say why don't we design and build to test our design stride. So we haven't said we are gonna test it first, there's no major changes like that".

"So you, you take a methodology as a whole. You don't make it as an overhead. You ask, what is the bare minimum to make this project run? So what do you take out? You take out the unnecessary aspects and staff...And as the project evolves, you find slight variations, certain things being dropped off...It is based on the project, the culture and the environment. So I think what a lot of the methodologies forget, is they don't take into account the agile way of working and that is very, very important....sometimes it's a smaller project so there's not much to do. When you go deeper you find, that's when you find, the bigger the project, the more evolution there is, so the more additions and subtractions there is".

4.2.2.5 Thoughts on ASDMs use

The interviewee was a major advocate of ASDMs but he did acknowledge that it has disadvantages. Generally Organization B has been using ASDMs for long and it is safe to assume they will continue to improve and adapt them as they have been doing over the years. Table 4.4 shows the advantages and disadvantages of ASDMs in Organization B.

Advantages of ASDMs	Disadvantages of ASDMs
Produces successful projects that meet users' needs **B11**: *"To be honest with you, If I could take traditional versus agile, traditional projects are implemented like 3 to 4, big projects. Did they meet the users expectation a 100%? No"*. *"Very successful. More successful than the traditional waterfall"*.	Not enough thought given before going to development **B11:"***I don't know if you know the term "cowboy". So you would just jump into it and start coding. Sometimes there is not enough thought put into it. So you would have to do a rework later on"*.
Ideal for rapidly changing markets, such as equities trading **B11:**"*There was a system that used to run pre-programmed algorithms for trading. Algorithms for trading. So this computer monitors the market, listens for prices and then trades based on the information. Now, these algorithms used to change all the time. So using the waterfall, things are done day by day. Analysis on Monday, Design, Tuesday. It was taking too long, so you would use the agile Scrum to sort of create a new story to say I wanna do this and you would go straight into building. Because a lot of times, analysis and design, when you actually build, there is so much to choose that you can do. So you would last two or three days which in trading is a lot of time and big money"*.	Requires the people, culture and environment to be agile **B11**:"*So I think what a lot of the methodologies forget, is they don't take into account the agile way of working and that is very, very important"*.

The customer approves work done quickly, as he/she sees it quicker **B11:** "*Also the customer gets to see if the right thing is being done. With your typical waterfall, you don't see anything*".	No detailed analysis and design hence the use of Waterfall for this **B11:** "*But yes, initially there were problems around into it without really understanding everything while the analysis phase in your traditional gave you all those things*".
Ideal for smaller projects with smaller teams and smaller changes after project completion **B11**: "*But I mean, in project where agile worked very well, was about 50 of us, IT... But on smaller amounts of changes, agile was the way to go*".	
Reduced costs **B11:** "*So you could say the benefits were much quicker time to develop, reduced costs and reduced time to market*".	
Quicker time to develop **B11:** "*So you could say the benefits were much quicker time to develop*"	
Reduced time to market **B11:** "*That is a real benefit, quicker time to market*".	

Table 4.4: Organization B's ASDM advantages and disadvantages

The expectations are shown in Table 4.5.

Expectations for contingent ASDMs
More ASDMs adoption to reduce time taken to market new products **B11:**…" I can definitely tell you the adoption of agile is gonna start increasing especially in financial services…"
More continued use of the Waterfall SDM together with Scrum **B11: …"**as time goes on, we are will see adaptation of agile methodologies on a smaller delivery and in a bigger delivery, they are still using waterfall but they improve…"
Faster and better delivery of orders to customers **B11: …"**to get our order to customers better and faster".

Table 4.5: Organization B's expectations

4.2.2.6 Organization B's Propositions

In this section are the propositions that have been formed from the interview data collected in Organization B. It is an international organization whose reputation is solid in the industry in which it is found. Its results could also be an indication of what is occurring in the consultancy, technology and outsourcing firms in South Africa. The propositions for Organization B will follow after a brief discussion of the findings and their supporting evidence.

Some organizations in the consultancy, technology and outsourcing firms in South Africa are still using the traditional SDM, waterfall methodology for their projects, especially those that are seen to have a lot of money involved or have more complications. Even if an organization has its own in-house SDM, it is loosely based on the waterfall methodology. It is still being used because it offers dependable analysis and design as shown below;

> **B11:** "*For their bigger projects, however, say they were replacing something in their underlying systems; yes they would go for traditional waterfall...The waterfall was pretty much the one everyone goes to...you see the analysis, design, build, test, that's typically*

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what they do. So I think from that perspective, that side, frequent implementations and changing platforms, and staff like that, waterfall".

Organization B has their own in-house SDM that they have used since the 70s and 80s and has been refined over the years to take into consideration changing business requirements;

B11: **"***Organization B has an in-house methodology...It started in the 70s, 80s. And has been adapted over the years to keep up with requirements. So we do have a delivery methodology that we use".*

Scrum is used by Organization B because it is the most defined, involved, mature, its level of adoption is high and it can overlap or co-exist with the Waterfall SDM well, as shown below;

B11: "*Yah and we use Scrum. And the reason why they use Scrum a lot is because I think it's the most defined, the most involved methodology. It's more mature, that's the word. The others are not at the level of maturity that Scrum is at. Also the level of adoption in Scrum is very very high. And also what you can see is Scrum and your traditional waterfall, they can sort of overlap in sense that you can have waterfall using the principles of Scrum to ensure delivery".*

Because of businesses moving fast, more and more large corporations are increasing their levels of ASDM adoption for their purposes and making them contingent as well;

B11: "*We can use agile for large projects. We will take waterfall, I think we will insert a certain concept and ideas of agile into it show constant delivery. The big corporations use agile to an extent".*

Organization B does not use SDMs, whether traditional or agile, in their theoretical format but makes them contingent to suit their projects. The contingent changes to ASDMs have not, however, been major;-

B11: ..."*So I do think that a methodology needs to be made...contingent to the culture and environment you work in. Because you are not just working for the project but for people and processes as well. So there will be some level of customization, adaptation,*

contingency of agile methodologies in an organization...each one adds their own flavour adapting it to their culture".

A criterion for making ASDMs contingent is used and it makes sure that an SDM that is chosen by Organization B, whether traditional or agile is made contingent appropriately for the success of the project and the organization as a whole. A project's needs and outcomes are what its output is going to be measured by. The project manager's style and choice also affect the project outcomes. The culture and environment and the people in it go through a change every time a project is carried out. Since every project is unique, every change brought by it will also be new and unique. The type of SDM to use is also influenced by the client if he/she specifies which one is to be used;

> **B11**: *..."So I do think that a methodology needs to be made...contingent to the culture and environment you work in...When a new project is started, the client will say, listen you need to deliver this, this is how we prefer to handle the delivery of software solutions and how can you fit into it. And then also sometimes Organization B will say we will dictate how to handle the methodology".*

> *..."If you've got a person who's very good project manager and can understand the methodologies makes the project successful...The project, we will decide based on the needs and outcomes of the project, what methodology we will use. So, for smaller projects, smaller timelines, smaller work items, something that would take maximum a month to do, we run that in agile. For a bigger project that would take typically 3 months to a year to run or longer, we would more than likely use the ahh...traditional because it becomes a much bigger investment".*

Organization B uses Scrum and Waterfall SDM to carry out large projects. The Waterfall SDM is used to carry out the analysis and design, while Scrum iterations will be used to deliver releases quickly for the client to approve or disprove;

> **B11: "***We can use agile for large projects. We will take waterfall, I think we will insert a certain concept and ideas of agile into it show constant delivery".*

Organization B uses the waterfall SDM to get a better understanding of the business requirements through its thorough analysis. Then they take components of what they want to design. ASDMs come in by means of the use of an iterative sprint approach in what they call a traditional sprint to ensure consistent delivery. In this way, they do not have to be six months into the project to only have the design done and the user changing the requirements. This mixed approach is applicable for large projects. If the two SDMs are not combined, ASDMs are used for small projects that take less than a month and have small work items;

> **B11**: …"*You ask, what is the bare minimum to make this project run? So what do you take out? You take out the unnecessary aspects and staff. For instance, the one agile project I worked on, required that I write a weekly report to say what we did. So I sat them down and said a weekly report is just too long to be realised. Let me just give you what we plan to do, what we did, what we didn't do. It was much shorter, much easier*".

> "*And as the project evolves, you find slight variations, certain things being dropped off and certain things say, listen, we should have added this in the methodology. We should have had those reports but we didn't have it so let's start creating those reports. So the current reports are too tedious and too time consuming, let's shorten them*".

> "*For a bigger project that would take typically 3 months to a year to run or longer, we would more than likely use the ahh...traditional because it becomes a much bigger investment. So you wanna make the analysis better and make sure that you have a full understanding of what is to be delivered. Once we got into that, like I said, we would go into our iterative sort of releases where we would develop stuff and release stuff. We wouldn't just create an entire design and only start building 6 months into the project*".

> …"*So what they typically do is they go through the entire analysis phase, understanding business requirements, to see what they want. We want the business to do this, that, they go through that. So once they do it, they then take design build...However, what they do is then take components of what they are gonna design and build. Then they take an iterative sprint approach. Where they take and say, OK. We want to know what is to be delivered in 2 weeks' time. So they call it a traditional sprint. What items should account for being in the user stories. I think this comes to later, customize it, adapt it to the*

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environment".

"But to ensure consistent delivery, they use these iterations. So what they do is that they are still building up the step marks full of requirements, developments...So, say we have create a customer report. So in a customer report, we have to create customer update, customer.... and in the first week, we say we have to create customer. So in two weeks they are gonna create that entire thing and they will show it to me and say look we created the customer. Great. Now we need to update. So we are gonna use the iterative approach but in the meantime, waterfall will design and build the facts. Just because business, they don't wanna see a system and six months later come back and say, this is not the system we want. I think that's the problem".

"So they do use waterfall specifically for design and build and test. Then use the iterative approach of say Scrum. They use a lot of pair programming in a small environment".

Organization B carries out fewer changes on ASDMs for projects that do not have much to do on them. For large projects, more evolution is needed; therefore more additions and subtractions are done;

B11:...*"However, does the way you make an agile SDM contingent depend on the project? Yes. Because sometimes it's a smaller project so there's not much to do. When you deeper you find that's when you find, the bigger the project, the more evolution there is, so the more additions and subtractions there is".*

Organization B does not document the process to make ASDMs more contingent, as the process for them has evolved to a point where it has become culture and employees have adapted to the agile mindset;

B11: **"***No...It evolves, it becomes culture so people just adapt to it".*

As individuals in Organization B, they monitor and manage themselves so that they do not change ASDMs too much. They meet at the end of the year to discuss what did not work or if the fundamentals of the ASDMs were lost. To prevent this, they always refer to academic theory to

make sure that they are using the best practice and stay up to date with what is out there. Overall the PMO oversees the use of, for example Scrum. They enforce it, make sure it is used as it should be used, ensure consistency and listen to feedback from the actual people using it so that they can update their repository;

> **B11**: *"To go and...Always take a retrospect to say at the end of the year, we have done these projects using Scrum. This is what didn't work, have we changed it too much? Have we lost the fundamentals? So you do always have to check yourself".*

> *"There's typically a PMO office which they'll say listen this is how you run Scrum. But when you are in the project environment, you tend to deviate a little bit but you will always get pulled back to it. So if you have a proper PMO in place that maintains that this is how you carry out a project using Scrum, you will find yourself get pulled back to it. That's why the PMO is very important in project management to make sure that methodologies are being enforced and adhered to. And also, it's a two way relationship between the projects and the PMO. It's supposed to create that consistency. And then for the projects themselves, to push feedback back up to the PMO to say listen, we don't really need to create a weekly report. If all the projects are saying the same thing that weekly reports are over the top, then they need to update their methodology repository to say listen for agile and Scrum, we don't need to do a by weekly report".*

> *..."The biggest worry is you get down to project Z and now you are actually not working with Scrum. That's why you always have to take it back to academics, making sure you use the best practices, stay up to date with what is out there".*

Almost all the projects in Organization B are using contingent ASDMs to develop their systems;

B11: "*All of them...Very successful. More successful than the traditional waterfall".*

Proposition 1

Some organizations in the consultancy, technology and outsourcing sectors adopt ASDMs because they produce successful results, are ideal for volatile markets, work is done and seen faster, costs are reduced and the time to market is reduced.

Proposition 2

Some organizations in the consultancy, technology and outsourcing sectors in South Africa find it difficult to adopt and implement ASDMs because of the agile culture and environment needed and not enough thought is given before going into development.

Proposition 3

The Waterfall SDM is the commonly-used, traditional SDM by some of the consultancy, technology and outsourcing companies in South Africa.

Proposition 4

Some consultancy, technology and outsourcing companies in South Africa have their own in-house SDM.

Proposition 5

Scrum is the most used ASDM type in some consultancy, technology and outsourcing companies in South Africa.

Proposition 6

ASDMs are increasingly being adopted in South Africa even by some large consultancy, technology and outsourcing corporations.

Proposition 7

Some consultancy, technology and outsourcing organizations in South Africa do not use ASDMs in their pure, theoretical and academic formats but make them contingent to fit their projects.

Proposition 8

The criterion for contingency of a SDM depends on the project's size, needs, outcomes, project manager, culture, environment and the influence of the client. This criterion also determines the SDM to use, whether traditional or agile in some consultancy, technology and outsourcing organizations.

Proposition 9

ASDMs can also be used for large projects if they are used in conjunction with the waterfall SDM in some consultancy, technology and outsourcing organizations.

Proposition 10

Consultancy, technology and outsourcing organizations in South Africa make an ASDM contingent by using only aspects that are applicable to a project.

Proposition 11

The amount of changes to make an SDM contingent depends on the project requirements in some consultancy, technology and outsourcing organizations.

Proposition 12

Some consultancy, technology and outsourcing organizations in South Africa do not document the procedure used to make ASDMs contingent.

Proposition 13

Some consultancy, technology and outsourcing organizations in South Africa have a Project Management Office (PMO), retrospection and academic theory to monitor and manage the procedure for ASDM contingency.

Proposition 14

A considerable number of projects have used contingent ASDMs in some consultancy, technology and outsourcing organizations in South Africa and they have been successful.

Proposition 15

More ASDM adoption, faster delivery of orders and a continued combination of Scrum and the Waterfall SDM are some of the expectations in some South African consultancy, technology and outsourcing organizations.

4.2.3 Case Study 3: Organization C

The last company interviewed was denoted 'Organization C'. The interviews were carried out in September 2012 with three of the company's representatives. One focus group interview was conducted and it lasted 27 minutes. The company was chosen because it represented a different sector than the other organizations interviewed as it is in the agricultural industry. It was important and necessary to determine if contingent ASDMs are still used, regardless of the type of environment or sector they are applied in. The interviews were semi-structured. Table 4.6 represents the interviewees' roles and experiences. Letter "C" is for the organization, "1" for the department and the last letters "1, 2 and 3" for the number of the interviewee.

Name	Role	Experience
C11	Web Developer	4.5 years
C12	Microsoft Developer	11
C13	IT Department Manager	5 years

Table 4.6: Organization C's roles and experiences

4.2.3.1 Organization C Overview

Organization C is a leading agricultural business established in South Africa, in 1909. It is an unlisted company with shares trading on the Over the Counter (OTC) platform. Its main business purpose is to provide production inputs to grain producers and market access for their agricultural produce. It also provides value-added services to them, such as financing, insurance and agricultural technical services.

Its operation extends across the SADC regions of Zambia, Malawi and Mozambique. It contributes to food security, provides storage and handling of agricultural products. The commodities that it delivers are clean, safe and healthy and have integrity and quality. Other services offered include reducing farming input costs, increase in profits, limiting risks, enhancing outputs and providing asset financing through a commercial bank.

4.2.3.2 Organization C's history with SDMs

Organization C uses its own hybrid in-house methodology for systems development called the Organization C's model. It is made up of aspects from different methodologies as it does not stick to one methodology from start to finish. It has aspects of the Waterfall SDM and more recently ASDMs. It added the ASDM components or aspects in 2007 when there was increased pressure from its environment to adopt them. This was due to customers demanding results at a high speed from different sectors. Adopting ASDMs helped it to respond to and cope with those needs.

> **C13: "***It's called the Organization C model, a hybrid of waterfall and agile because you had standards that you must adhere to and we've got a lot of iterations...it's about 3, 4 years. Let's say 5 years. The idea behind it is to ensure that they can do it quicker***".**
>
> **C12: "***Well, Umm, it's a very high speed, high pressure sort of environment. People want the stuff now and you've got various sources of, we've got the delivery side that wants their stuff and this side that want their stuff...So we don't go and plan to do this agile, it happens because of the environment that we are in***".**

4.2.3.3 Organization C's current SDM

Organization C's SDM used is still its hybrid model that includes different aspects of different methodologies. The only new addition is the use of ASDMs components.

> **C11:** *Yah. Once again, it's the hybrid agile*

The model that the organization uses is based on the Waterfall SDM with added aspects that are its own and applicable to it. The model is process oriented in that one phase is completed before embarking on to the next phase, therefore similar to the Waterfall SDM (Appendix E).

Figure 4.2 gives an overview of the model.
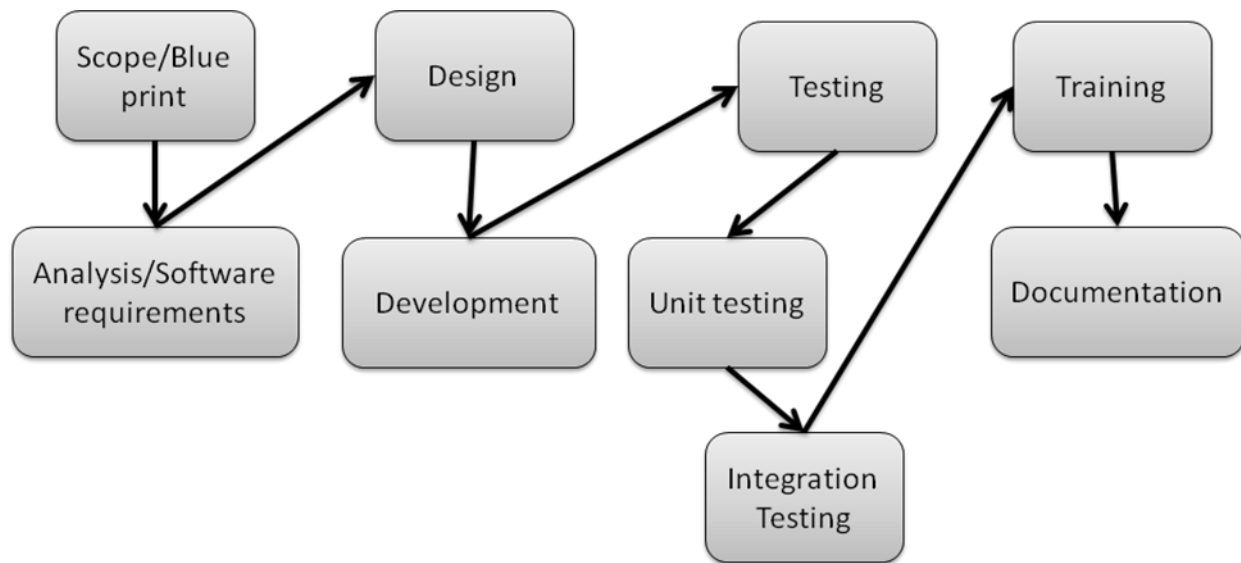
Figure 4.2: Organization C's model

There are differences though from the pure Waterfall SDM, as the organization is using more and more iterations for its delivery, for it to be faster. There is, however, some confusion on what type or method of ASDMs it is using. There was no consensus, as they insisted that they just use whatever works for each project and do not pay attention to exactly which method the aspects that they have chosen, belong to. However, the ASDMs whose aspects they thought they had used before or are familiar with, were DSDM, Scrum and XP. They use them mainly for their iterations. There was no special reason for the use of those particular ASDMs as the following quotes suggest;

> **The author: "**_Which agile methodology would you say you are using? The aspects that you are using. Which type of agile methodology are you using?_"
>
> **C12: "**_Give us a list we can choose from_".
>
> **The author**: "_There is XP, there is Scrum, there's Dynamic Systems Development Methodology, FDD_"- *C12 is looking at his IPad*
>
> **C11: "**_I would say Dynamic_"
>
> **C12: "**_I would say-_"
>
> **C11: "**_Yah, it could be Scrum as well because-_"
>
> **C12:** "_Yah_"

C13: "*Yah, he's right***"**

C11: "*It could be Scrum as well because we do get together in two weeks and talk about the project and we decide this is what we are gonna do and then we go on from there. Yah, Scrum or Dynamic, probably Dynamic. It's difficult because, yah...***"**

C12: *Looking up from his IPad* *"Extreme programming sounds like the one we are using because we are not so strict on the theory of it. We do what is necessary to get the job done basically. So it sounds like XP to me"*

The author: *"Any reason, any particular reason for using XP? Any reason for using XP? Or Scrum?"*

C12: *"Like I said, we don't plan on using these things, it just happens"* *they all agree*. *"We'll step back and say that's how it turned out"*.

4.2.3.4 Organization C's Contingency Approach

The contingency approach of Organization C is not formalized at all. They do make all SDMs that they use in their organization contingently, regardless whether they are traditional or agile. They take aspects that they need from each methodology to suit a project's needs and success. It appears that the project determines what aspects of a methodology and which one, are applicable to be used at a certain point of its life cycle. Therefore the process of contingency is unique every time.

> **C12:** *"We basically, like I said we don't make a decision that this is what we are gonna do. We plan the project we say, ok this is what we wanna approach, this is how we wanna approach this. We don't follow theory, levels and theory. We take the project and we say ok, this is the task, this is how we are gonna split it up, this is the way we wanna make it happen, this is how fast we wanna do it. And sometimes we end up using a model just because that's the way they know basically. Coz stuff happens that you don't plan for but we do the agile thing mostly because, ahh, we do testing through the whole project and the user must check every bit we do. We don't go and finish something completely and say we are done".*
>
> **C11: "***That's almost like we don't fit the project to a specific methodology, it's almost as if the project's needs determines what we gonna do***"**
>
> **C12: "***Yah, we tailor, tailor it to fit the project specifically***".**

C13: *"I think what we do works for us, might be different in another company. So, yah, I would say that the methodology should fit the project, yah. But it might be different somewhere else".*

They do admit, though, that ASDM method aspects are used much more than other methodologies. About 80% of their projects have used ASDM methods and have been successful. The amount of changes varies depending on what has to be done per project and could be from very little to considerable. In addition, if the specifications for a project are well established and are known from the start, less iterations will occur.

C12: *"But we do use agile more than any others...80%"*

C11: *"Yah. Once again, it's the hybrid agile"*

C13: *"Yah, what we do really work for us. It really does"*

C11: *"When the business is not mature and the user doesn't know exactly what they want, it tends to be more agile and a lot of iterations"*

4.2.3.5 Thoughts on ASDMs use

The sentiments in Organization C are that they will continue to do what they have been doing, which is mixing and matching different SDM to suit their purposes. They state that they could be moving towards the theoretical ASDMs much more in order to have a unified agile mindset. Some of the advantages and disadvantages experienced in Organization C are shown in Table 4.7.

ASDM Advantages	ASDM Disadvantages
It fits the business and gets the job done C12: *"Well it fits the business; we get the job done and, yah".*	Project Scope Creep C11: *"I think project scope creep could be a problem sometimes. Ahh, going over schedule stuff like that. Say like if you getting together every two weeks and you start the new project or new part of a project over and you don't specifically know what the specs are and from*

	the start, you could go over schedule and over cost".
Shortens the development time **C11: "***I think the biggest benefit is in terms of timelines. It shortens the development time a lot, you know"*	

Table 4.7: Organization C's ASDM advantages and disadvantages

The expectations for the department for ASDM use are shown in Table 4.8.

Expectations
Movement towards the theoretical ASDMs **C12: "***I think we gonna keep using it and I think we may just move towards the theoretical one a bit more"*
Formalize ASDM and the mindsets **C11**: *"Formalize agile and make sure that all the guys are on the same page with that"*
More rapid development **C11: ..."***definitely more rapid development. I mean we are always just fighting fires..."*
More growth and opportunities in South Africa generally **C11: "***But technology wise, I think we gonna grow along. It doesn't matter whether it's going good or bad, there's always new, ahh, what do you call, opportunities. And someone is always gonna see a new opportunity and technology is always gonna be there in the future"*

Table 4.8: Organization C's expectations

4.2.3.6 Organization C's Propositions

The following are the propositions formed from the data collected from Organization C. It is also a leader in its industry and its results could be used to generalise that this could also be happening in other organizations in South Africa in the agricultural sector. A brief discussion of the findings in Organization C will be presented followed by its propositions.

Organization C gave in to pressures from its own environment requiring it to adopt ASDMs in order to deliver projects and products quicker as shown below;

> **C12: "***Well, Umm, it's a very high speed, high pressure sort of environment. People want the stuff now and you've got various sources of, we've got the delivery side that wants their stuff and this side that want their stuff...So we don't go and plan to do this agile, it happens because of the environment that we are in".*

Organization C has its own methodology that is based on the Waterfall SDM and it is made up of different SDMs, including ASDMs. The mix of the different SDMs depends on a project's needs;

> **C11**: *..."It's sort of a hybrid way of in, doing...We tend not to stick to methodologies strictly because users need variants...it's the hybrid agile"*
> **C12: "***We also take every project at its own way at the method that will work for the project, we will use"*

Organization C uses ASDMs for businesses that are not mature and the users do not know exactly what they want. The process in this instance tends to be more agile with many iterations. Otherwise, less iterations are used;

> **C11**:*..."When the business is not mature and the user doesn't know exactly what they want, it tends to be more agile and a lot of iterations"*

Scrum, DSDM and XP are used by Organization C although they are not really sure which one they are actually using. They do not plan on which ASDM they are going to use but just use them according to their needs.

Organization C does not have a formal process of choosing what methodology they are going to use because sometimes they can even use a model just because that is what they know. However, whatever SDM will be used will have to suit the project type and its needs;

> **C12:** *"We basically, like I said we don't and make a decision that this is what we are gonna do. We plan the project we say ok this is what we wanna approach, this is how we wanna approach this. We don't follow theory, levels and theory. We take the project and we say ok, this is the task, this is how we are gonna split it up, this is the way we wanna make it happen, this is how fast we wanna do it. And sometimes we end up using a model just because that's the way they know basically. Coz stuff happens that you don't plan for but we do the agile thing mostly because, ahh, we do testing through the whole project and the user must check every bit we do. We don't go and finish something completely and say we are done".*
>
> **C11:** **"***That's almost like we don't fit the project to a specific methodology, it's almost as if the project's needs determines what we gonna do".*

Organization C does not use SDMs and stick to them completely. They make it contingent to suit the needs of the project so that it can be successful. The contingency done to an SDM is specific and unique to a project and it depends on the specifications stipulated by the user;

> **C12:** *"We basically, like I said we don't and make a decision that this is what we are gonna do. We plan the project we say ok this is what we wanna approach, this is how we wanna approach this. We don't follow theory, levels and theory"*
>
> **C13:** **"***I think what we do works for us, might be different in another company. So, yah, I would say that the methodology should fit the project, yah. But it might be different somewhere else".*
>
> **C12:** **"***Yah, we tailor, tailor it to fit the project specifically".*

Organization C uses pieces of an ASDM to make it contingent by using bits that are useful for their different projects in combination with other useful SDMs, such as the Waterfall SDM. The ways the aspects are combined are different every time because the needs and requirements also differ;

C11: "*We tend not to stick to methodologies strictly because users need variants*"

C12: "*We also take every project at its own way at the method that will work for the project, we will use. Coz they are all not the same*"

C13: "*That depends on how much specs we've got from the start, yah*" *they all agree*

C12: "*Yah. Once again, it's the hybrid agile*"

Organization C's central help desk, apart from handling technical problems, monitors changes that are made in projects and documents them for future reference.

C13: "*We've got a central help desk. But in there is the whole process of change management is included there. So they will lock a call typically and a user will register a need and that's where the call starts. And all the documentation and changes are related to that gets attached to that*".

Organization C's IT department has used the hybrid SDM that contains aspects of ASDMs useful for a project for most of its projects and it has been successful for them;

The author: "*Ok. What is the percentage of projects that have used agile methodologies in your department?*"

C12: "*80%*"

C11: "*Yah. Once again, it's the hybrid agile*"

The author: "*And how successful has it been?*"

C13: "*Yah, what we do really work for us. It really does*"

Organization C makes ASDMs contingent based on the project needs; therefore the changes could range from significant to minor;

The author: "*How significant are the changes?*"

C12: "*Like I said, it depends on the project. I don't think for each project, this is exactly what we did*".

C11: "*That would be from very little to a lot*" *They all agree*

Proposition 1

Some South African organizations in the agricultural sector adopt ASDMs because of their ability to fit their business and shorten development times **[C11 and C12].**

Proposition 2

Some South African agricultural organizations have difficulty adopting and implementing ASDMs because of their ability to increase the project scope [**C11**].

Proposition 3

The environments that some agricultural organizations are in, force them to adopt ASDMs [**C12**].

Proposition 4

Some agricultural organizations in South Africa have an in-house or hybrid methodology based on the Waterfall SDM **[C11** and **C12].**

Proposition 5

Some agricultural organizations in South Africa use ASDMs for businesses that are not mature and have uncertain user requirements [**C11**]**.**

Proposition 6

Scrum, DSDM and XP are used in some agricultural organizations in South Africa.

Proposition 7

Some agricultural organizations in South Africa choose SDMs, traditional or agile, based on what they know and the project's needs [**C11 and C12**]**.**

Proposition 8

Some agricultural organizations in South Africa do not use SDMs to the letter, they make them contingent to suit their project's needs [**C12 and C13**]**.**

Proposition 9

Some agricultural organizations in South Africa make ASDMs contingent by using only aspects of them that are useful for a particular project [**C11, C12 and C13**].

Proposition 10

Some agricultural organizations have a central help desk that monitors changes and documents them [**C13**].

Proposition 11

The majority of projects in agricultural organizations in South Africa make use of contingent ASDMs and they have been successful [**C11, C12 and C13**].

Proposition 12

The amount of changes to make an ASDM contingent depends on the project in some agricultural organizations [**C11 and C12**].

Proposition 13

The expectations for contingent ASDM use in agricultural organizations in South Africa is a movement towards the theoretical and formal, rapid development and growth through the use of opportunities [**C11 and C12**].

4.3   Comparison of Propositions

Cross-case analysis will be conducted in this section. We have formed the propositions that are applicable to the study through the use of ATLAS.ti used to analyse the data. Different combinations of the codes were used to form the propositions for each organization interviewed. The propositions formed were compared using cross-case analysis to find the differences and similarities. The organizations used to form a proposition are shown at the end of the proposition. A brief discussion of the similarities and differences of the findings will be discussed followed by the final revised propositions for all the interviews and focus groups conducted.

Some organizations have their own in-house SDMs that are based on the Waterfall SDM. Organization A uses its in-house SDM for large and small projects but is in the process of

evolving it to be agile. Organization B has refined theirs over the years to take into consideration changing business requirements. Organization C's in-house SDM is made up of different SDMs, including ASDMs. The mix of the different SDMs depends on a project's needs.

The organizations interviewed are still using the traditional Waterfall SDM for their projects, especially those that are seen to have large sums of money involved or have more complications. It is still being used because it offers dependable analysis and design.

Pressures from within organizational environments force them to adopt ASDMs in order to deliver projects and products quicker, to reduce costs incurred by IT and to improve the success rate of projects

Organization A's in-house SDM is still being used to develop systems while the culture and processes are transiting to the agile mindset. Some in Organization A have the option of choosing ASDMs or Organization A's in-house SDM, thus the adoption is not yet formal for them while others are using both at the same time. For those using them already, they start ASDMs on small projects first. The level of complexity in an organization also affects the speed of adoption of ASDMs.

Employees were taken for training on ASDMs before they could be used in Organization A. This was to ensure that they know how to use them for the success of their projects and their organization as a whole.

Organization C uses ASDMs for businesses that are not mature and the users do not know exactly what they want. The process in this instance tends to be more agile with many iterations. Otherwise, less iterations are used.

Because of businesses moving fast, more and more large corporations are increasing their levels of ASDM adoption for their purposes and making them contingent as well

The ASDM, Scrum, is the methodology being used in some organizations interviewed across South Africa because it is believed to help the organizations to adapt to rapidly changing technology and customer needs, it is the most defined, involved, mature, its level of adoption is high and it can overlap or co-exist well with Waterfall SDM. Other ASDMs used are XP, Kanban and DSDM.

Organization A matches the project with the SDM in order to achieve the project objectives or requirements thereby ensuring success. Organization A's in-house SDM used to be used for all projects regardless of requirements but now with the adoption of ASDMs, they are matching each unique project with the methods that would be compatible with it. Organization A also uses the volume of documentation required by clients to choose an SDM to use. If more documentation is required, then Organization A's in-house SDM will be used. If less documentation is required, then ASDMs will be used. Organization C does not have a formal process of choosing what methodology they are going to use because sometimes they can even use a model just because that is what they know. However, whatever SDM will be used will have to suit the project type and its needs.

The criterion used to make ASDMs contingent makes sure that an SDM that is chosen by Organization B, whether traditional or agile, is made contingent appropriately for the success of the project and the organization as a whole. A project's needs and outcomes are what its output is going to be measured by. The project manager's style and choice affect the project outcomes as well. The culture and environment and the people in it go through a change every time a project is carried out. Since every project is unique, every change brought by it will also be new and unique. The type of SDM to use is also influenced by the client if he/she specifies which one is to be used.

Some organizations interviewed do not use SDMs, whether traditional or agile, in their theoretical format but make them contingent to suit their projects and they will continue to do so for the success of their projects. The contingency done to an SDM is specific and unique to a project and it depends on the specifications stipulated by the user. ASDMs were chosen to be used specifically because they make contingency easy to do and they fit organizational needs.

Organization B uses Scrum and the Waterfall SDM to carry out large projects. The Waterfall SDM is used to carry out the analysis and design, while Scrum iterations will be used to deliver releases quickly for the client to approve or disprove.

Different projects run in different ways, depending on the requirements; therefore the above contingency criterion applies. Organization A is in the process of making an ASDM contingent approach that can be used for all future projects to maintain standardization and quality. A

project's requirements, needs and outcomes are what its output is going to be measured by. The project manager's style and choice affect the project outcomes as well.

Organization A is making their ASDMs contingent by using aspects, and bits and pieces of them to suit their unique and different projects' needs and to make them successful. Kanban is used to make the work visual, Scrum for communication purposes (i.e. when to meet, how regularly, how to conduct the meetings and the duration thereof) and XP to conduct the sprint sessions.

Organization B uses the Waterfall SDM to get a better understanding of the business requirements through its thorough analysis. Then they take components of what they want for design. ASDMs come in by means of the use of an iterative sprint approach in what they call a traditional sprint to ensure consistent delivery. In this way, they do not have to be six months into the project to only have the design done and the user changing the requirements. If the two SDMs are not combined, ASDMs are used for small projects that take less than a month and have small work items.

Organization C uses pieces of an ASDM to make it contingent by using bits that are useful for their different projects in combination with other useful SDMs such as the Waterfall SDM. The ways in which the aspects are combined are different every time because the needs and requirements also differ.

Organization A does not document contingency changes made to ASDMs, as they regard it as a guideline that gives direction. In the future, they might develop some standards. The same applies to Organization B as the process for them has evolved to a point where it has become culture and employees have adapted to the agile mindset.

Organization B carries out fewer changes on ASDMs for projects that do not have much to do on them. For large projects, more evolution is needed; therefore more additions and subtractions are done. The changes for Organization C range from very little to considerable.

Organization A has a PMO to monitor the quality of work that is delivered and how successful it is. It looks at what was delivered before and after the adoption of an SDM. Otherwise, individuals monitor themselves through making notes, and daily Scrums and weekly meetings to record best practices for future use.

As individuals in Organization B, they monitor and manage themselves so that they do not change ASDMs too much. They meet at the end of the year to discuss what did not work or whether the fundamentals of the ASDMs were lost. To prevent this, they always refer to academic theory to make sure that they are using the best practice and stay up to date with what is out there. Overall the PMO oversees the use of, for example, Scrum. They enforce it, make sure it is used as it should be used, ensure consistency and listen to feedback from the actual people using it so that they can update their repository.

Organization C's central help-desk, apart from handling technical problems, monitors changes that are made in projects and documents them for future reference

Almost all the projects in Organization B are using contingent ASDMs to develop their systems. Organization C's IT department has used the hybrid SDM that contains aspects of ASDMs useful for a project for most of their projects and it has been successful for them.

Revised Propositions

Proposition 1

ASDMs are used in some telecommunication, consultancy, technology, and agricultural organizations in South Africa because development is carried out faster and successfully with improved quality, communication and reporting, reduced costs and reduced time to market. It also fits some businesses, it is ideal for volatile markets and it is easy to implement [**A, B and C**].

Proposition 2

ASDMs are difficult to adopt and implement in some telecommunication, consultancy, technology, and agricultural organizations in South Africa because of culture, resistance to change, complexity of the company, too much effort required, an agile mindset needed, confusing, uncertain users bringing in more problems, not enough thought given before going into development and their ability to increase the project scope [**A, B and C**].

Proposition 3

Some telecommunication, consultancy, technology, and agricultural organizations in South Africa have an in-house methodology that is based on the Waterfall SDM **[A, B and C].**

Proposition 4

The in-house methodology used in the telecommunication organization is being evolved into an agile SDM **[A].**

Proposition 5

The environments that some telecommunication, consulting, technology, outsourcing and agricultural organizations are in, force them to adopt ASDMs **[A and C].**

Proposition 6

Before adopting ASDMs, employees are trained on their use in some telecommunication companies **[A].**

Proposition 7

Some telecommunication companies adopt ASDMs slowly to allow for the transition of the employees' mindsets and culture to the agile way of thinking **[A].**

Proposition 8

Some agricultural organizations in South Africa use ASDMs for businesses that are not mature and have uncertain user requirements **[C].**

Proposition 9

ASDMs are increasingly being adopted in South Africa even by some large consultancy, technology and outsourcing corporations **[B].**

Proposition 10

Scrum is the commonly used ASDM in some of the telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa **[A, B and C].**

Proposition 11

Some agricultural organizations in South Africa choose SDMs, traditional or agile, based on what they know and the projects' needs**[C].**

Proposition 12

Compatibility between the project and SDM, documentation required by the customer and the level of influence of the executives are some of the factors that determine what SDM will be used for a project in some telecommunication companies **[A].**

Proposition 13

The criterion for contingency of an SDM depends on the project's size, needs, outcomes, project manager, culture, environment and the influence of the client. This criterion also determines the SDM to use, whether traditional or agile, in some consultancy, technology and outsourcing organizations **[B].**

Proposition 14

Some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa do not use SDMs and ASDMs to the letter, they make them contingent to suit their projects' needs **[A, B and C]**.

Proposition 15

ASDMs can also be used for large projects if they are used in conjunction with the Waterfall SDM in some consultancy, technology and outsourcing organizations **[B].**

Proposition 16

The criteria for making ASDMs contingent depends on an individual project's size, scope, complexity and dependencies on other project timelines in some telecommunication companies **[A].**

Proposition 17

Some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa make ASDMs contingent by using only aspects in them that are useful for their projects **[A, B and C]**.

Proposition 18

The amount of changes to make an SDM contingent depends on the project requirements in some consultancy, technology, outsourcing and agricultural organizations **[B and C]**.

Proposition 19

Some telecommunication, consultancy, technology and outsourcing organizations in South Africa do not document the procedures used to make ASDMs contingent if they are not major **[A and B]**.

Proposition 20

Some telecommunication, consultancy, technology and outsourcing companies in South Africa make use of a Project Management Office (PMO), notes, academic theory, themselves and retrospection to monitor project quality and how successful an SDM is in an organization, and to control the procedure used to make ASDMs contingent **[A and B]**.

Proposition 21

Some agricultural organizations have a central help-desk that monitors changes and documents them **[C]**.

Proposition 22

The majority of projects in some consultancy, technology, outsourcing and agricultural organizations in South Africa make use of contingent ASDMs and they have been successful **[B and C]**.

Proposition 23

Some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa expect the ability to work faster, more adaptability, easier alignment with the business, a unified agile mindset, more ASDM adoption, faster delivery of orders, a continued combination of Scrum and the Waterfall SDM, movement towards the theoretical and formal ASDM, rapid development and growth through the use of opportunities from the future use of contingent ASDMs [**A, B and C**].

Summary of Propositions

How the final propositions were formed is shown in Table 4.9**.**

Final Propositions	Organization A	Organization B	Organization C
Proposition 1 - Advantages	**Proposition 1 -** Advantages	**Proposition 1 -** Advantages	**Proposition 1 -** Advantages
Proposition 2- Disadvantages	**Proposition 2 -** Disadvantages	**Proposition 2 -** Disadvantages	**Proposition 2** Disadvantages
Proposition 3 -In-house SDM based on Waterfall SDM	**Proposition 3** – In-house SDM based on Waterfall SDM	**Propositions 3 and 4 -** In-house SDM based on Waterfall SDM	**Proposition 4 -** In-house SDM based on Waterfall SDM
Proposition 4 - In-house SDM being evolved to Agile SDM	**Proposition 4** – In-house SDM being evolved to Agile SDM		
Proposition 5 – Pressure to adopt ASDMs	**Proposition 6 –** Pressure to adopt ASDMs		**Proposition 3** - Pressure to adopt ASDMs
Proposition 6 – Training for ASDM use	**Proposition 7 –** Training for ASDM use		
Proposition 7 – Slow transition to ASDM use	**Proposition 8 –** Slow transition to ASDM use		
Proposition 8 – ASDMs used for businesses that not mature			**Proposition 5 –** ASDMs used for businesses that not mature
Proposition 9 – ASDMs used in large companies		**Proposition 6 –** ASDMs used in large companies	

Proposition 10 – Scrum used	Proposition 5 – Scrum used	Proposition 5 - Scrum used	Proposition 6 - Scrum used
Proposition 11 - SDM to be used criteria			Proposition 7 - SDM to be used criteria
Proposition 12 -SDM to be used criteria	Proposition 9 – SDM to be used criteria		
Proposition 13 - SDM to be used criteria and ASDM contingency		Proposition 8 - SDM to be used criteria and ASDM contingency	
Proposition 14 - ASDMs are made contingent	Proposition 10 – ASDMs are made contingent	Proposition 7 - ASDMs are made contingent	Proposition 8 - ASDMs are made contingent
Proposition 15 -Scrum and Waterfall SDM for large projects		Proposition 9 – Scrum and Waterfall SDM for large projects	
Proposition 16– Criteria for making ASDMs contingent	Proposition 11 – Criteria for making ASDMs contingent		
Proposition 17 – Tailoring used for contingent ASDMs	Proposition 12 – Tailoring used for contingent ASDMs	Proposition 10 – Tailoring used for contingent ASDMs	Proposition 9 – Tailoring used for contingent ASDMs
Proposition 18 – ASDM changes depend on project		Proposition 11 – ASDM changes depend on project	Proposition 12 – ASDM changes depend on project
Proposition 19 - No documented contingency changes	Proposition 13 - No documented contingency changes	Proposition 12 - No documented contingency changes	
Proposition 20 -PMO monitors ASDM changes	Proposition 14 – PMO monitors ASDM changes	Proposition 13- PMO monitors ASDM changes	
Proposition 21 – Help desk monitor ASDM changes			Proposition 10 – Help-desk monitors ASDM changes
Proposition 22 -– Contingent ASDMs successful		Proposition 14 – Contingent ASDMs successful	Proposition 11 – Contingent ASDMs successful
Proposition 23 –Future expectations	Proposition 15 – Future expectations	Proposition 15 – Future expectations	Proposition 13 – Future expectations

Table 4.9: Summary of Propositions

4.4 Contradictions and final thoughts on Data Analysis

There were few contradictions from the data collected. The problem was in understanding the questions asked and some respondents did not have much knowledge about systems development methodologies. They use them as they are told to but do not have extensive knowledge about them and in the case of Organization A, it could be because they recently adopted ASDMs. On two occasions, the author had to mention the types of ASDMs that are available;

Organization A

> **The author**: *"OK, and what agile systems development methodologies are you using?"*
> **A11**: *"Pardon?"*
> **The author**: *"What are you using? The agile systems development methodology, which one are you using?"*
> **A12**: *"It is a methodology isn't it?"*
> **The author**: *"Yes it is, but isn't it there are different types of agile systems development methodologies? There is extreme programming, scrum..."*
> **A11**: *"Scrum, yah"*
> **A12**: *"Yah, that's the one, is it the one that has all those things"**pointing to the board* (There is a board in the conference room where the interview was carried that has some things written on it). *"I thought scrum was one of the items in the agile"*
> **The author**: *"Yes it is, it's part of them"*
> **A12**: *"It's one of them?"*
> **The author**: *"Yes it is"*
> **A12**: *"So Scrum is basically the one that where you meet in the mornings, isn't it?"*
> **The author**: *"Yes"*
> **A12**: *"Yes. Isn't it a feature of, of...? Ok let me try to answer your question. I thought we using agile, we..."*
> **A11**: *"There are several different types of agile but I am not even sure which one it is that we..... We are not hang up on names"* *We all laugh*.
> **A12: "***But Scrum yah...Sounds like the one. You see we were just from training. It's one of the things we use as one of the approaches. We still resisting, eh, some of us eh... We are still stuck on the SVC because that how we were taught at school and yah it works*

best for us and yah"

Organization C

> **The author: "***Which agile methodology would you say you are using? The aspects that you are using. Which type of agile methodology are you using?"*
>
> **C12: "***Give us a list we can choose from"* *we all laugh*
>
> **The author**: *"There is XP, there is Scrum, there's Dynamic Systems Development Methodology, FDD"* *The Microsoft Developer is looking at his IPad*
>
> **C11:"** *I would say Dynamic"*
>
> **C12: "***I would say-"*
>
> **C11: "***Yah, it could be Scrum as well because-"*
>
> **C12:** *"Yah"*
>
> **C13: "***Yah, he's right"*
>
> **C11: "***It could be Scrum as well because we do get together in two weeks and talk about the project and we decide this is what we are gonna do and then we go on from there. Yah, Scrum or Dynamic, probably Dynamic. It's difficult because, yah"*
>
> **C12:** *Looking up from his IPad* *"Extreme programming sounds like the one we are using because we are not so strict on the theory of it. We do what is necessary to get the job done basically. So it sounds like XP to me".*

They could not agree on the ASDM that they are using.

One of the interviewees in Organization A was not sure about the benefits:

> **The author**: *"So what benefits have you experienced so far from agile systems development methodologies?"*
>
> **A11**: *"I can't say I have experienced any, because as I said we are sort of in the beginning phases of this..... Well actually you know, umm, I'm gonna change that statement...So I think the benefit that we have seen is ahh... results are going to the business quicker basically".*

The advantages and disadvantages that were derived across the departments in Organization A

were very different from each other even though they are in the same organization. Each had their own unique commendations and grievances about ASDMs. What they agreed on as an organization is that culture plays a big role in the adoption of ASDMs and how fast it can be carried out. A unified agile mindset is needed for success and progress. Across the organizations, the advantages were more similar than the disadvantages. Organization A highlighted the disadvantage of the complexity of their organization impeding the easier adoption of ASDMs. Organization B pointed out that lack of detailed analysis and design in ASDMs made them use the waterfall in those phases. Organizations A and C agreed that project scope creep could be a problem if requirements are not finalized and they are constantly changing.

Organizations A and B had different opinions on one of the ASDM disadvantages. Organization A stated that there was too much thinking required in their implementation:

> **A11**: *"I think the thing about agile is that you have to think about things. The waterfall, you don't have to think about anything, these are the rules you follow, these are the documents you deliver and that's it".*

While Organization B stated:

> **B11: "***I don't know if you know the term "cowboy". So you would just jump into it and start coding. Sometimes there is not enough thought put into it. So you would have to do a rework later on".*

The expectations across the organizations interviewed were better and faster delivery of products to the clients and more adaptability where everyone had a unified mindset.

In the propositions, the concepts that were mentioned in passing but were important were added as part of the final revised propositions because they are important and it does not necessarily mean that they do not happen in other organizations. For instance, Organization A had recently been sent for training and was new to the use of ASDMs, thus they were constantly referring to it. Organization B, on the other hand, has been using ASDMs for a long time, which means that the culture has changed and they have an agile mindset, therefore training was not mentioned at all.

The criteria they use to choose SDMs and ASDMs, and to make them contingent are slightly different across the organizations. They have some common aspects, such as the executive influence, size and needs. Dependencies on other project's' timelines, project manager style and culture were different categories used by Organizations A and B to choose and make ASDMs contingent. Organization C, on the other hand, uses the project type to make such decisions.

> **The author**:...*"Does the type of project determine how you are going to choose the methodology?"*
>
> **C12: "***Yes, basically*" *They all agree*
>
> **C11: "***That's almost like we don't fit the project to a specific methodology, it's almost as if the project's needs determines what we gonna do"*.

The organizations interviewed all make ASDMs contingent and the way in which they do it is similar to each other, as they use the methods in them that are useful for them. They do not document these changes in detail if the changes are not significant. They also have offices, such as the Project Management office and the Central help-desk that monitor and manage the deployment of ASDMs and any changes made to them. The majority of their projects have used contingent ASDMs. They have been successful and they will continue to make them contingent.

Chapter Summary

Case studies were conducted on three organizations that use ASDMs in South Africa. To collect information, focus groups and interviews were used. The organizations interviewed were discussed, their overviews, the SDMs they make use of, their contingency approaches and their thoughts on ASDM use. Individual propositions for each company concluded the section on the organizations. The data collected was used to derive propositions that applied across all the organizations, highlighting their similarities and differences by using cross-case analysis.

The final propositions formed at the end of the chapter will be used in the next and final chapter to determine whether the purpose of the research was achieved. Conclusions, limitations, future work and other aspects will be discussed next.

CHAPTER FIVE

RESEARCH CONCLUSION AND FUTURE WORK

5.0   Introduction

In this chapter, concluding discussions will be carried out to officially find out if the research questions brought forward in the Chapter 1 were answered. The contributing literature will be shown and discussed, as well as the future work, at the end of the chapter.

5.1   Research Results

The results that were derived after conducting the research are discussed in this section. The main aim of the research study was to investigate the contingent use of ASDMs in South Africa. To help to investigate this, research aims and objectives were proposed that would serve as a guideline. Three case studies were done on some organizations in South Africa that make use of ASDMs. No conclusive results for all or even most companies can be concluded as much more data would be required. However, the case studies do show some trends, which could be universally true and indicative of what could be happening in the environments in which the organizations are found.

The propositions will now be put under the research aims and objectives that they apply to, to show that the research problem was solved. After each research aim and objective, a discussion of the results will follow as well the supporting propositions.

- *The current use of ASDMs in South Africa by three companies*

    It was found that some organizations have an in-house methodology that they use for their projects. This in-house SDM is usually based on the traditional Waterfall SDM. The Waterfall methodology is predominantly being used in some organizations in South Africa that were interviewed. When some organizations adopt ASDMs for use for their projects, it is because of pressures that they face in their environments to deliver projects faster, to reduce costs and to improve the success rate of projects. Businesses that are not mature and have uncertain requirements also add to this pressure.

When ASDMs are newly adopted in some organizations, employees are trained on their proper use to ensure their successful use for projects and the organization as a whole. In such organizations, employees are given options to either use their old SDM or the new one so that they can slowly learn how to work with the new one. And when they do start to use ASDMs, they first apply them to small projects. The more complex the organization is, the longer the level of adoption of ASDMs will take.

The commonly used ASDM in the South African organizations interviewed is Scrum because it is thought to be mature, well defined, and adaptable to rapidly changing requirements and it can co-exist with the Waterfall SDM. Some large corporations are also increasingly adopting ASDMs for their large projects as well, such as Organization A.

There are a number of aspects that are used to decide which SDM to use whether traditional or agile. Some organizations will look at the compatibility between the SDM and its methods, and the project. Other factors used to match SDMs to a project include the amount of documentation required by the client (more documentation-use waterfall, less documentation - agile) and executive influence. These findings are supported by the following propositions;

Proposition 1

ASDMs are used in some telecommunication, consultancy, technology, and agricultural organizations in South Africa because development is carried out faster and successfully with improved quality, communication and reporting, reduced costs and reduced time to market. They also fit some businesses, are ideal for volatile markets and are easy to implement.

Proposition 2

ASDMs are difficult to adopt and implement in some telecommunication, consultancy, technology, and agricultural organizations in South Africa because of culture, resistance to change, complexity of the company, too much effort required, an agile mindset

needed, confusing, uncertain users bringing in more problems, not enough thought given before going into development and the ability to increase the project scope.

Proposition 3

Some telecommunication, consultancy, technology, and agricultural organizations in South Africa have an in-house methodology that is based on the Waterfall SDM.

Proposition 4

The in-house methodology used in the telecommunication organization is being evolved into an agile SDM.

Proposition 5

The environments that some telecommunication, consulting, technology, outsourcing and agricultural organizations are in force them to adopt ASDMs.

Proposition 6

Before adopting ASDMs, employees are trained on their use in some telecommunication companies.

Proposition 7

Some telecommunication companies adopt ASDMs slowly to allow for the transition of the employees' mindsets and culture to the agile way of thinking.

Proposition 8

Some agricultural organizations in South Africa use ASDMs for businesses that are not mature and have uncertain user requirements.

Proposition 9

ASDMs are increasingly being adopted in South Africa even by some large consultancy, technology and outsourcing corporations.

Proposition 10

Scrum is the commonly used ASDM in some of the telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa.

Proposition 11

Some agricultural organizations in South Africa choose SDMs, traditional or agile, based on what they know and the projects' needs.

Proposition 12

Compatibility between the project and SDM, documentation required by the customer and the level of influence of the executives are some of the factors that determine what SDM will be used for a project in some telecommunication companies.

- *Do practitioners make ASDMs contingent and why, or why not?*
  Some telecommunications, consultancy, technology, outsourcing and agricultural organizations in South Africa do not use SDMs, traditional or agile, according to the way in which they are portrayed in educational publications. They are made contingent. This is because they want to make sure that the SDM chosen suits the project's needs. If the SDM suits the project, the chances of it succeeding are very high. The way an SDM is made contingent is different for every project. The proposition below is used to support these findings;
  Proposition 14

Some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa do not use SDMs and ASDMs to the letter, they make them contingent to suit their project needs.

- *How do they make ASDMs contingent? Adding, omitting or ignoring some aspects and why?*
  The interviewed organizations in South Africa apply criteria for making ASDMs contingent. Factors, such as project requirements, needs, outcomes, type, size, scope, project manager style, culture, environment, complexity, influence of the client and dependencies on other project's timelines apply to the criteria. All these factors are

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relevant, as different unique projects are all run in different ways. These criteria are used to ensure project success.

Some organizations can also use ASDMs in large projects if Scrum and the Waterfall SDM are combined. The Waterfall SDM would be used for analysis and design, and Scrum for delivering releases quickly.

The way in which some interviewed organizations make ASDMs contingent is to use aspects in methods that are applicable for their projects. For instance, some organizations use Kanban to make the work to be done visual, the Waterfall SDM to have a better understanding of the requirements by the use of its analysis and design, Scrum for communicating with each other and XP to conduct the sprint sessions for quick releases to the client. The way these methods are combined, once again, is unique to each project in order to make them successful. If ASDMs are used on their own, they are used for small projects that have small work items that have to be delivered in less than a month.

The contingency approach used by the three interviewed organizations is similar to Zhu's (2002) contingency on the onset and situational method engineering (Asadi and Ramsin, 2009; Henderson-Sellers, 2006; Burns and Deek, 2010). Organization C, in particular, uses blending to form a hybrid of methodologies that is useful for their purposes. Organization A, on the other hand, is currently selecting from a group of ASDM methods the one they want to use but since they are in the process of creating an agile SVC, they will have a standard SDM that will be adaptable to different projects. Organization B uses a hybrid of the Waterfall SDM and Scrum with selection depending on the situation. Therefore, it is safe to say tailoring is the method used to make ASDMs contingent in some South African organizations.

The amount of changes made to a SDM to make it contingent depends on the project. For an organization that has newly adopted ASDMs, such as Organization A, the changes are not significant. For those that have adopted them for some time, the changes are dependent on the projects. For smaller projects, few changes are done. For large projects, more evolution is needed; therefore more additions and subtractions are carried out.

Some organizations do not document the procedure that they use to make ASDMs contingent during systems development. They regard ASDMs as guidelines that provide direction to their efforts, thus no documentation is necessary. Organization B does not document the procedure because the process for them has evolved to a point where it has become culture and they have adapted to the agile mindset.

The Project Management Office (PMO) is used to monitor project's and ASDM quality and success, and the proper use of an ASDM in some organizations. They enforce consistency and listen to feedback from the systems development team. Central help desks are also used to monitor and document any changes that occur in a project. Academic theory is useful for practitioners who want to use it as a reference guide in order not to stray too far from the fundamentals of an ASDM during its contingency. This is similar to the findings by Conboy and Fitzgerald (2010). Practitioners monitor themselves and the contingency changes that they make by making notes, using daily scrums, weekly and annual meetings to compare what they did, what they did not do and what still needs to be done.

In light of the discussion above, it is safe to conclude that some South African organizations also make all SDMs contingent, including ASDMs, which are supposed to be flexible already in line with Burns and Deek's (2010) and Meso and Jain's (2006) research.

The following propositions support the findings;-
Proposition 13

The criterion for contingency of a SDM depends on the project's size, needs, outcomes, project manager, culture, environment and the influence of the client. This criterion also determines the SDM to use, whether traditional or agile, in some consultancy, technology and outsourcing organizations.

Proposition 15

ASDMs can also be used for large projects if they are used in conjunction with the Waterfall SDM in some consultancy, technology and outsourcing organizations.

Proposition 16

The criteria for making ASDMs contingent depends on an individual project's size, scope, complexity and dependencies on other projects' timelines in some telecommunication companies.

Proposition 17

Some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa make ASDMs contingent by only using aspects in them that are useful for their projects.

Proposition 18

The number of changes to make an SDM contingent depends on the project requirements in some consultancy, technology, outsourcing and agricultural organizations.

Proposition 19

Some telecommunication, consultancy, technology and outsourcing organizations in South Africa do not document the procedure used to make ASDMs contingent if they are not major.

Proposition 20

Some telecommunication, consultancy, technology and outsourcing companies in South Africa make use of a Project Management Office (PMO), notes, academic theory, themselves and retrospection to monitor project quality and how successful a SDM is in an organization, and to control the procedure used to make ASDMs contingent.

Proposition 21

Some agricultural organizations have a central help-desk that monitors changes and documents them.

- *How successful are ASDMs that have been made contingent?*

Contingent ASDMs have been successful for some interviewed organizations in South Africa. In some organizations, the majority of their projects have used contingent ASDMs and they have all been successful. The percentage of projects that have used contingent ASDMs ranges from 75% and above. The fact that the projects have been successful is the reason why SDMs will continue to be made contingent. The following propositions support this finding;

Proposition 22

The majority of projects in some consultancy, technology, outsourcing and agricultural organizations in South Africa make use of contingent ASDMs and they have been successful.

Proposition 23

Some telecommunication consultancy, technology, outsourcing and agricultural organizations in South Africa expect the ability to work faster, more adaptability, easier alignment with the business, a unified agile mindset, more ASDM adoption, faster delivery of orders, a continued combination of Scrum and the Waterfall SDM, movement towards the theoretical and formal ASDM, rapid development and growth through the use of opportunities from the future use of contingent ASDMs.

5.3   Research Contributions

The research study delivered several findings that could be added to the academic database. The results of the study revealed that the waterfall methodology is the traditional SDM used across the organizations interviewed and that Scrum, is the most used ASDM. It is important to know that a SDM has to be matched with a project before it can be used. The criteria for choosing a SDM, whether traditional or agile, is

- compatibility between the project and SDM chosen
- the amount of documentation required by the client (more documentation - use waterfall, less documentation - agile)
- project needs
- project type
- what the organization knows and is familiar with.

It was found that ASDMs are also made contingent by practitioners. In fact, all types of ASDMs are made contingent to suit projects and to increase their chances of succeeding. The criteria used to make ASDMs contingent include;-

- project requirements
- needs
- outcomes
- type
- size
- scope
- project manager style
- culture
- environment
- complexity
- influence of the client
- dependencies on other project's' timelines.

It was discovered that some South African telecommunication, consultancy, technology, outsourcing and agricultural organizations make ASDMs contingent by using aspects in methods that are applicable to their projects based on the contingency criteria above that would suit them and make them successful. It was also found that contingent ASDMs have been successful for some telecommunication, consultancy, technology, outsourcing and agricultural organizations in South Africa.

The contributions in short are as follows;

- The identification of the most used traditional SDM by some South African organizations
- The identification of the most used ASDM in some South African organizations
- The identification of reasons why some organizations in South Africa use and adopt ASDMs
- The discovery that ASDMs are made contingent to suit project needs by some South African companies and why
- The criteria used for making ASDMs contingent by some South African companies
- The way that ASDMs are made contingent by some South African companies
- The way that contingency of ASDMs is monitored, managed, controlled and documented in some South African companies
- The discovery that contingent ASDMs can be used for some large projects in South African organizations
- The discovery that contingent ASDMs have been successful in some South African organizations

5.4   Future Work

Full and detailed documentation needs to be collected on the contingency done on ASDMs in more South African organizations. This could be very useful in order to draw precise and specific conclusions. The research therefore has opened doors to other master's' degree research to explore this research topic further, especially using positivistic research. In addition, Organization A that had newly adopted ASDMs, may, in a year or two, have developed a contingency approach and that would be interesting to observe. The contingency approach they are working on will be based on their current SDM but with added agility. More case studies could be used and the propositions could also be tested in other organizations in South Africa in the future.

Chapter Summary

This was the final chapter in the research study and it presented the concluding findings from the case studies carried out on three organizations from different environments. How the research

questions were answered and the problem solved was shown by the propositions at the beginning of this chapter. The contributions made to the academic database were also shown as well what needs to be done in the future. The results indicated that there are numerous informal and varying ways in which ASDMs are made contingent in some South African organizations but whatever is done in that process is for the success of the project and the organization.

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Appendix A – Organization B's Contingency Approach

This is the original and traditional Scrum Process utilized by Organization B

Tailored – SCRUM / Waterfall SDLC

The tailored SCRUM / Waterfall SDLC below uses the over arching theme of Waterfall but uses the iterative method of SCRUM in each of the Waterfall SDLC stages.

PRINCE 2 Project Management Methodology supports the product based delivery which is the underpinning theory of this combined SCRUM / Waterfall SDLC approach.

Traditional Waterfall SDLC		
SCRUM Round #1	SCRUM Round #2	SCRUM Round #3

SCRUM iterations for various pieces of functionality will be run independently (e.g. Trading, Allocations, Settlement)

Analysis
- Product Backlog
- Daily Stand-ups
- Burn Chart
- Sprint Retrospective

Design
- Product Backlog
- Daily Stand-ups
- Burn Chart
- Sprint Retrospective

Build
- Product Backlog
- Daily Stand-ups
- Burn Chart
- Sprint Retrospective

Test
- Product Backlog
- Daily Stand-ups
- Burn Chart
- Sprint Retrospective

Deploy
- Daily Stand-ups

The reason for this approach is that Waterfall is required when driving large complex projects, however SCRUM ensures consistent and iterative delivery of project deliverables (i.e. products) preventing the typical situation in Waterfall SLDC stages where work gets left to the last minute and delivery dates are missed, and risks and issues are never raised. SCRUM drives transparency and the quick resolution of "roadblocks".

The contingent approach to ASDMs used by Organization B is shown above and it can be seen that the SDLC phases have been added to suit their project.

Appendix B – ATLAS.ti Coding

Before the qualitative data analysis can occur, ATLAS.ti recommends the coding of the textual or audio data. Coding is essential to attach meaning to the data. They are handles that group related information. They are short pieces of data that reference other related information for the purpose of comparisons (ATLAS.ti.com, 2012). In the transcript below, the codes are shown on the left-hand side. If a section had ASDM problems, it was highlighted and a meaning (code), was attached to it.

After the coding had been done, the analysis process started, based on the codes or the text, depending on the information needed to be derived. The tools for qualitative data analysis as provided by ATLAS.ti include the use of the word cruncher, query tool, co-occurrence tools, super codes, super families, network function and the hypertext tool. Only those that were useful for the analysis, the network diagram and query tool, were used. In the diagram below the code "ASDM Problems" was used to attach meaning to a quotation or text.

Appendix C – ATLAS.ti Network Diagram

The network view function is a diagram or network that helps with the exploration of data and visualisation of ideas and findings. The networks are made up of codes and they are used for the purpose of "enhancing the retrieval of quotations". A network is defined as a set of nodes and links while a node is linked to other nodes. A link connects different nodes. Nodes can be codes (ATLAS.ti.com, 2012). One theory formed from the network diagram below is that contingent ASDMs have been successful for the South African organizations interviewed.
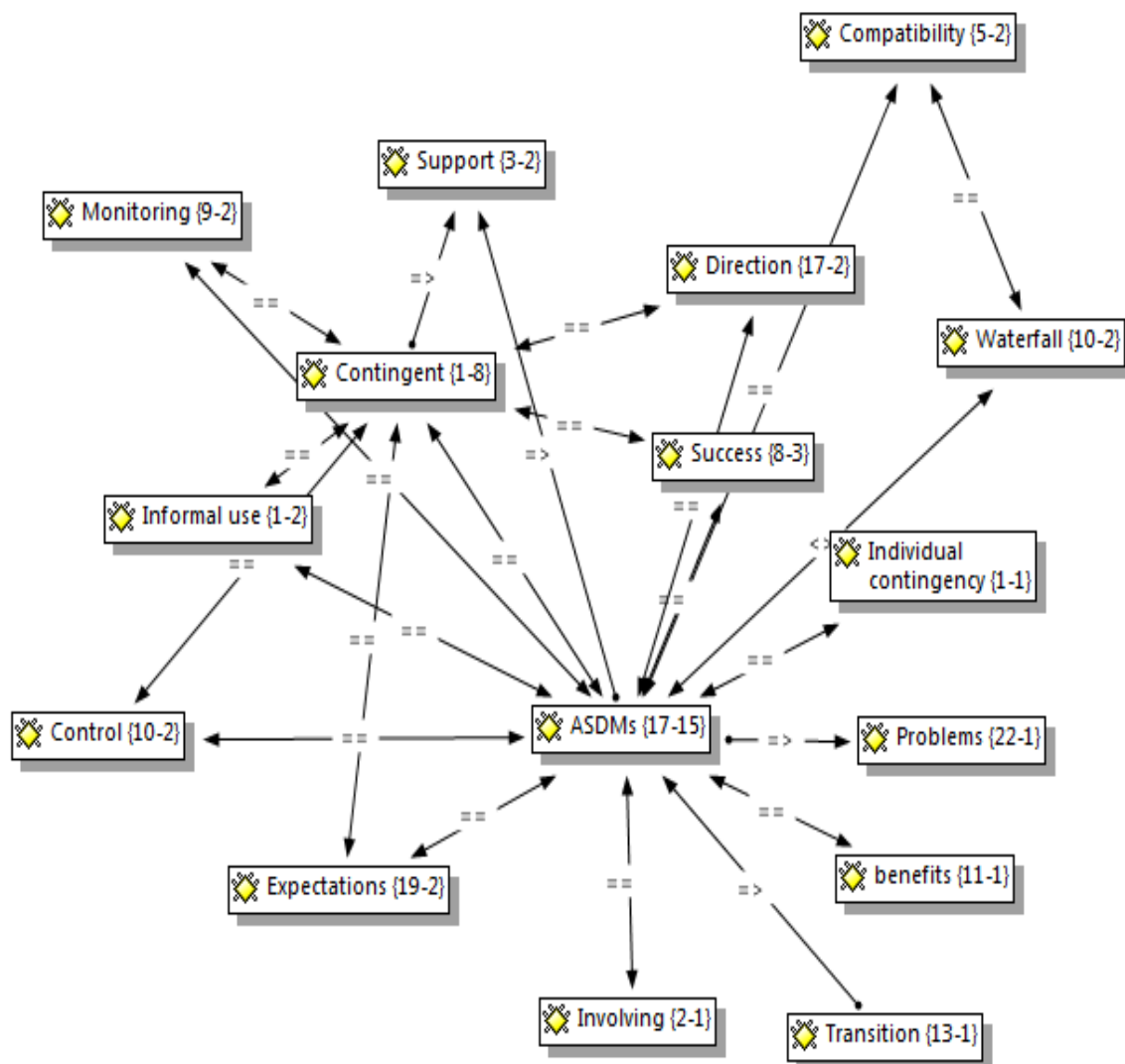
Appendix D – ATLAS.ti Query Tool

During analysis, when using the ATLAS.ti tool, the author would, for instance, choose codes on the right such as "ASDM" and "benefits" and use the operator "OR" to combine all the text that is contained there across the entire interview data collected to derive all the benefits that had been experienced by the three South Africa companies.

The query tool would then create a report that was used to form theories from the data derived, as can be seen below.
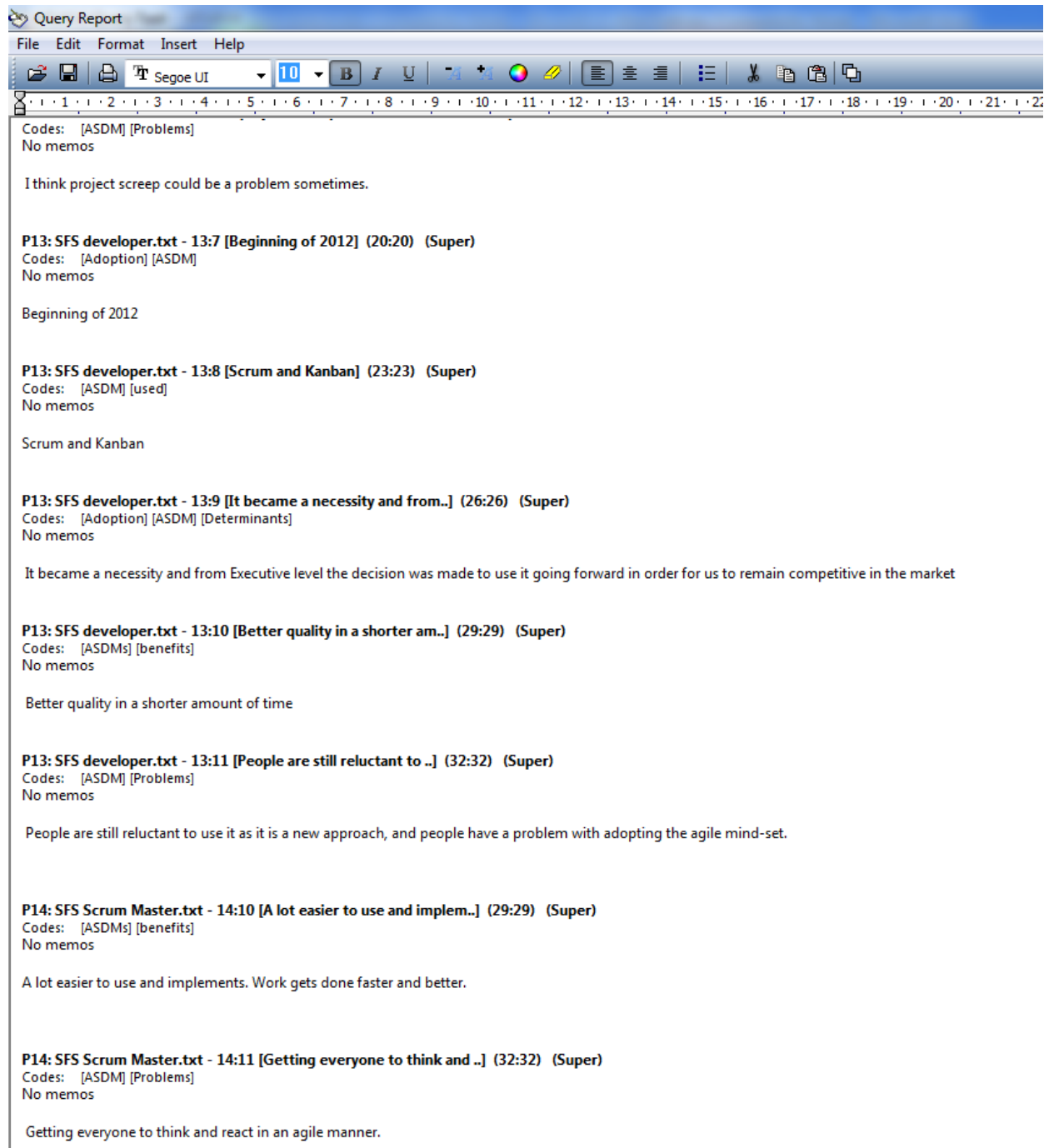
Appendix E – Organization C's In-house Methodology phases

As can be seen in the extract below from Microsoft project on Organization C's methodology, it is similar to the traditional waterfall SDM.

2		⊞ Subproject: Scope / Blueprint	4 days	Wed 09/19/12	Mon 09/24/12	
8		⊞ Subproject: Analysis/Software Requirements	14 days	Tue 09/25/12	Fri 10/12/12	
18		⊞ Subproject: Design	15 days	Mon 10/15/12	Fri 11/02/12	
26		⊞ Subproject: Development	22 days	Mon 11/05/12	Tue 12/04/12	
33		⊞ Subproject: Testing	24 days	Wed 12/05/12	Mon 01/07/13	
49		⊞ Subproject: Training	33 days	Wed 01/02/13	Fri 02/15/13	
58		⊞ Subproject: Documentation	15 days	Tue 01/08/13	Mon 01/28/13	33
68		⊞ Subproject: Pilot	9 days	Mon 02/18/13	Thu 02/28/13	49
75		⊞ Subproject: GO Live	6 days	Fri 03/01/13	Fri 03/08/13	
82		⊞ Subproject: Post Implementation Review	3 days	Mon 03/11/13	Wed 03/13/13	