



NORTH-WEST UNIVERSITY
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**AN INTERPRETIVE ANALYSIS OF
SYSTEMS DEVELOPMENT
METHODOLOGY ADAPTATION IN
SOUTH AFRICA**

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BSc in IT, Hons BSc

**Dissertation submitted in partial fulfillment of
the requirements for the degree Magister
Scientiae at the Potchefstroom Campus of the
North-West University**

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November 2006

ACKNOWLEDGEMENTS

Love, support and friendship! These are three of the most important factors any human need in his or her life. While writing this dissertation, I have realized in an indescribable way how important friends and family are in life. Without love – you are nothing. Without support – you will keep falling. Without friendship – well, life just wouldn't be the same!

Due to the contribution of many people, this dissertation has been successfully completed. Their love, support and friendship have made this dissertation possible. My sincerest thanks and gratefulness go to all of them.

A special word of thanks to the following people:

-  Most importantly, I would like to thank God for blessing me with the strength and talent to complete this dissertation. For always showing me His mercy, when life seems to be getting difficult.
-  My parents, Dries and Lynette Pieterse, for all their patience, love and encouragement during the writing of this dissertation. Thank you for believing in me and thank you for sharing my dreams with me. Your love is immeasurable!
-  My friends - for all their little surprises and smiles on a day that seemed to be dark. Thank you for giving that day a silver lining.
-  My supervisor, Prof H M Huisman, for her friendship, guidance, comments, encouragement and support. Thank you for always being there for me. Thank you for believing in me. Thank you for making this dissertation a reality.
-  My colleagues, Amanda Lourens, Estelle le Roux, Zita Prinsloo and Hannekie Botha – thank you for the support you gave me. Thank you for all the help, the jokes, motivation and smiles! Thank you for helping me to build my dream!

-  Anriëtte Pretorius. Thank you for the support and guidance. Thank you for always being friendly, patient and willing to help. Thank you for all the effort in providing the necessary research material.
-  Mrs Cecilia van der Walt and Ms Hannekie Botha. Thank you for taking care of all the grammatical and language concerns. Thank you for being prepared to walk the extra mile with me when time caught up with us!
-  Susan Barnard, for her friendliness, support and guidance. Thank you for the accommodation she has provided during the conduction of one of the case studies.
-  Dr Richard Weeks, thank you for believing in this dissertation. Thank you for making the case study at Company A possible.
-  Francina Botha and Deon Ludick. Thank you for making the case study at Company B possible.
-  Dr Maarten Venter. Thank you for making the case study at Company C possible.
-  Thank you to all the Interviewees at Company A, Company B and Company C for their time and patience while I was performing the case studies. Thank you for all your knowledge and experiences that you have shared.
-  A special thanks to all the unknown reviewers of this dissertation. Thank you for taking the time to review this dissertation.
-  The financial assistance of the National Research Foundation (NRF) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the NRF.

ABSTRACT

AN INTERPRETIVE ANALYSIS OF SYSTEMS DEVELOPMENT METHODOLOGY ADAPTATION IN SOUTH AFRICA

According to recent surveys on the use of systems development methodologies, many organizations claim that they are adapting systems development methodologies (Hardy *et al.* 1995; Russo *et al.* 1996; Fitzgerald, 1998). The purpose of this dissertation is to investigate the adaptation of systems development methodologies in South Africa. This problem was investigated by addressing the following research questions:

- ❏ What are the perceptions of system developers regarding systems development methodologies?
- ❏ Why do system developers adapt system development methodologies?
- ❏ How do they adapt the methodologies?
- ❏ Is there a difference in the quality of the systems which are developed with these adapted systems development methodologies opposed to those systems which are developed according to a specific formalized methodology?

In this dissertation, interpretive case studies have been used to add to the researcher's knowledge concerning *how* and *why* systems development methodologies in South Africa are adapted. Qualitative interviewing was used as a data collection method. All interviews were recorded and transcribed. The next step was to analyze the transcribed data. In this study, content analysis with cross-case analysis was used. The findings obtained were confirmed by making use of triangulation and member checking.

The results indicated that although the use of systems development methodologies is mandatory in organizations, it is not enforced by senior employees. Organizations use multiple systems development methodologies. Systems development methodologies are adapted due to several reasons, i.e. financial gains that is obtained, the lack of knowledge, time limitations, the fact that methodologies are not universally applicable, etc. Systems development methodologies are statically and dynamically adapted by adding and removing steps. The combination of methodologies and switching between methodologies also occur. The results indicate that developers realize that formal systems development methodologies produce systems of a higher quality. However, because it is so time-consuming, they are prepared to accept a lower quality system in order to gain a faster delivery time.

KEYWORDS:

Adapt, Adaptation, Case Study, Constant-Comparison, Methodologies, Qualitative Research, SDM, South Africa, System Development Methodology, Systems Development Methodology Adaptation

Uittreksel

'N INTERPRETIEWE ONTLEDING VAN STELSELONTWIKKELINGSMETODOLOGIE AANPASSING IN SUID-AFRIKA

Onlangse opnames oor die gebruik van stelselontwikkeling metodologieë het aan die lig gebring dat talle organisasies daarop aanspraak maak dat hulle stelselontwikkelingsmetodologieë aanpas (Hardy *et al.* 1995; Russo *et al.* 1996; Fitzgerald, 1998). Die doel van hierdie verhandeling is om die aanpassing van stelselontwikkelingmetodologieë in Suid-Afrika te ondersoek. Die volgende navorsingsvraagstukke is hanteer:

-  Wat is die persepsies van stelselontwikkelaars ten opsigte van die metodologie van stelselontwikkeling?
-  Hoekom pas stelselontwikkelaars metodologieë aan?
-  Hoe word die metodologieë aangepas?
-  Is daar 'n verskil tussen die kwaliteit van die stelsels wat ontwikkel word met 'n formele metodologie teenoor dié wat ontwikkel word met 'n aangepaste metodologie.

Interpretiewe gevallestudies is in hierdie verhandeling gebruik om die navorser te lei om te begryp hoe en waarom stelselontwikkeling metodologieë in Suid-Afrika aangepas word. Data-insameling is gedoen deur middel van kwalitatiewe onderhoude. Alle onderhoude is opgeneem en getranskriebeer waarna die data ontleed is. Inhoudsanalise is gedoen deur middel van die analise van vergelyking van gevalle. Die resultate wat verkry is, is bevestig deur middel van triangulasie en deelnemer-kontrole.

Die resultate het getoon dat, alhoewel stelselontwikkelingsmetodologieë verpligtend is in sommige organisasies, dit nie afgedwing word deur senior werknemers nie. Organisasies maak ook gebruik van verskeie metodes van stelselontwikkeling. Aanpassing van stelselontwikkelingsmetodologieë geskied om verskeie redes, byvoorbeeld finansiële gewin, gebrek aan kennis, tydsbeperkinge en die feit dat die metodes nie universeel van toepassing is nie. Stelselontwikkelingsmetodes word staties en dinamies aangepas deur die byvoeg of verwydering van stappe. 'n Kombinasie van metodes en wisseling tussen metodes kom ook voor. Die resultate het ook getoon dat ontwikkelaars besef dat 'n formele metodologie stelsels ontwikkel met 'n hoër kwaliteit. Alhoewel, omdat dit so tydrowend is, is hulle bereid om laer kwaliteit te handhaaf om sodoende 'n vinniger afleweringstyd te bereik.

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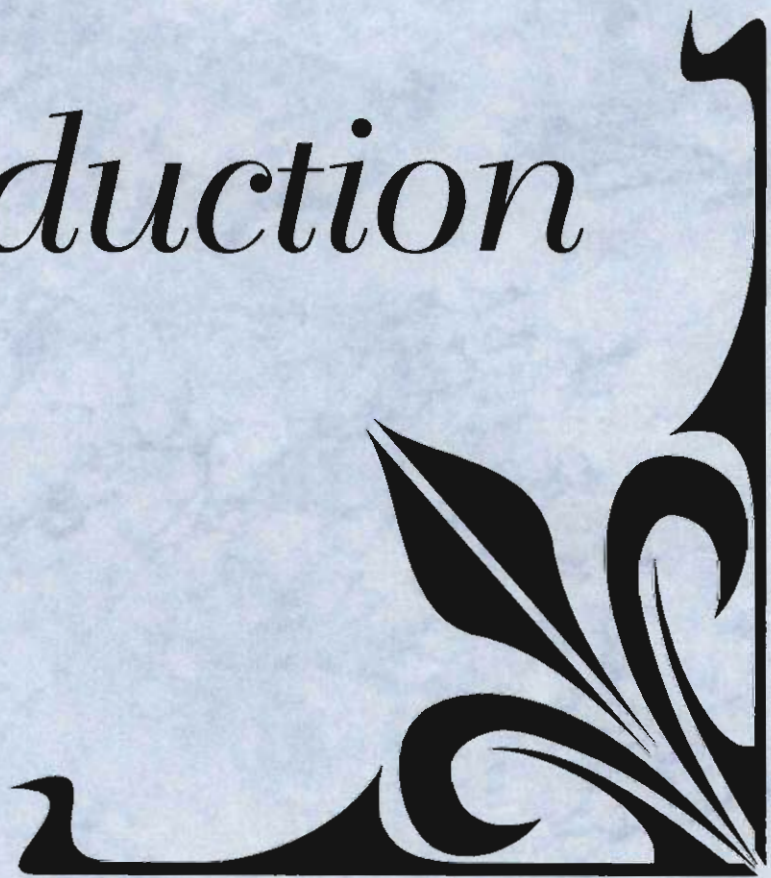
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Chapter 1

Introduction

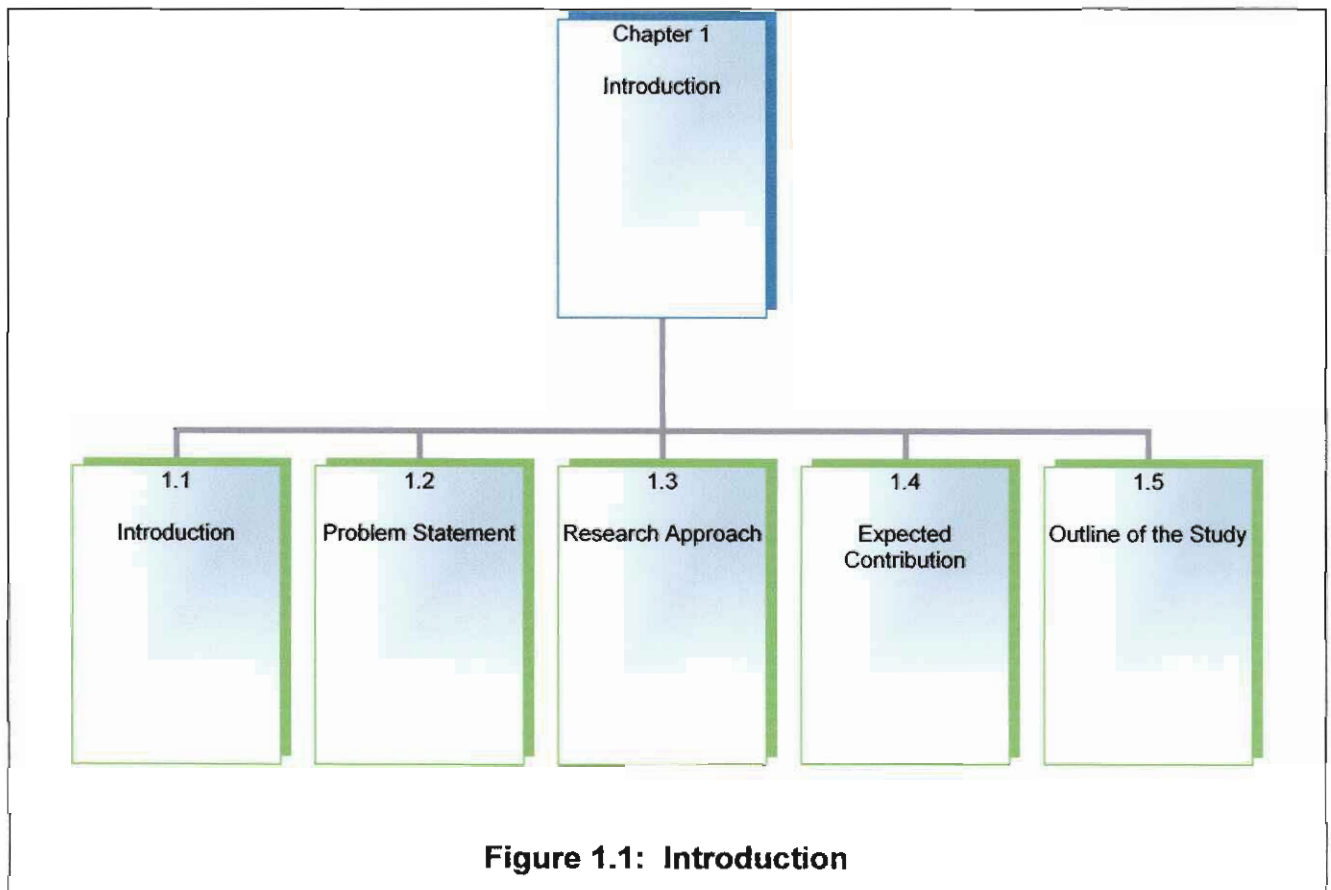


CHAPTER 1

INTRODUCTION

1.1 Introduction

The layout of this chapter is visually presented in Figure 1.1. After an introduction to the dissertation, the problem statement is explained. This will be followed by a brief discussion of the research approach followed in this study and the expected contribution of the study. The chapter ends with a description of the outline of the study.



According to Pegels (1995), it is extensively believed that the quality of the systems development process is important in the development of high quality information systems. Systems development methodologies are seen to be important in the efforts to improve the quality of the systems development process which will indirectly result in higher quality developed systems. Hardy *et al.* (1995) states there exists an extensive belief that the use of systems development methodologies is beneficial to an organization. To stay competitive, many organizations are under great pressure to use systems development methodologies. International standards, such as CMMI and ISO 9000 are being sought, which exacerbate these pressures (Fitzgerald *et al.*, 2002). Governments also enforce development standards, which increases the pressure on practitioners (Fitzgerald *et al.*, 2002).

According to Saeki (1998), it is generally assumed that systems development methodologies are used in practice. However, the realistic effectiveness of systems development methodologies is still an issue of disagreement, despite the pressure to use these methodologies (Introna & Whitley, 1997; Nandhakumar & Avison, 1999). Arguments and pressures in favour of and against the use of methodologies exist (Fitzgerald, 1998). The awareness of the limitations of the methodologies influences the decision to use methodologies and the way they are being used. While many organizations claim that they do not use any systems development methodologies (Hardy *et al.*, 1995; Chatzoglou & Macaulay, 1996; Fitzgerald, 1998), others are using it with positive results (Chatzoglou & Macaulay, 1996; Rahim *et al.*, 1998). Many organizations develop their own systems development methodologies in-house, instead of using commercially available products, while other organizations are adapting the existing systems development methodologies (Rowlands, 2006). Apart from this, we do not know how effective these adapted methodologies are compared to methodologies which are strictly adhered to.

Systems development methodologies are designed to be internally accurate and consistent. Methodologies rely on a certain minimum set of procedures that should be followed. One of the major strengths of systems development methodologies is its exact internal consistency and structure. The inevitability for systems development methodologies to be used strictly and entirely in order to obtain the advantages normally associated with the use of a methodology, such as improvements in the quality of

developed systems and the development process (Avison & Fitzgerald, 1995), is an arguable topic (Humphrey *et al.*, 1991; Vessey & Conger, 1994; Wynekoop & Russo, 1997).

Huisman and livari (2003) noted that methodologies are adapted in the majority of software developing companies in South Africa. However, it is not known how such decisions are made or how such adaptation is done, how frequently it is done, whether there are any controls over the changes, and how well the adapted methodologies work (Russo *et al.*; 1995).

The focus of this research will be on the adaptation of systems development methodologies in three organisations in South Africa. According to recent surveys on the use of systems development methodologies, many organizations claim that they are adapting systems development methodologies (Hardy *et al.* 1995; Russo *et al.* 1996; Fitzgerald, 1998). The existence of a systems development methodology in an organization does not guarantee that it is used in all the projects, or that it is strictly followed. To fit the needs of the projects, organizations choose to adapt the systems development methodology, or to use only specific aspects of the methodology (Huisman & livari, 2003; Van de Velde, 1992; Dietrich *et al.*, 1997; Hughes, 1998). Possible reasons for the adaptation of systems development methodologies are as follows:

- ❑ To adapt a methodology may be cheaper than developing a new methodology in-house (Russo *et al.*, 1995).
- ❑ Methodologies must be continually refined to meet changing needs of the situation (Russo *et al.*, 1995; Fitzgerald, 1998). Many traditional methodologies are insufficient for the development of e-commerce systems. (Standing, 2002)
- ❑ Formalized methodologies are not appropriate for every development project. (Russo *et al.*, 1995). Methodologies must be adapted at the project level to select the appropriate components of the methodology to be used for a particular project, and the correct degree of complexity with which to employ them (Crinnion, 1991).

For example, developers tend to adapt a methodology or to not follow it strictly when the project seems to be straightforward and uncomplicated (Fitzgerald, 1998).

-  A methodology does not always fit the needs of the organization. Thus they adapt the methodology to adjust to their needs (Fitzgerald *et al.*, 2002). Methodologies must be adapted at organizational level to suit the culture and applications portfolio of the company (Crinnion, 1991). For example, a methodology is hardly ever followed rigorously when the client is non-governmental (Fitzgerald, 1998).
-  Developers have different view-points and/or philosophies (Longworth, 1985). Some developers may feel that following a methodology rigorously, will prevent them from deriving new ideas and being creative. (Parnas & Clements, 1986; Standing, 2002)
-  There is a lack of understanding of the Information systems development methodologies (Rowlands, 2006).

Methodologies are adapted by adding or removing certain techniques, procedures, tasks, etc. Instead of adapting methodologies, organizations may decide to use different methodologies on different projects. Sometimes more than one methodology is combined when developing a system (Fitzgerald, 1997; Parnas & Clements, 1986; Longworth, 1985; Kunsch *et al.*, 2001; Bustard *et al.*, 2000). Some companies use a different methodology for every different development phase.

1.2 Problem Statement

The concern in this research lies in adapted system development methodologies in a more general sense. A methodology in this research is interpreted as entirety of systems development approaches, process models, methods and techniques used in an organization.

Systems development methodologies are developed in a very formal manner (Ter Hofstede & Van der Weide, 1992). The methodologies' developers expect that these methodologies are followed in a specific sequence and used in a specific way (Huisman, 2000). In order to adapt a systems development methodology and ensure that all the results are also accurate and consistent, specialized knowledge is required. Despite this, system developers in practice are changing these system development methodologies (Huisman & Iivari, 2003).

According to Wynekoop and Russo (1997), Fitzgerald (1997), Rowlands (2006) and Iivari and Maansaari (1998), organizations usually adapt a systems development methodology. While it is known that organizations adapt methodologies, it is not known how they adapt it and whether it is still reliable.

The purpose of the research is to investigate the adaptation of systems development methodologies in three organisations in South Africa. This problem will be investigated by addressing the following research questions:

-  What are the perceptions of system developers regarding systems development methodologies?
-  Why do system developers adapt system development methodologies?
-  How do they adapt the methodologies?

-  Is there a difference in the quality of the systems which are developed with these adapted systems development methodologies opposed to those systems which are developed according to a specific formalized methodology?

1.3 Research Approach

The research approach used in this study will be based on the following:

-  Research target: The research target will be systems development methodologies as a general technology, rather than specific methods and techniques. Much of the previous research into systems development methodologies has focused on the use of specific methods and techniques. The problem with previous studies is the fragmentation of research, due to the huge number of methods and techniques.
-  Research method: In this study a qualitative approach will be followed. Interpretive case studies will be performed at three organizations in South Africa. Semi-structured interviews and open-ended questionnaires will be used to collect the data. To analyze the data, content analysis will be performed using cross-case analysis.
-  Adopting units and stakeholder groups: At the organizational level, data will be collected from IT departments in 3 companies in South Africa. Within these organizations we will focus on the use and adaptation of systems development methodologies by individual developers.

1.4 Expected Contribution

This research is important to both the research community and to practitioners. In the research community, this study could contribute to our knowledge of the adaptation of systems development methodologies in practice. The following studies report on the adaptation of systems development methodologies:

-  The application model and the conceptual model of the HERA-methodology have been adapted in designing a Web Information System ([Frasincar et al. 2004](#)).
-  It was reported that the Object-oriented methodology had been adapted by Mathiassen ([Rose, 2002](#)).
-  The ETHICS methodology was adapted when an information technology support system was developed in an academic environment ([Adman & Warren, 2000](#)).
-  A software development methodology was tailored at Motorola ([Fitzgerald et al., 2003](#)).
-  A new methodology, named ACM, was developed by combining the system dynamics (SD) modelling framework with the group multi-criteria decision aid (GMCD) ([Kunsch et al., 2001](#)).
-  A framework was developed to allow practitioners to adapt off-the-shelf components and methodologies ([Bracciali et al., 2005](#)).
-  The Soft Systems Methodology (SSM) has been linked with Unified Modeling Language (UML) ([Bustard et al., 2000](#)).

A detailed literature survey has been done to indicate the need for knowledge on the subject of systems development methodology and systems development methodology adaptation. The search has been done by searching a database for all the publications containing the keyword(s) "systems development methodology". Once the results were found, "adaptation" was added to the keywords to search for publications containing "systems development methodology adaptation". Thereafter, a search was done on the keywords "methodology adaptation". These searches have been repeated, with different variances. The word "information" was added to the keywords, and adaptation was replaced with tailoring. These searches have been repeated on different databases. The results of the literature survey are summarized in Appendix A. It is noticed that the majority of publications was in 2005, followed by 2004 and 1998.

Studies that focus on the adaptation of systems development methodologies in South Africa are very limited. Two recent studies have been done by [Huisman \(2000\)](#) and [Kalanjee \(2006\)](#). The main focus of these studies was on the use and effectiveness of systems development methodologies, and adaptation of methodologies was not studied in depth. Clearly there is a need for further research in this area. With this study, we hope to increase our understanding of the adaptation of systems development methodologies in South Africa in particular. These results could also be valuable to the international community in general.

This knowledge is very important to all organizations in South Africa who are using systems development methodologies or who are planning to use systems development methodologies in future. Practitioners can evaluate the results to establish the quality of the systems developed by an adapted methodology opposed to those developed by a formalized methodology which has been strictly adhered to. Practitioners can make an informed decision to use a formalized methodology or to adapt an existing methodology.

1.5 Outline of the Study

The dissertation will be organized as follows:

Chapter 1 - Introduction

In this chapter, the research problem and the research question of the study are defined.

Chapter 2 –Systems Development Methodology Adaptation

The definition of a Systems Development Methodology is presented. A short overview of previous research into the use and effectiveness of Systems Development Methodologies will be discussed. The understanding of Information systems development methodologies and their role in information systems development will be clarified.

Chapter 3 – The Method-in-Action Framework

The method-in-action framework will be presented for investigating the complex nature of information systems development and the use of Information Systems Development methodologies in practice. The framework and each of its components will be briefly described in this chapter.

Chapter 4 – Research Method

Qualitative Research will be defined and the challenges that exist for Qualitative Research will be discussed. The strategy and design will also be discussed. The design and process of the case studies will be explained.

Chapter 5 - Results

The results obtained from the case studies will be evaluated and explained.

Chapter 6 – Summary and Final Conclusion

In this chapter, a discussion and interpretation of the results of the study will be given.

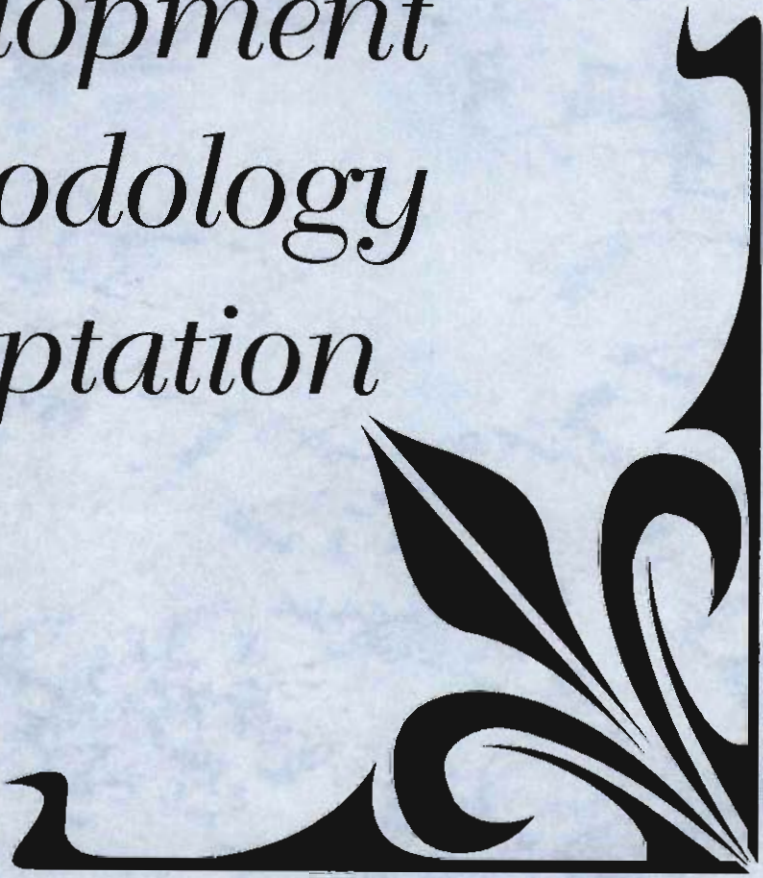
References

A detailed list of all the references used in this research will be presented.



Chapter 2

Systems Development Methodology Adaptation



CHAPTER 2

SYSTEMS DEVELOPMENT METHODOLOGY ADAPTATION

2.1 Introduction

The layout of this chapter is visually presented in Figure 2.1. This chapter begins with a discussion of systems development methodologies. First of all, a definition is established for a systems development methodology. Thereafter, a historical perspective of systems development methodology evolution and development will be discussed and the purpose of a systems development methodology will be explained. Arguments and pressures in favour of a systems development methodology are discussed, as well as arguments and pressures against systems development methodologies. Finally, classification frameworks of system development methodologies will be discussed.

The second section of this chapter consists of a discussion of systems development methodology adaptation and starts with an acknowledgement of other terms which have been used for systems development methodology adaptation, such as tailoring and customization. Possible reasons for systems development methodology adaptation are discussed. Thereafter, the way adaptation is done will be explained, and finally, cases of systems development methodology adaptation in practice will be briefly discussed.

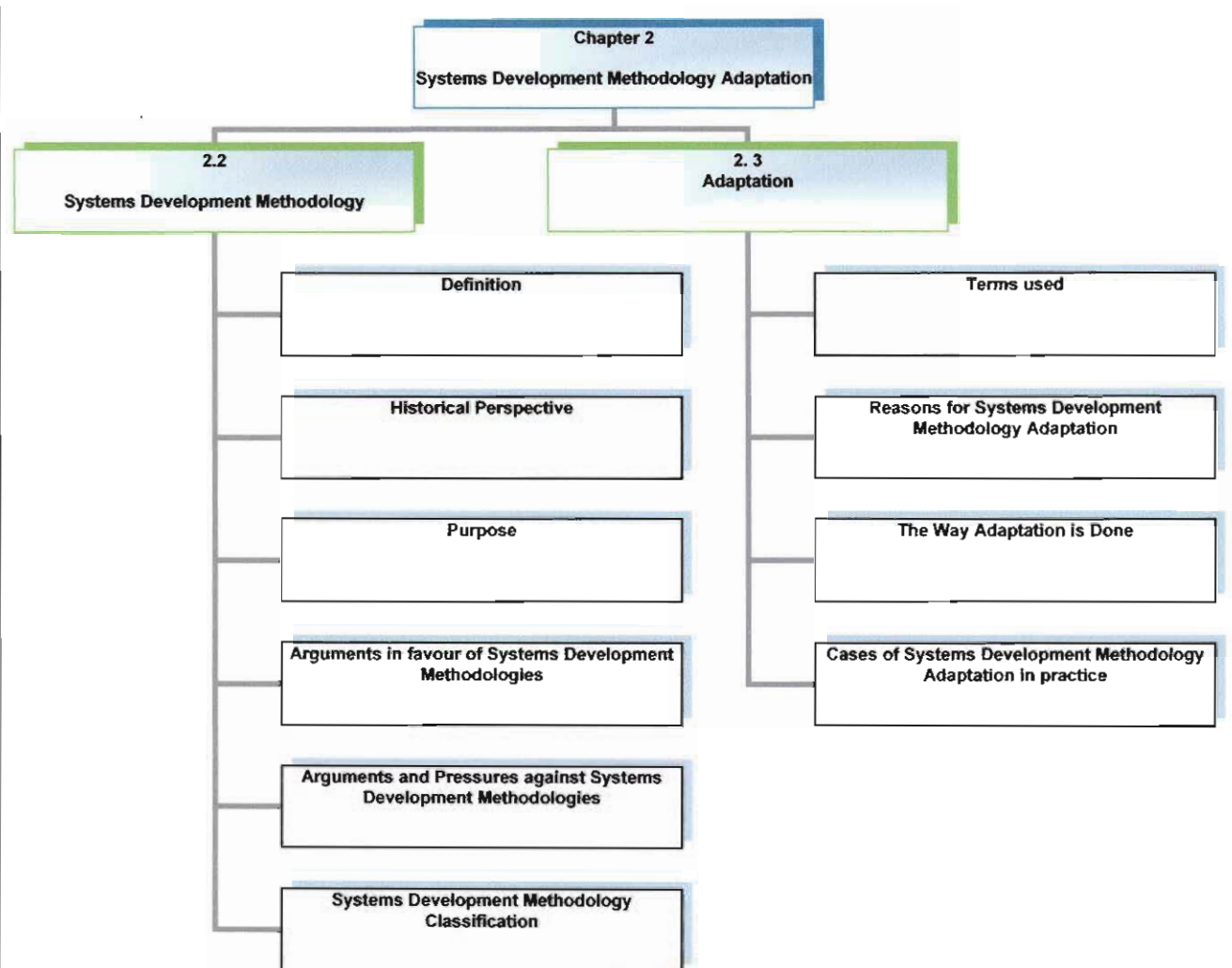


Figure 2.1: Systems Development Methodology Adaptation

2.2 Systems Development Methodology

The first part of this chapter will focus on systems development methodologies. In order to understand the adaptation of systems development methodologies, one has to have a clear understanding of systems development methodologies first.

The arguments in favour of systems development methodologies could lead to an understanding of why organisations do not adapt their systems development methodologies. Arguments and pressures against systems development methodologies could lead to possible reasons of why organisations are adapting their systems development methodologies.

Systems development methodology classifications could help one to understand why systems development methodology adaptation are more likely to be found in some organisations than in other.

2.2.1 Definition of a Systems Development Methodology

According to [Iivari et al. \(1999\)](#), almost just as many definitions exist for a systems development methodology as there are methodologies. Due to the estimation of more than 1000 methodologies ([Jayaratna, 1994](#)), the term “methodology jungle” originated. According to [Avison and Fitzgerald \(2006\)](#), this figure could be believed to be less than a 100; thus the term methodology jungle is no longer relevant. In this dissertation, the researcher will use the term “variety of methodologies” to indicate the huge number of existing methodologies.

Systems Development Methodologies is a subject which is widely studied by numerous researchers. According to [Avison and Fitzgerald \(2003\)](#), a methodology must result in the development of a better end product, a better development process and a standardized

process. According to Brodie *et al.* (1983), a methodology must be general, precise and comprehensive. According to Veryard (1985), a systems development methodology must be effective, efficient, reliable and accurate, stable, flexible, simple or easy to learn and use and acceptable to users, measurable, visible, universally applicable or comprehensive and the objectives must be well-defined.

When adopting a methodology in practice, there is great doubt as to what the methodology contains. According to Avison and Fitzgerald (2006), a methodology:

-  Can be anything from a detailed product to an unclear outline of the basic principles.
-  Can cover different areas of the development process.
-  Can cover conceptual or physical design or even both.
-  Can be anything between a methodology designed for specific application development or a methodology which is generally applicable.
-  May be valuable to any developer or only to trained and educated developers.
-  May require a team to handle all the tasks, or may not even have any tasks.
-  May or may not include tools and toolsets.

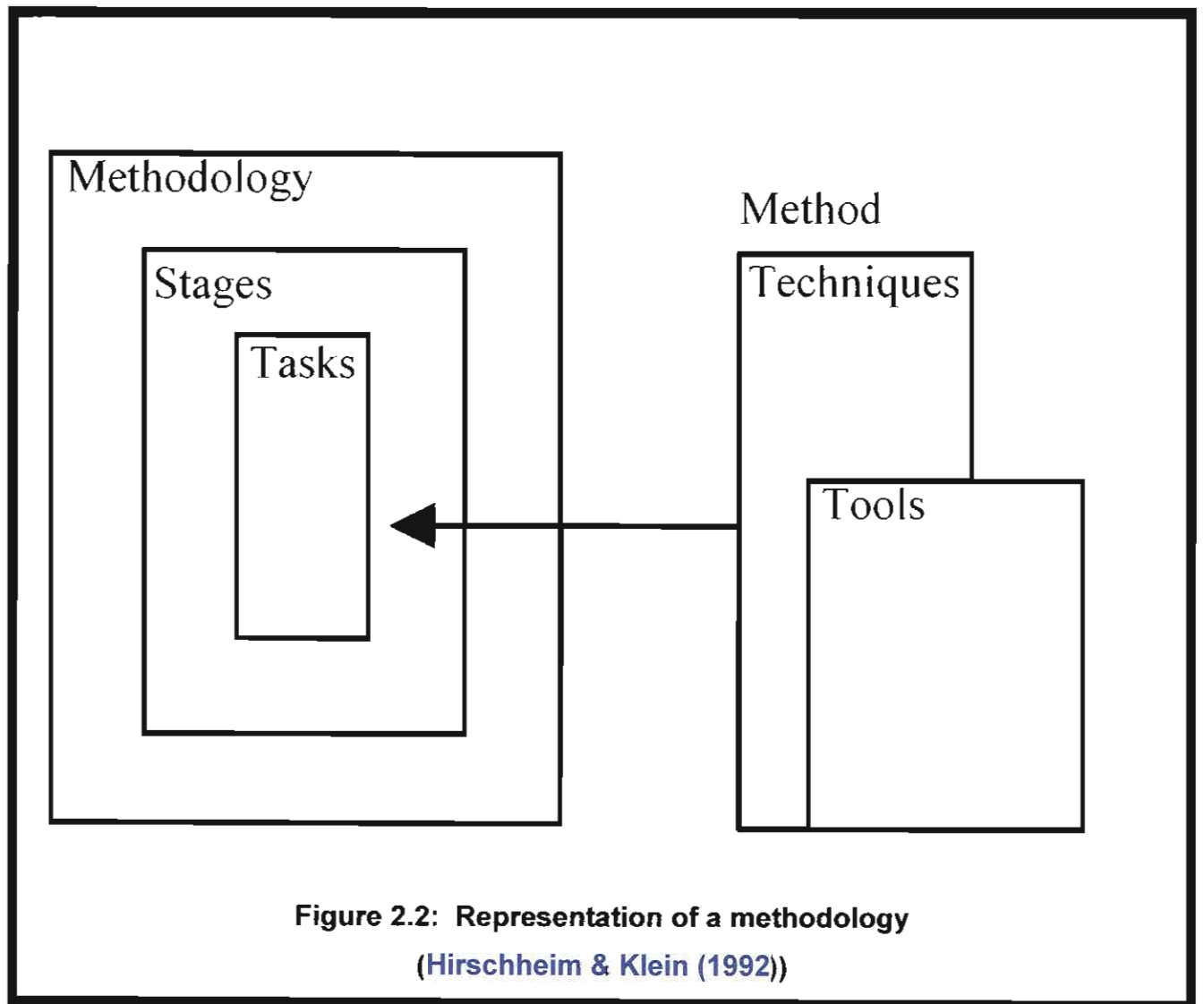
When trying to define a systems development methodology, one will notice that a debate in the literature is taking place concerning the term to be used – **method or methodology**.

According to Huisman (2000), some researchers argue that the term “methodology” is not applicable to information systems, because it has a literal meaning of a “science of methods”. Other researchers come with the counter-argument that the terms can be applied interchangeably. (Avison *et al.*, 1998) Another view which exists is that methodologies encompass methods or that methods encompass methodologies. In

contrast with these arguments, Connors (1992) states that the term “method” is hardly ever used in the literature.

When studying the literature, one will notice that the word “method” and the word “methodology” are regularly used as synonyms. However, many researchers have strived to make a clear distinction between these two terms. According to Oliga (1988), a differentiation between the terms “method” and “methodology” can have an important effect only where no ontological agreement is understood, with the end result that the validity of different modes of inquiry and problem-solving approaches (i.e. methods) needs to be evaluated against a set of higher-order criteria (i.e. methodology) which lie outside those methods.

Hirschheim and Klein (1992) are of opinion that there is an existing distinction between “method” and “methodology”. They define a “method” as *“a description of a specified technique in some symbolic language”*. They define a “methodology” as *“a comprehensive procedural framework directed towards accomplishing a particular change in the object system.”* These concepts are illustrated in Figure 2.2. Furthermore, Hirschheim and Klein (1992) make a clear differentiation between two aspects of a methodology: “process” and “framing”, where process refers to the tasks, tools and techniques used to achieve the procedural components of a methodology, and framing refers to how the object system is perceived, and the types of changes which take place.



However, researchers generally make a choice between the two terms. Below are two examples in which researchers defined and used the term systems development "methodology":

"An information Systems Development Methodology has been interpreted as an organizational collection of concepts, methods, beliefs, values, and normative principles supported by material resources" (Iivari et al., 2000:186).

"A systems development methodology is a recommended means to achieve the development, or part of the development, of information systems based on a set of rationales and an underlying philosophy that supports, justifies and makes coherent such a recommendation for a particular context. The recommended means usually includes the identification of phases, procedures, tasks, rules, techniques, guidelines, documentation and tools. They might also include recommendations concerning the management and organization of the approach and the identification and training of the participants" (Avison & Fitzgerald, 2006:568).

Although the term "methodology" is used by several researchers, some of them are using the term with much criticism against the term "methodology", because it actually means "study of method". Stamper (1988) is one of the researchers who uses the term "methodology" with disapproval:

"I use the term 'methodology' under protest, bowing only to customary usage. It would be better, as in the philosophy of science, to speak of 'methods' when referring to specific ways of approaching and solving problems, and to reserve 'methodology' for comparative and critical study of methods in general; otherwise this vital field of study is nameless"

Other researchers prefer the term systems development 'method', for example [Fitzgerald et al. \(2002\)](#) believes that the word "method" is more uncomplicated than methodology and defines an information systems development method as:

"A coherent and systematic approach based on a particular philosophy of systems development, which will guide developers on what steps to take, how these steps should be performed and why these steps are important in the development of an information system."

[Orr et al. \(1989\)](#) defines a "method" as a procedure or technique for performing some significant portion of the software life cycle, while [Palvia & Nosek \(1990\)](#) use the term method to describe three categories used for developing information systems: methodologies, techniques and tools.

In this dissertation the term "methodology" will be used. In accordance with [Avison and Fitzgerald \(2006\)](#), the researcher is of opinion that the term "methodology" has a deeper meaning than "method" and entails the philosophical approach, method, process and tools and techniques. This view is also expressed by [Ter Hofstede and van der Weide \(1992\)](#). They explain a methodology as a way of thinking (the philosophy behind the methodology and the basic assumptions and viewpoints of the methodology), a way of control (project management), a way of modelling (the models and model components used in the methodology), a way of working (strategies and procedures of how to arrive at specific models) and a way of support (tool support). This concept is illustrated in Figure 2.3.

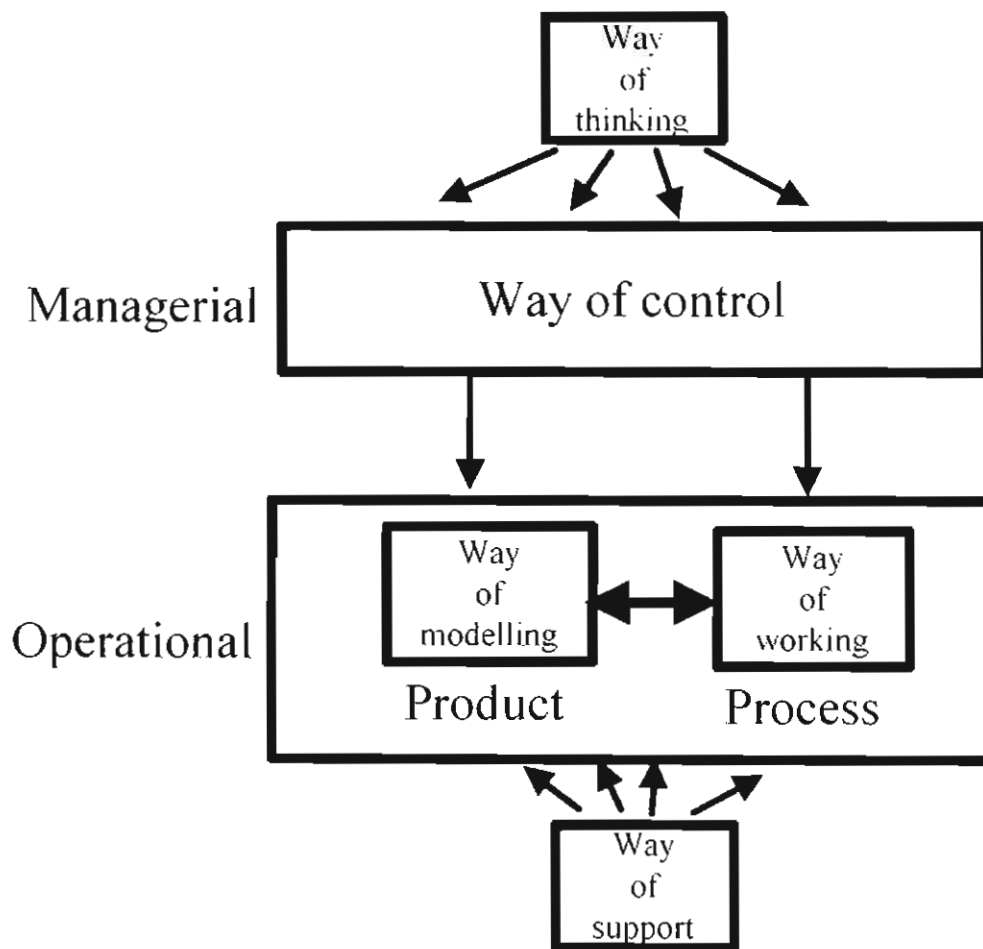


Figure 2.3: Explanation of a methodology
(Ter Hofstede & van der Weide, 1992)

A number of the definitions that exist for a systems development methodology are summarized in Table 2.1 displayed below.

Author(s)	Definition(s) of a Systems Development Methodology
Avison and Fitzgerald (2006:568)	“A systems development methodology is a recommended means to achieve the development, or part of the development, of information systems based on a set of rationales and an underlying philosophy that supports, justifies and makes coherent such a recommendation for a particular context. The recommended means usually includes the identification of phases, procedures, tasks, rules, techniques, guidelines, documentation and tools. They might also include recommendations concerning the management and organization of the approach and the identification and training of the participants.”
Riemenschneider <i>et al.</i> , (2002)	“A comprehensive guide to developing a system”
Whitten <i>et al.</i> , (2001:78)	“A systems development methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables, and automated tools for system developers and project managers to use to develop and maintain most of or all information systems and software.”
Iivari <i>et al.</i> , (2000:186)	“An information Systems Development Methodology has been interpreted as an organizational collection of concepts, methods, beliefs, values, and normative principles supported by material resources.”

Author(s)	Definition(s) of a Systems Development Methodology
Roberts <i>et al.</i> (1998)	"A Systems Development Methodology comprises an overall strategy for computer-based information system development that includes a flexible framework of the sequence of development tasks along with the techniques used to accomplish each task."
Wynekoop and Russo (1997)	"A methodology is a systematic approach to conducting at least one complete phase of system development, consisting of a set of guidelines, activities, techniques and tools, based on a particular philosophy of system development and the target system."
Brinkkemper (1996)	"The methodology of information systems development is the systematic description, explanation and evaluation of all aspects of methodical information systems development."
Jayaratna (1994)	"A methodology is an explicit way of structuring one's thinking and actions. Methodologies contain model(s) and reflect particular perspectives of "reality" based on a set of philosophical paradigms. A methodology should tell you "what" steps to take and "how" to perform those steps but most importantly the reasons "why" those steps should be taken, in that particular order."
Connors (1992)	"A methodology is how to navigate through each phase of the software process model and how to represent phase products."
Sakthivel (1992)	"A systems development methodology (SDM) is a collection of organized methods to develop computer based information systems."

Author(s)	Definition(s) of a Systems Development Methodology
Ter Hofstede and van der Weide (1992)	"A collection of procedures, techniques, tools and documentation aids which help the system developers in their efforts to implement a new information system."
Avison and Wood-Harper (1990)	"A methodology is a coherent collection of concepts, beliefs, values and principles supported by resources to help problem-solving groups to perceive, generate, assess and carry out, in a non-random way, changes to an information situation."
Orr <i>et al.</i> (1989)	"A methodology is a collection of methods based on a common philosophy that fit together in a framework called the systems development life cycle."
Veryard (1985)	"A tentative definition of a methodology might be a generalized set of methods and procedures used on projects."

Table 2.1: Definitions of a Systems Development Methodology

When one studies these definitions of a systems development methodology, it is clear that certain aspects are repeated in some of these definitions. The most useful definition for a systems development methodology which encompasses all these aspects is one which encompasses the following aspects (Huisman, 2002; Huisman & livari, 2006; Huisman & livari, 2003b):

 "A systems development approach:

- *This involves the philosophical view on which the methodology is built. It is the set of goals, guiding principles and beliefs, fundamental concepts, and principles of the systems development process that drive interpretations and actions. Examples are the structured, object-oriented and information modelling approaches.*

 *A systems development process model:*

- *A process model is a representation of the sequences of stages through which a system evolves. Some examples are the linear life-cycle model and the spiral model.*

 *A systems development method:*

- *A method is a systematic way of conducting at least one complete phase of systems development, consisting of a set of guidelines, activities, techniques, and tools, based on a particular philosophy and the target system. Examples include Information Engineering.*

 *A systems development technique:*

- *Development techniques can be defined as procedures, possibly with a prescribed notation, to perform a development activity, for example construction of entity relationship diagrams.'*

In this dissertation systems development methodologies are defined and used as a collective term which contains the systems development approach, process model, method and techniques and tools. This is illustrated in Figure 2.4.

Systems Development Methodology



Figure 2.4: Representation of a Systems Development Methodology

2.2.2 Historical Perspective According to Avison and Fitzgerald (2006)

In order to gain a good understanding of systems development methodologies, it is necessary study its history. Avison and Fitzgerald (2006) classify the evolution and development of system development methodologies into the following eras:

Pre-methodology era

- This era is known as the era where developers developed and implemented information systems without making use of any clear-cut or formalized systems development methodology, and existed until the early 1970s. During this era developers had little knowledge of the business or the organizational context in which the systems were being implemented.

Early-methodology era

- This era existed between the 1970's and the early 1980's. It was the time when the traditional Systems Development Life Cycle (SDLC) was developed, which is also known as the "waterfall model". The emphasis of this era is on the identification of phases and stages.
- According to Avison and Fitzgerald (2006), the approaches (i.e. the Systems Development Life Cycle (SDLC)) of the early methodology era is characterized by the following limitations:
 - Failure to meet the needs of management – Management information required when making decisions about resources, are neglected.
 - Instability - Models of processes are unstable, due to the fact that business changes. Thus, processes need to adapt to fit the new environments created by the business.

- Inflexibility - Output-driven design leads to inflexibility, because outputs which are meant to be produced by the system are decided very early in the systems development process.
- User dissatisfaction - Users lose their commitment to the system, because they are not involved in the development process between user specifications and sign off.
- Problems with documentation - The purpose of documentation is communication, not to be a technically-oriented document.
- Lack of control - Due to the complexity of some phases and the inexperience of some practitioners, estimations of time, people, etc. are unreliable.
- Incomplete systems - Exceptional conditions are not catered for in the systems. It is often ignored or forgotten.
- Application backlog - There are a number of systems that are waiting to be developed. Some users may wait years before the development process is started, not to mention implementation.
- Maintenance workload - The workload is too heavy; thus maintenance is neglected.
- Problems with the "ideal" approach - The SDLC assume a top-down process which is performed step-by-step. However, it is essential to follow an iterative approach during systems development, which is not supported by the traditional systems development life cycle (SDLC).
- Emphasis on "hard" thinking - It is necessary to follow an alternative approach, rather than assuming simplistic assumptions like a few "facts" that need to be investigated and identified.

The above-mentioned limitations have lead to the following era, which is known as the “Methodology era”.

Methodology era

- This was the era when most methodologies known today, were developed. They originated either from practice or from theory. Methodologies have been developed in universities, research institutions and in organizations. These new methodologies emerged due to the limitations and criticisms of the SDLC. This era existed from the mid to late 1980s until the mid to late 1990's.

Era of methodology reassessment

- This era is the era from the mid to late 1990's onward. This era is characterized by organizations which have turned to different methodologies and approaches, or discarded the use of a systems development methodology completely. Another noticeable action from organizations in this era is that organizations tend to adapt their systems development methodology to fit their needs. It is an era where debates exist concerning the meaning of the term “methodology”. It is an era where uncertainty exists with regards to the use and effectiveness of systems development methodologies. The post-methodology era is a time in the software industry in which developers discuss arguments and pressures and critique against methodologies on a daily basis.

According to [Avison and Fitzgerald \(2003\)](#), real-world performance has led some developers to decline methodologies in general terms. This has been termed as the backlash against methodologies.

Many reasons for this developer backlash have been suggested. According to [Avison and Fitzgerald \(2006\)](#), possible reasons for this “backlash against methodologies” are:

-  Productivity - Methodologies do not deliver the productivity benefits they are supposed to deliver.
-  Complexity - Methodologies are over-complex.
-  “Gilding the lily” - Methodologies are known to be over-compensating.
-  Skills - Practitioners need considerable skills to fully benefit from the use and processes of systems development methodologies.
-  Tools - The tools provided by methodologies are difficult to use and do not generate enough benefits.
-  Not contingent - The methodology is independent upon the type of project or the size of the project.
-  One-dimensional approach - There is an existing need for a more political and organizational as well as and other dimensions. The underlying issues and problems needs to be addressed.
-  Inflexible - Since user-/business requirements frequently change during the development process, there is a need for methodologies to be more flexible.
-  Invalid or impractical assumptions - Many methodologies make assumptions which do not exist in practice, i.e. assumptions concerning the competitive environment, business and information systems strategy, etc.

-  Goal displacement - Developers focus too intensely on the methodology, and do not give the necessary attention to the real needs of the project which is being developed.
-  Problems of building understanding into methods - There is a need for practitioners to understand the method itself.
-  Insufficient focus on social and contextual issues - Instead of focusing on the narrow, technical development issue, methodologies need to also focus on the social and organizational aspects of systems development.
-  Difficulties in adopting a methodology - Since some developers resist methodologies, and methodologies are restrictive, some organizations have found it difficult to adopt a systems development methodology.
-  No improvements - Without improvement, it is believed that the use of systems development methodologies do not necessarily result in better systems.

The methodology era of reassessment has brought a time in the software development industry where developers are confronted with the choice as to whether or not to adopt a methodology, and if they do adopt a methodology, whether they are going to use it as it was intended to be used or adapt the methodology to fit their needs. According to [Avison and Fitzgerald \(2006\)](#), there are four directions in which organizations can choose to move:

-  Ad hoc development
 - This direction can be described as moving backwards into the era where no formalized methodologies were followed. This is known as the most extreme reaction to the backlash against methodologies. A contrasting viewpoint to methodical systems development is known as Amethodical systems development. Amethodical systems development rejects structure – it takes places without a predefined sequence, control, rationality, or claims to universality.

Further development in the methodology arena

- In this direction, methodologies will continuously evolve and new ones will be developed. In this direction, the emphasis is on knowledge, rather than information. The importance of Customer Relationship Management is also increasing, due to the focus on customers as stakeholders.

Contingency

- In this direction, practitioners realize that all the situations and environments are different, and there could never be a “blue-print” to use for all system development. In this approach, a structure is presented to practitioners, but they have the choice as to what tools and techniques will be used or not, or used and adapted. This direction allows for different approaches, as long as standardization is not lost. Skill is required to handle all these different approaches. Experience and skills are required to make the best judgments.

External development

- Some practitioners make the decision to buy their requirements in the form of package systems. This is an increasingly sophisticated market and the packages are becoming more tailorable. There are dangers of not being in control of the features, but many practitioners are willing to take the risk. All these continuing problems with systems development methodologies have thus resulted in outsourcing.

Apart from the historical perspective defined by [Avison and Fitzgerald \(2006\)](#), there are also other generations that need to be defined.

[Siponen \(2005\)](#) states that the “first-generation is the selection of components from management standard, while the second generation encompasses mechanistic engineering methods, and the third generation entails logical modelling methods that focus on abstracting information system problems”. Such third generation approaches are for instance logical modelling and the spiral approach. The fourth generation adds the social and socio-technical design aspects to the third generation approaches. It is known as the

socio-technical design generation with design approaches such as the semantic responsibility analysis.

According to Siponen (2005), there is a need for a fifth generation methodology era. This era may be known as the era for social and adaptable information systems methodologies. In this era, methodologies should include social and adaptable information systems development methodologies that are strictly developed along with practice. Methodologies in this era should integrate the use of social techniques, such as user participation. This era will be developer driven, rather than methodology driven. This era will provide developers the freedom of choice and sufficient guidance and support. (Siponen, 2005; Vlasblom *et al.*, 1995).

In this study we will investigate how companies adapt their systems development methodologies. Therefore, the research will focus on the contingency direction as described by Avison and Fitzgerald (2006), and the fifth generation methodology era as described by Siponen (2005).

2.2.3 Purpose of a Systems Development Methodology

According to [Jayaratna \(1994\)](#), the main purpose of a Systems Development Methodology is to develop valuable information processing systems in the most efficient way. According to [Avison and Fitzgerald \(2006\)](#), the purpose of a systems development methodology is to result in a better end product, a better development process and a standardized process.

Each methodology was designed to fulfil a specific purpose. The purpose of a systems development methodology as a general subject is discussed, seeing that the research concerns the adaptation of methodologies in general and not about certain specific formalized methodologies.

The following purposes of a systems development methodology are reported by several researchers.

-  A methodology records correctly the requirements for an information system. This is made possible by the methodology which provides for a suggestion of any changes that need to be made as early as possible in the development process. This leads to better requirements analysis as well as an extended scope, which increases user satisfaction and provides better user understanding and/or user participation ([Avison & Fitzgerald, 2006](#); [Sumner & Sitek, 1986](#); [Essink, 1986](#)).
-  A methodology enables faster development of information systems and provides an organized method of development so that progress can be efficiently monitored, as well as an information system within a suitable time limit and at a satisfactory cost, which is thoroughly documented and effortlessly sustained. A methodology also has the *“means of improving the management and control of the software development process and product by specifying activities to be done and techniques to be used.”* This leads to information systems which are more flexible and trustworthy with a

sufficient level of functionality (Avison & Fitzgerald, 2006; Russo *et al.*, 1995; Essink, 1986).

According to Fitzgerald *et al.* (2002), the purpose of a systems development methodology is also influenced by its rational and political roles.

The rational roles played by methodologies are based on the factors which support the use of systems development methodologies.

According to Fitzgerald *et al.* (2002), the rational roles which justify the formalized methodologies and influence the Method-in-Action framework (discussed in Chapter 3) are the following:

-  Methodologies reduce the complexity of information systems development.
-  Methodologies facilitate project management and control.
-  Methodologies divide labour between developers. This reduces the development time and improves quality.
-  A methodology ensures a structured way of development which systematizes development knowledge.
-  A methodology gives standardization to the development process.

According to Fitzgerald *et al.* (2002), the political roles which justify the formalized methodologies and influence the Method-in-Action, are the following:

-  Methodologies make information systems development work more professionally.
-  The information systems department is more proactive in strategy formulation, thanks to methodologies.

-  The use of methodologies provides comfort and confidence to the developers.
-  Audit trail of a methodology provides protection in case design decisions turn out to be wrong in the future.
-  Organizations claim to use a methodology to achieve ISO-certification or to attain CMM-compliance.
-  Methodologies are frequently used to improve the organization's profile.

From the above discussion it is clear systems development methodologies have different roles in an organization.

2.2.4 Arguments and Pressures in favour of Systems Development Methodology use

Despite all the negative critique and attitude towards systems development methodologies, there are still practitioners who are in favour of systems development methodologies and acknowledge the advantages provided by systems development methodologies. Cases where systems development methodologies are used successfully are reported by Chatzoglou and Macaulay (1996) and Rahim *et al.* (1998).

According to Fitzgerald (1998), early systems development projects frequently used disorganized methods. However, as the intricacy of the systems increased, more disciplined methodological approaches were advocated. Some of the essential concepts, arguments and factors supporting the use of methodologies are:

-  Systems development is a very compound process. Methodologies may provide a reductionist subdivision of this process into reasonable and rational steps (Fitzgerald, 1998).
-  By describing the development task more observable and obvious, methodologies may smooth the progress of project management and control of the development process, thus decreasing risk and uncertainty (Fitzgerald, 1998).
-  They may provide a persistent framework for the application of techniques and resources at suitable times during the development process (Fitzgerald, 1998).
-  There is an underlying monetary principle: methodologies may allow expertise specialization and partitioning of labour which can receive different compensation rates (Fitzgerald, 1998).

-  An underlying epistemological principle can be recognized as methodologies may provide a structural framework for the acquirement of knowledge. Thus, any learning from past development experiences can be systematized and stored for future reference (Fitzgerald, 1998).
-  Standardization of the development process is achievable. This facilitates interchangeability among developers. Also, it can lead to increased productivity and quality, as resource necessities can be predicted and made available as and when required (Fitzgerald, 1998).
-  Many practitioners argue that methodologies may be used because they are teachable (Roberts *et al.*, 1998).
-  Many organizations adopt methodologies in order to fuel the desire to achieve ISO-certification (Fitzgerald, 1998; Fitzgerald, 1996).
-  Some governments, who are appreciably involved in systems development, have required that certain methodologies must be used for development (Fitzgerald, 1998).
-  The use of methodologies led to better control of a project (Avison *et al.*, 1992).
-  They provide consistency because everyone uses the same techniques (Roberts *et al.*, 1998).
-  They require explicit deliverables which may be checked for quality (Roberts *et al.*, 1998).
-  They provide an engineering-like development discipline (Roberts *et al.*, 1998).
-  It allows organizations to standardize the development process and address system application backlogs (Roberts *et al.*, 1998).

-  It improves the successful use of available automated tools to support systems development (Roberts *et al.*, 1998).
-  It should help organizations to integrate business modelling with information system modelling and development (Roberts *et al.*, 1998).

It is clear that systems development methodologies can offer many advantages to organizations where systems development takes place.

2.2.5 Arguments and Pressures against Systems Development Methodology use

When one studies the literature, it is impossible to ignore the fact that there are practitioners and researchers who are against the use of systems development methodologies.

Some criticisms against the use of systems development methodologies are as follows:

-  Estimates propose that more than 1000 brand-named methodologies exist (Fitzgerald, 1998). This causes a considerable amount of confusion when organizations have to select a suitable systems development methodology.
-  Generalization has been made without sufficient conceptual and experimental groundwork, since many methodologies have been extended on the starting point of restricted use (Fitzgerald, 1998).
-  Systems development is not, in fact, a methodical coherent process, but most system development methodologies treat it as such, with foremost emphasis on technical reasonableness at the expense of social aspects (Fitzgerald, 1998).
-  There may be some means-to-ends inversion, as developers proceed in unquestioning and unsighted obedience to methodologies, while losing sight of the fact that development of an actual system is the real objective (Fitzgerald, 1998).
-  Often, there is an assumption that methodologies are universally applicable across all development situations (Fitzgerald, 1998). As discussed in section 2.2, this assumption is not true, and today much focus is placed on the contingency aspect of system development methodologies.

- ❏ There is an insufficient acknowledgment of developer personified factors, since system development methodologies do not address factors important to successful development, such as individual creativity and instinct, or learning over time (Fitzgerald, 1998).
- ❏ Some methodologies do not cover phases such as systems planning or requirements analysis while others do not cover system implementation (Fitzgerald *et al.*, 2002). Hence systems development methodologies are incomplete.
- ❏ Systems development in practice is not a methodical organized phased process. Requirements specification and systems design are profoundly interdependent, but in the phased approach to development the *what* of requirements specification is rigorously separated from the *how* of design (Fitzgerald *et al.*, 2002).
- ❏ Methodologies fail to deliver the suggested productivity benefits (Avison & Fitzgerald, 2006; Avison & Fitzgerald, 2003b; Avison & Fitzgerald, 2002).
- ❏ Methodologies require considerable skills in their use and processes, and developers need guidance which is not always available (Avison & Fitzgerald, 2006; Avison & Fitzgerald, 2002).
- ❏ The tools that are used by the methodologies are complicated to apply and do not yield sufficient benefits. (Avison & Fitzgerald, 2006; Avison & Fitzgerald, 2002).
- ❏ Methodologies do not allow adjustments to requirements during development (Avison & Fitzgerald, 2006; Veryard, 1985).
- ❏ Some organizations find it difficult to adopt a methodology (Avison & Fitzgerald, 2006).
- ❏ Methodologies do not necessarily result in better systems (Avison & Fitzgerald, 2006).

- ❏ Some methodologies place too much emphasis on the diagrams used and lose sight of the goal of the development (Avison & Fitzgerald, 2006; Essink, 1986; Avison & Fitzgerald, 2002).
- ❏ The use of systems development methodologies are too time consuming (Avison & Fitzgerald, 2006; Sumner & Sitek, 1986; Standing, 2002).
- ❏ There is a poor link between tools used for analysis and design resulting in the need to move to another methodology (Essink, 1986; Sumner & Sitek, 1986).
- ❏ Documentation is inconsistent and frequently a duplication of effort (Avison & Fitzgerald, 2006).
- ❏ Many concepts used by systems development methodologies are fuzzy and artificial from the problem domain point of view. It is argued that the concepts are not exact and/or well defined (Bubenko, 1986).
- ❏ It is argued that the influence of systems development methodology use tends to minimize or completely eliminate important factors such as social, cultural, political, semantic, managerial, etc. (Rose, 2002).
- ❏ Many methodologies are too prescriptive (Standing, 2002). It restricts the developer to follow his instincts and suppresses creativity.
- ❏ Methodologies should not be seen as a set of rules that needs to be followed rigorously, but rather as a framework containing tools and techniques which can be drawn upon as and when needed (Avison *et al.*, 1992).
- ❏ Methodologies must be more flexible for today's dynamic business environment (Standing, 2002; Veryard, 1985).
- ❏ Incorporation and adaptation of packages and outsourcing are quite common in today's environment, yet few methodologies cater for this problem (Fitzgerald, 2000).

-  Business systems development is often algorithmically uncomplicated. Thus methodologies which may be strong in the area of real-time engineering systems design may not be as appropriate for business systems development (Fitzgerald, 2000).
-  Neither the top-down SDLC approach, which implies the elicitation and confirmation of requirements in advance, nor the bottom-up prototyping and iterative development approach, which views requirements as emerging as the development process takes place, are adequate in isolation. Rather, a mix of strategies may be more suitable (Fitzgerald, 2000).
-  While methodologies can introduce inflexibility to the development process, productivity may necessarily suffer, and this substitution is not acceptable (Fitzgerald, 2000).
-  The development process can be over-intellectualized, and in some conditions a methodology may prescribe an overly-composite approach whereas a simpler one may be more suitable (Fitzgerald, 2000).
-  Departures from the prearranged steps of methodologies are familiar in practice. However, these departures rather are conscious and purposeful than subjective (Fitzgerald, 2000).
-  The level of granularity of methodological steps needs to be different, with the methodology specifying at a higher level of abstraction the outcome to be achieved, with the exact manner in which it is achieved left to the good judgment of the developer. Therefore, rather than prescribing the finer points of steps developers are expected to follow, the focus should be on higher level goals and deliverables, and the specific manner in which these are essentially achieved should be left to the developer (Fitzgerald, 2000).

-  Because of the daily changing nature of the business environment, short-term needs are now dominant (Fitzgerald, 1998). The existing business environment requires that organizations act more successfully in shorter time frames. Fitzgerald (2000) states that there is a need for more rapid systems delivery than that which is presently being achieved with the massive development approaches inherent in traditional system development methodologies.
-  There is also some evidence of a changed outline of systems development environment (Fitzgerald, 1998).

In this study we will investigate whether these arguments and pressures against systems development methodologies will lead to its adaptation.

2.2.6 Systems Development Methodology Classification

The classification of systems development methodologies are of great importance, for both academic and practical reasons. According to [Avison and Fitzgerald \(2006\)](#), the academic reason is to better understand the nature of methodologies in order to perform classifications and to improve future information systems development. The practical reason, as stated by [Avison and Fitzgerald \(2006\)](#), is to select a methodology, or part of one, or a number of methodologies, for a particular application, a group of applications, or for an organization as a whole.

In this section we will discuss three classification frameworks to understand the nature of systems development methodologies better, namely the classification of [Avison and Taylor \(1997\)](#), The NIMSAD framework of [Jayaratna \(1994\)](#), and the classification of [Avison and Fitzgerald \(2006\)](#).

Systems Development Methodology Classification according to [Avison and Taylor \(1997\)](#)

[Avison and Taylor \(1997\)](#) groups methodologies in five classes for diverse problem situations. Each class reflects a different type of problem situation, with the fifth class containing the most complex problem situations. These classes are as follows:

Class 1

- “Well-structured problem situations with a well-defined problem and clear requirements.” Examples are the waterfall model and methodologies based on the traditional systems development life cycle (SDLC).

Class 2

- “Well-structured problem situations with clear objectives but uncertain user requirements.” Examples are methodologies which are based on data modelling, process modelling or prototyping as well as STRADIS, YSM, IE, SSADM.

Class 3

- “Unstructured problem situations with unclear objectives.” Examples are soft systems approaches like SSM.

Class 4

- “Situations where there is a high user interaction with the system.” Examples are the ETHICS methodology

Class 5

- “Complex problem situations, combining two or more of classes 1–4, requiring contingency approach to information systems development.” Examples are the Multiview framework.

Systems Development Methodology Classification according to Jayaratna (1994)

A framework for classifying methodologies, as proposed by Jayaratna (1994), is NIMSAD (Normative Information Model-based Systems Analysis and Design). This framework has three elements:

 the “problem situation” (the methodology context) concerns the understanding and identification of:

- the clients and their understandings, experiences, and commitments;
- the problem owners, their concerns, and problems;
- the situation the methodology users are facing, its diagnosis as structured or unstructured;
- the ways in which the methodology might help the situation;

- the culture and politics of the situation, including the risks associated with using the methodology in various circumstances;
- the views of the stakeholders concerning “reality”, i.e. philosophical assumptions
- the dominant perceptions in the problem situation, i.e., technical, political, social?



the intended problem solver (the methodology user) asks questions about the:

- methodology users' beliefs, values and ethical positions;
- relationship of the above to that assumed or demanded by the methodology;
- way in which mismatches in the two above may be handled or reconciled;
- methodology users' philosophical views;
- methodology users' experience, skills and motives in relation to those required by the methodology.



the problem-solving process (the methodology) consists of the way in which the methodology provides specific assistance for:

- understanding the situation of concern and setting boundaries;
- performing the diagnosis, i.e. the models, tools, techniques which are used and their interaction;
- defining the prognosis outline, i.e. the desired states;
- defining problems;
- deriving notional systems;
- performing conceptual/logical and physical design, including who is involved and what are the implications;
- implementing the design.

Systems Development Methodology Classification according to Avison and Fitzgerald (2006)

Yet another classification framework is proposed, namely by Avison and Fitzgerald (2006). This framework consists of seven elements:

-  Philosophy (distinguishes a “methodology” from a “method”)
 - Paradigm (the specific way of thinking about problems)
 - Objectives (the methodological objective – to determine the boundaries of the area of concern)
 - Domain (it is necessary to perform a top-down analysis of the organization, sort out the strategic requirements of the business, and thus, to ensure that the information systems are designed to support these fundamental requirements)
 - Target (the applicability of the methodology)
-  Model (the basis of the methodology's view of the world)
-  Techniques and tools
-  Scope (an indication of the stages of the life cycle of systems development the methodology covers)
-  Outputs (the deliverables at each stage of the methodology)
-  Practice
 - Background (commercial and academic)
 - User base (number and type of user)
 - Participants
-  Product

2.3 Systems Development Methodology Adaptation

In the first part of this chapter we discussed systems development methodologies in order to get a clear understanding of its concepts. In this part of the chapter the focus will be on the adaptation of systems development methodologies.

2.3.1 Terms used for Systems Development Methodology Adaptation

Many researchers use other terms to refer to systems development methodology adaptation, although there is no difference in the meaning of the terms. Other terms which are just as popular to use as adaptation are “tailoring” and “customization”.

☐ The term “Tailoring” instead of adaptation is used by Keenan (2004), Fitzgerald *et al.*, (2002), Morch (1998) and Melanson *et al.*, (1997).

☐ The term “Customization” instead of adaptation is used by Lam *et al.* (2006), Zhang & Jiao (2006), Frutos and Borenstein (2004), Ceri *et al.* (2000) and Akoka (1996).

In this dissertation the term “adaptation” will be used, because the researcher feels that it is the most general term to use in context with systems development methodologies.

2.3.2 Reasons for Systems Development Methodology Adaptation

When one studies the literature available on systems development methodologies, it is clear that systems development methodologies are not used by all practitioners. Chatzoglou and Macaulay (1996) reported that a methodology is used on approximately 53% projects. Fitzgerald (2000) reported that approximately 60% of organizations do not use a methodology, while only 14% use a formalized methodology.

A possible reason for these reported results is that some practitioners make a knowledgeable decision not to use systems development methodologies because of their awareness of the limitations of the methodologies. Other organizations develop their methodologies in-house instead of using commercially available products, while other practitioners adapt methodologies or use only specific aspects of a methodology to fit their needs. These are important directions to bear in mind when one studies systems development methodology use, and it was also noted by Huisman (2000), Hardy *et al.* (1995) and Wynekoop and Russo (1997). According to Huisman (2000), specialized knowledge is essential in order to adapt a systems development methodology and ensure that all the results are also precise and reliable.

Russo *et al.* (1995) claim that the adaptation of methodologies in order to fit a particular situation appears to be a common phenomenon. Vlasblom *et al.* (1995) argues that flexibility in methodologies is a necessary step.

Possible reasons for the adaptation of systems development methodologies are as follows:

-  Adaptation is cheaper and methodologies must be continually refined to meet the evolving needs (Russo *et al.*, 1995).
-  Methodologies are unmanageable and consume time and resources which are frequently unavailable. Thus, on small projects, the benefits did not seem to be more important than costs (Fitzgerald, 1998).
-  The requirements are not always available or clear (Parnas & Clements, 1986). Frequently many details are only available when one has progressed to the development process (Parnas & Clements, 1986).
-  Project changes, occasionally due to external reasons (Parnas & Clements, 1986).
-  Humans can make errors. Thus it is necessary to repeat specific parts of a methodology or combine two or more methodologies (Parnas & Clements, 1986; Longworth, 1985).
-  To follow a methodology rigorously, prevents designers from deriving new ideas and being creative. Frequently the users are not able to see in their mind's eye everything they want or what the system can provide (Fitzgerald, 2000; Longworth, 1985; Rose, 2002).
-  It is necessary to regularly adapt systems development methodologies in order to meet market trends, to stay competitive and to take advantage of new technology (Longworth, 1985).
-  Developers have different viewpoints and/or philosophies (Rose, 2002).
-  A methodology which is often used is not always suitable for all systems development situations. Thus they adapt the methodology to adjust to their needs (Russo *et al.*, 1995; Avison *et al.*, 1992; Sakthivel, 1992).

-  There is a lack of understanding of the information systems development methodology (Rowlands, 2006).
-  Developers have different interpretations of a specific methodology (Fitzgerald, 1998; Rowlands, 2006).

In this study we will investigate whether these reasons for the adaptation of systems development methodologies are also applicable in South Africa.

2.3.3 How Systems Development Methodology Adaptation is Done

According to Wynekoop and Russo (1997), Fitzgerald (1997), Rowlands (2006) and Iivari and Maansaari (1998), organizations usually adapt a systems development methodology. While it is known that organizations adapt methodologies, it is not known how they adapt it and whether it is still reliable.

Methodologies are adapted to fit the practitioner's needs by adding or removing certain techniques, procedures, tasks, etc. Methodologies may also be adapted by combining two or more existing methodologies (Fitzgerald, 1997). Instead of adapting methodologies, organizations might decide to use different methodologies on different projects. It is also possible that organizations might develop a methodology in-house, instead of adopting and then adapting a methodology.

Aydin *et al.* (2005) identifies two ways of performing methodology adaptation. Static methodology adaptation refers to "selecting and assembling structured fragments based on a predefined set of criteria". Static methodology adaptation results in several route maps. Aydin *et al.* (2005) describes a route map as an established plan which prescribes which structured fragments should be used in a project. The second way of performing methodology adaptation is dynamic adaptation which takes place during the development process. Dynamic adaptation is normally applied to the development of agile systems. The role of coaches is essential when using dynamic adaptation in order to adapt both structured and unstructured fragments to the contexts, or vice versa.

In conclusion, methodologies are adapted to fit the practitioner's needs by mainly adding or removing certain techniques, procedures, tasks, etc. Adaptation is also performed by the combination of two or more existing methodologies.

2.3.4 Cases of Systems Development Methodology

Adaptation in practice

When one studies the pressures for change in the traditional approaches to systems development, it is rational for developers and practitioners to adapt systems development methodologies, or to use only parts of a methodology.

According to a study performed by [Fitzgerald \(1997\)](#), there was not a single organization that followed their methodologies exactly as they were intended to be followed. A literature study showed that systems development methodologies are indeed being adapted. The following studies reported on the adaptation of systems development methodologies:

-  The application model and the conceptual model of the HERA-methodology had been adapted in designing a Web Information System ([Frasincar et al., 2004](#)).
-  It has been reported that the Object-oriented methodology has been adapted by Mathiassen, ([Rose, 2002](#)).
-  [Melanson et al. \(1997\)](#) adapted the OMT method by supplementing it with a meta-model of the design and a set of design guidelines.
-  The ETHICS methodology was adapted when an information technology support system was developed in an academic environment. This adaptation was performed by combining the ETHICS methodology with the QUICKethics methodology ([Adman & Warren, 2000](#)).
-  A software development methodology has been tailored at Motorola. This tailoring process involved three levels: the industry level, organizational level and project level. The methodology was adapted at the industry level to comply with the Capability Maturity Model. The methodology needed to be adapted at organizational level to ensure that certain processes are only applicable to specific departments. At

project level it was important to adapt the methodology in order to provide sufficient models, tools and techniques in the development process (Fitzgerald *et al.*, 2003).

- ❏ A new methodology, named ACM, had been developed by combining the system dynamics (SD) modelling framework with the group multi-criteria decision aid (GMCD) (Kunsch *et al.*, 2001).
- ❏ A framework has been presented to allow practitioners to adapt off-the-shelf components and methodologies (Bracciali *et al.*, 2005).
- ❏ The Soft Systems Methodology (SSM) has been linked with Unified Modeling Language (UML) (Bustard *et al.*, 2000).
- ❏ Avison *et al.* (1992) adapted a methodology by combining existing methodologies. It has been stated that it is important to select an approach which identifies and satisfies the requirements of the users. Because no single methodology fits the needs of the project, Avison *et al.* (1992) blended the Yourdon approach with a data-oriented approach and added an intermediary phase. The intermediary phase was added to look at some key low-level requirements. Several problems have been encountered with this adaptation. One of the main problems encountered was with the intermediary phase where the process of normalization led to a huge number of tables which needed to be produced, which affected the performance of the database. The adaptation also had its advantages. By combining two approaches, it was made easy to maintain the data dictionary and limited scope for potential inconsistencies (Avison *et al.*, 1992).

In conclusion, a literature survey showed that many organisations are indeed adapting their systems development methodologies. Adaptation is mainly done by combining two or more existing systems development methodologies.

2.4 Chapter Summary

The layout of this chapter was visually presented in Figure 2.1. This chapter began with a discussion of systems development methodology.

First of all, the term systems development methodology was defined. It is noticeable that an ongoing debate between the terms “method” and “methodology” exists. In this dissertation the term “methodology” will be used. In accordance with [Avison and Fitzgerald \(2006\)](#), the researcher is of opinion that the term “methodology” has a deeper meaning than “method” and entails the philosophical approach, method, process and tools and techniques.

Thereafter a historical perspective of systems development methodology evolution and development were discussed. [Avison and Fitzgerald \(2006\)](#) classify the evolution and development of system development methodologies in the “Pre-methodology era”, “Early-methodology era”, “Methodology era” and “Era of methodology reassessment”. According to [Avison and Fitzgerald \(2006\)](#), there are four directions in which organizations can choose to move: Ad hoc development, further development in the methodology arena, contingency and external development. This dissertation will focus on the contingency direction. Research will be done to study how companies adapt their systems development methodologies.

The purpose of a systems development methodology was explained. According to [Jayaratna \(1994\)](#), the main purpose of a Systems Development Methodology is to develop valuable information processing systems in the most efficient way. According to [Avison and Fitzgerald \(2006\)](#), the purpose of a systems development methodology is to result in a better end product, a better development process and a standardized process.

Arguments and pressures in favour of a systems development methodology were discussed, as well as arguments and pressures against systems development methodologies.

Finally, three classification frameworks to understand the nature of systems development methodologies better, namely the classification of [Avison and Taylor \(1997\)](#), The NIMSAD framework of [Jayaratna \(1994\)](#), and the classification of [Avison and Fitzgerald \(2006\)](#), were discussed.

The second section of this chapter consisted of a discussion of adaptation and began with an acknowledgement to other terms which have been used for systems development methodology adaptation. Many researchers use other terms to refer to systems development methodology adaptation, although there is no difference in the meaning of the terms. Other terms which are just as popular to use as adaptation are “tailoring” and “customization”.

Possible reasons for systems development methodology adaptation were discussed. Thereafter the way adaptation is done, was explained. Methodologies are adapted to fit to the practitioners’ needs by adding or removing certain techniques, procedures, tasks, etc. Methodologies might also be adapted by combining two or more existing methodologies ([Fitzgerald, 1997](#)). Instead of adapting methodologies, organizations might decide to use different methodologies on different projects. It is also possible that organizations might develop a methodology in-house, instead of adopting and then adapting a methodology.

Finally, cases of systems development methodology adaptation in practice were briefly discussed.

Chapter 3

*The
Method-in-Action
Framework*

CHAPTER 3

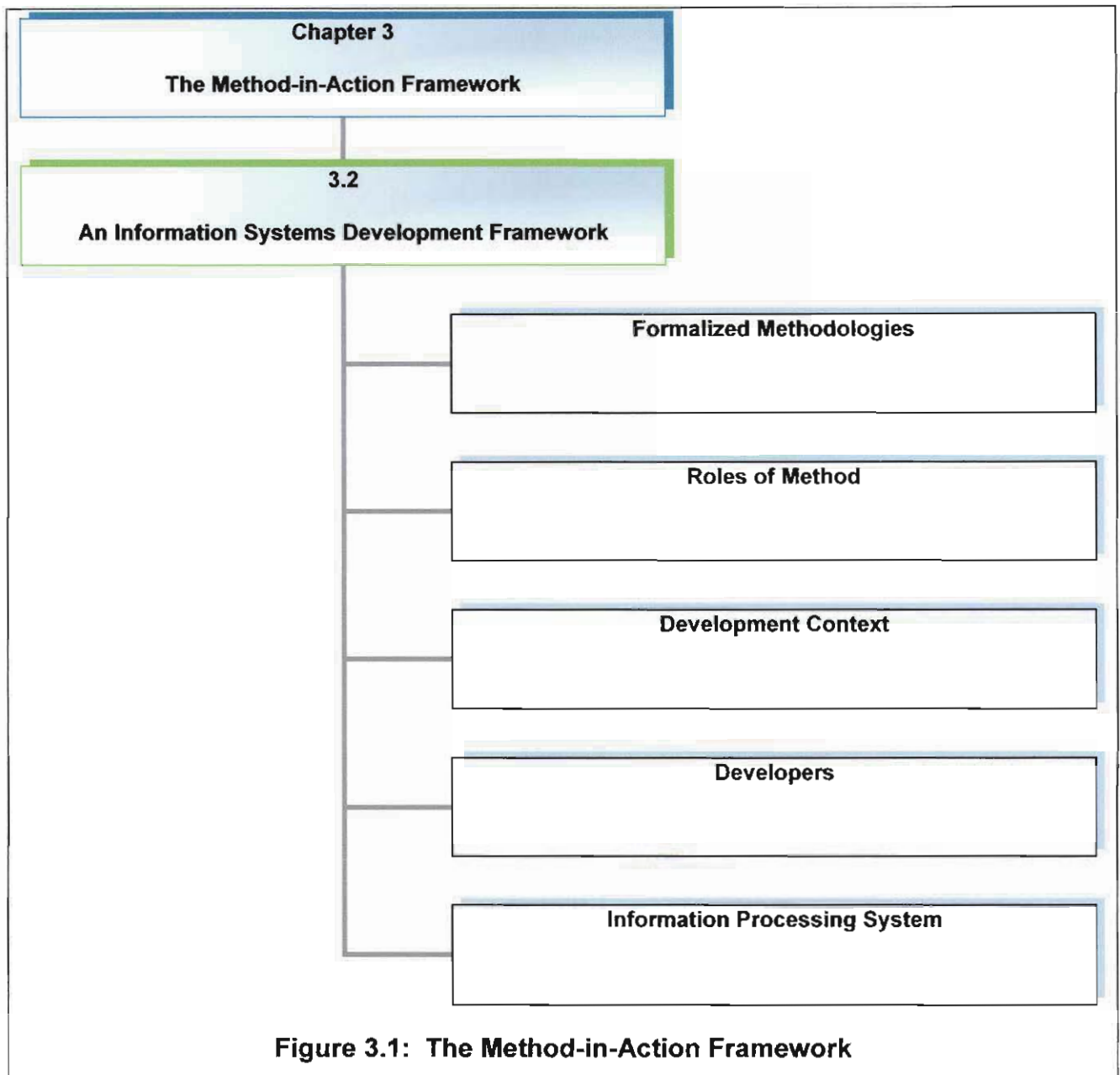
THE METHOD-IN-ACTION FRAMEWORK

3.1 Introduction

The layout of this chapter is visually presented in Figure 3.1. The focus point of this chapter is the method-in-action framework as defined by [Fitzgerald et al. \(2002\)](#). First of all, the framework is explained in general. Thereafter, each one of the components of this framework will be discussed. We start with a discussion of how formalized methodologies may be the basis of a method-in-action. The roles of methods are discussed next, followed by a discussion on the development context which shapes a method-in-action. Thereafter it is discussed how the developers enact with a method-in-action. The chapter ends with a discussion of the information processing system developed by the developers.

Information System Development Methodology use has been the focal point of much research over the past few years. One point of controversy in the research is whether the methodologies available are applicable and useful. Practitioners argue that methodologies do not fit their needs and that they are not applicable to all development projects. This has led to the adaptation of systems development methodologies.

This debate centres around the use of formalized methodologies versus the use of an adapted methodology or “method-in-action”, as termed by [Fitzgerald et al., 2002](#). Formalized methodologies have been promoted to be competent enough to make the development process more efficient, more secure, more predictable and easier to control. However, according to [Vlasblom et al. \(1995\)](#), the incorporation of flexibility in methodologies is important to achieve a safe and sound foothold amidst the changes indicated. [Avison et al. \(1992\)](#) stated that no single formalized methodology was appropriate for a specified application and organization, thus adaptation of methodologies is necessary.



Fitzgerald *et al.* (2002) developed a framework to understand the relationship between systems development and methods in practice. In this framework they used the term “method-in-action” to indicate that systems development methodologies are rarely applied exactly as originally intended, but that they are adapted (or tailored). This framework is discussed in this chapter. In this study the researcher would like to establish whether this framework is applicable to the information systems development practice in South Africa in general, but more specifically to the adaptation of systems development methodologies.

The framework will be studied to establish whether:

-  A formalized methodology is the basis of the adapted methodology
-  The development context in the organisation has any influence on the adaptation of the methodology
-  The developers has any influence on the adaptation of a methodology

Since the focus of this dissertation is on systems development methodologies in general, no specific methodology will be discussed. A discussion of specific methodologies can be found in [Fitzgerald *et al.* \(2002\)](#).

3.2 An Information Systems Development Framework

Please note that the main reference in this chapter is [Fitzgerald et al. \(2002\)](#), unless otherwise stated. In order to improve the readability of the discussion, multiple references to [Fitzgerald et al. \(2002\)](#) were eliminated.

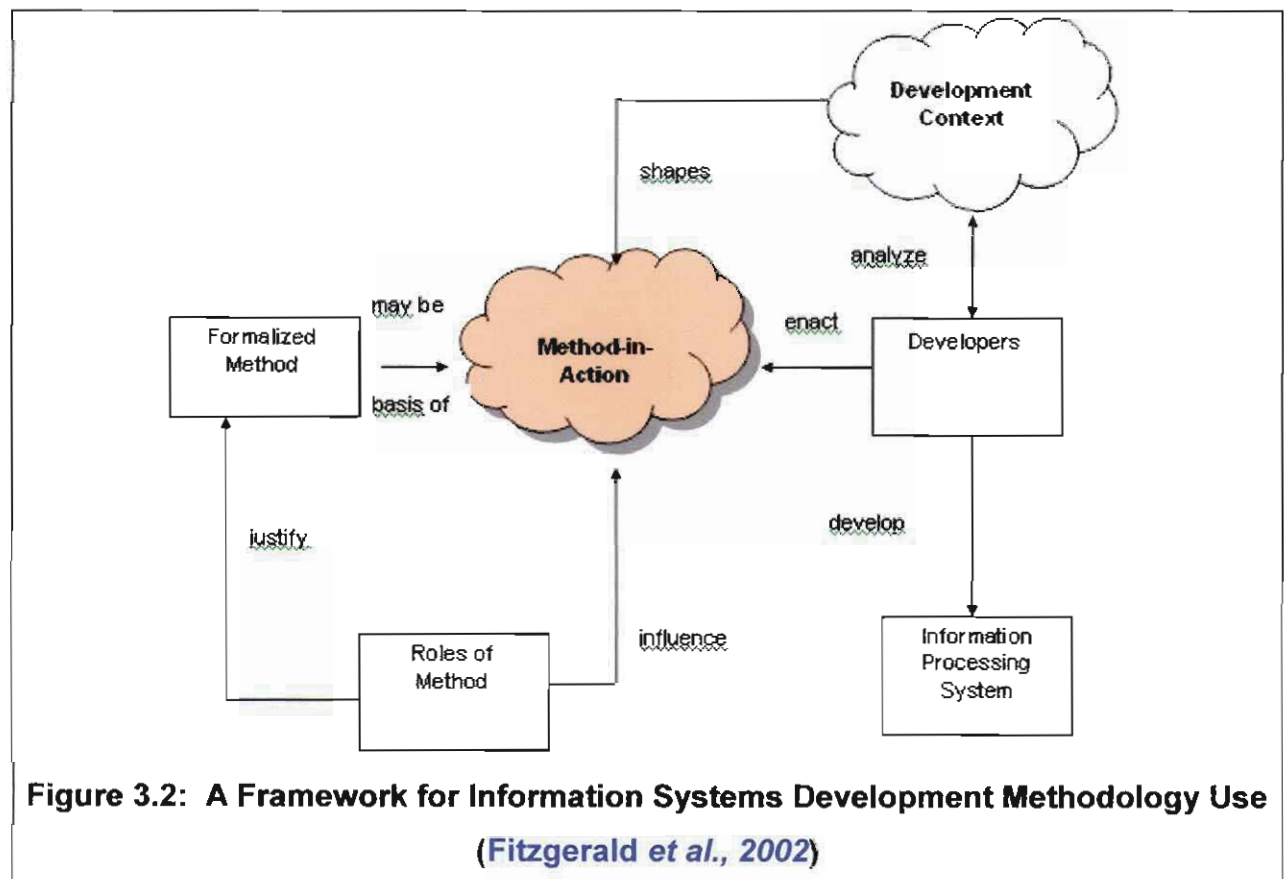


Figure 3.2 illustrates the framework for Information Systems Development Methodology Use. This framework consists of the following components: formalized methods, method-in-action, roles of methods, the development context, the developers, and the information processing system.

Formalized methodologies are one of the time-honoured central points in information systems development research. The term formalized method includes methodologies which had formally been developed and documented in-house and methodologies which are commercially available. Formalized methodologies may be the basis of the method-in-action and is justified by the roles of the methodologies.

The Method-in-Action refers to the fact that systems development methodologies are never applied as they are intended to be used. The Method-in-Action is influenced by the roles of the methodologies and shaped by the development context. Different developers will not interpret and apply the same methodology in the same way; neither will the same developer apply the same methodology in the same way in different development situations. Therefore the method-in-action is uniquely enacted by the developer.

An important component of the framework is that of the roles of methodologies. The roles of the methodologies include the rationale roles behind the use of the methodologies, as well as the political roles.

Development context refers to the different contexts in which methodologies are used. Every unique development context has unique preconditions for the development process. Being aware of this uniqueness is one of the fundamental principles for all successful information systems development projects. Formalized methodologies recommend how development circumstances must be approached in a systematic way, independent of the type of context. The development context is analyzed by the developers and shapes the method-in-action.

According to [Fitzgerald et al. \(2002\)](#), it is tremendously important that the developer is awarded a central role in the framework, thus reflecting the fact that it is people, not methodologies, who develop systems. Methodologies are simply frameworks which need to be influenced by the intelligence of human developers. The inventiveness and capability of the developer cannot be distant to any formalized information systems development methodology. The significance of learning over time as developers add to their level of expertise needs to be recognized, as does the important contribution made by developer understanding of the application problem domain or business context. These factors are

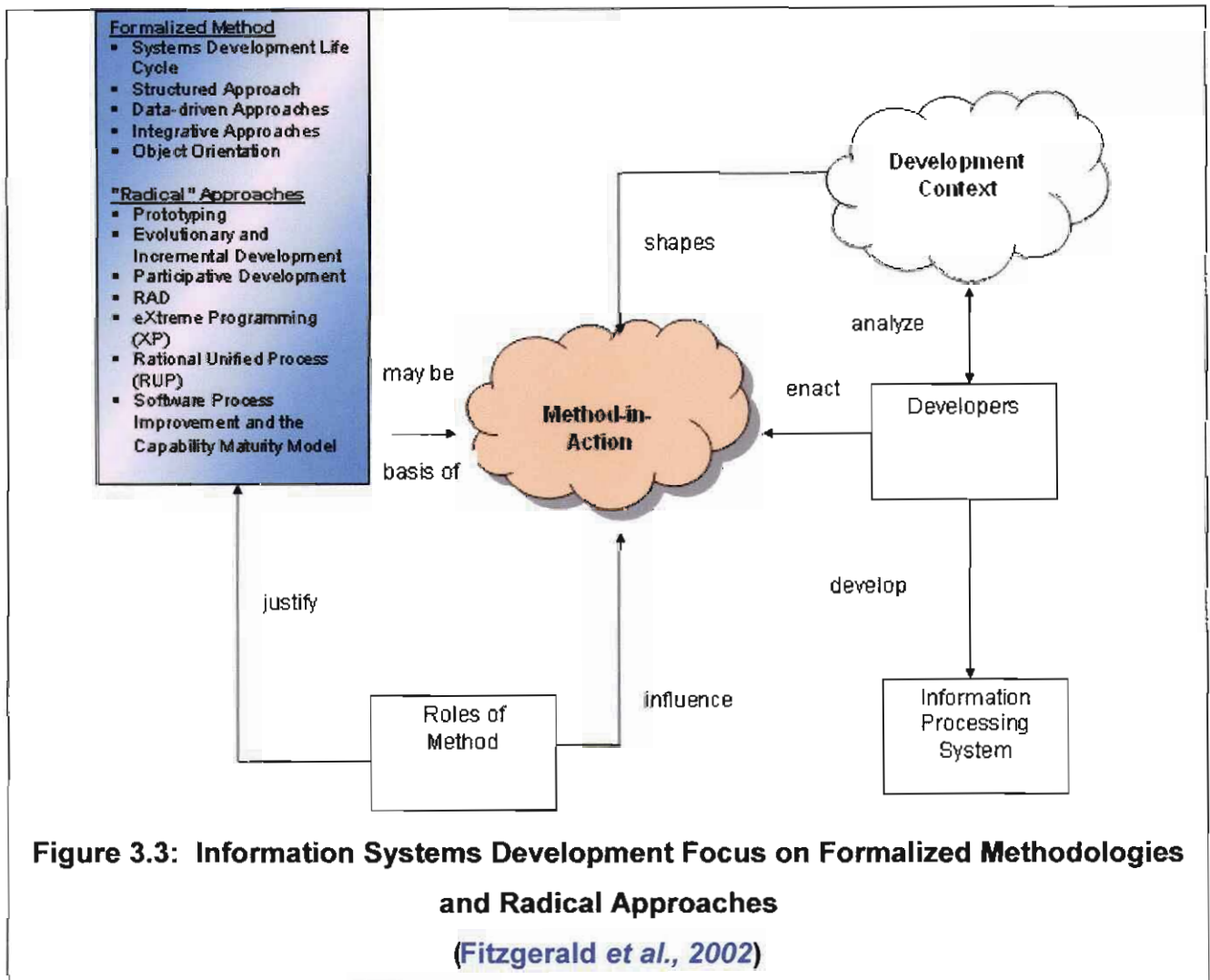
extremely important and are taken into account in the framework in the approach in which the developer analyses the development context and uniquely enacts the Method-in-Action to develop an information processing system. To a large degree information systems development is based on the re-use of development patterns, as acknowledged by experienced developers.

Families of information processing systems can be typified by dimensions such as the purpose of the system, the complexity of the system, unique versus generic systems and solved versus unsolved problems. These various dimensions can be used to form a more universal understanding of a system, even if it has to fit a unique context. These basic aspects of a system also influence the way in which it must be developed. These families are thus important, since the contradictory distinctiveness of each family serves to affect the Method-in-Action which will be needed to develop systems.

Each of the above-mentioned components of the framework will now be discussed in more detail.

3.2.1 Formalized Methodologies

Figure 3.3 is a refinement of the framework, with the focus on formalized methods. In the diagram, the emergence and evolution of systems development methods are indicated, starting with the systems development life cycle, and ending with more radical approaches.



The *systems development life cycle (SDLC)*, consists of four basic phases – systems study, preliminary design, detailed design and programming. Four major categories of approaches followed the SDLC. These approaches include the *structured approach* (i.e., Yourdon, Structured Analysis and Design Technique (SADT)), *data-driven approaches* (i.e., Data Structured Systems Development (DSSD), Development of Data Sharing

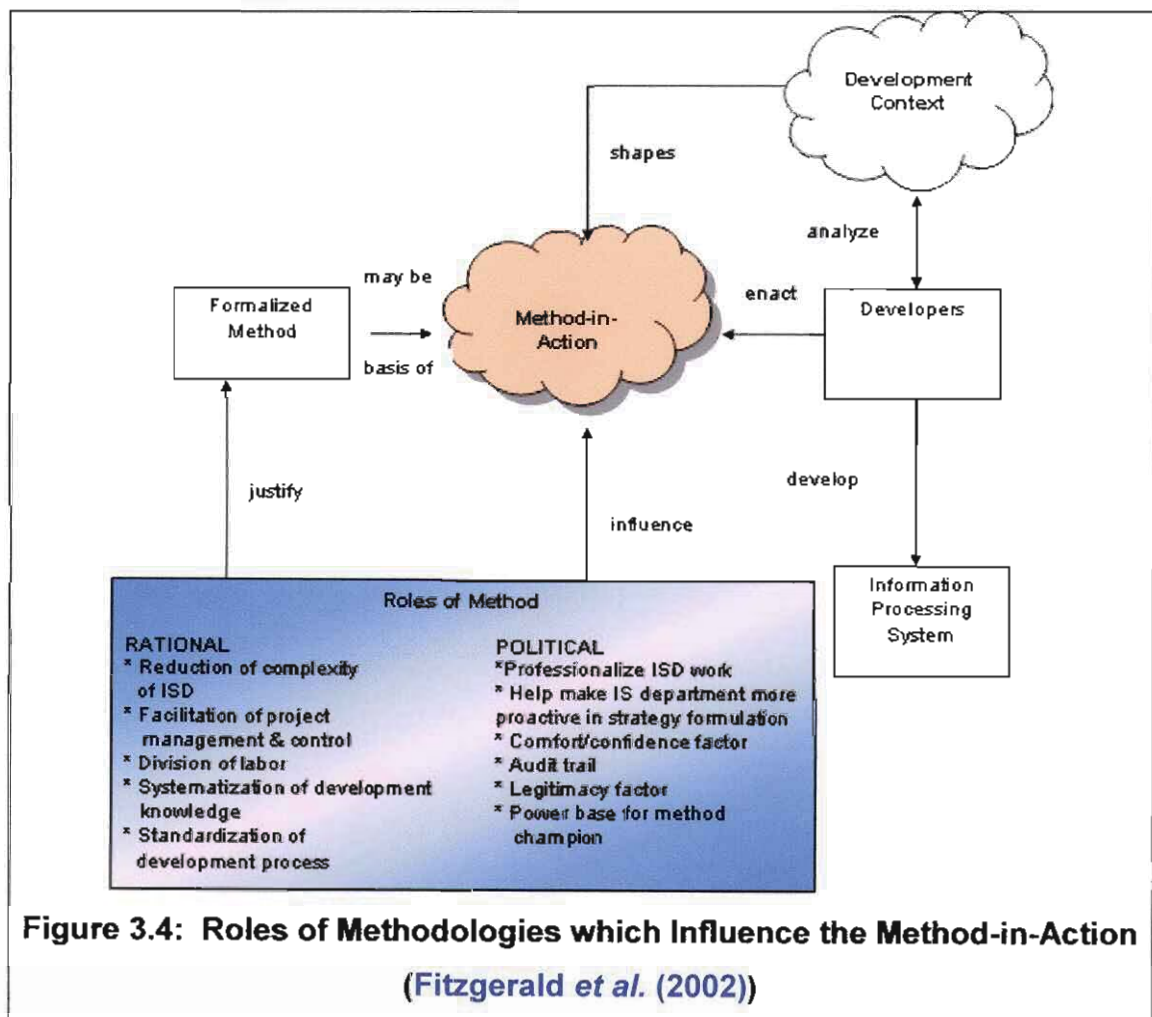
Systems (D2S2), Information Engineering), *integrative approaches* (Structured Systems Analysis and Design Method (SSADM), Jackson Systems Development (JSD)) and *object-oriented approaches* (Object-Oriented Analysis (OOA), Rational Unified Process (RUP)).

The *radical approaches* illustrate those methodologies which do not necessarily follow the traditional systems development life cycle. The emphasis of these methodologies is more on the "soft" human and organizational factors of systems development, and the dynamic nature of the development process, than on technology. Among the approaches that are classified as radical approaches, are the Rapid Application Development (RAD) and eXtreme Programming (XP).

As indicated in the introduction, these specific methodologies are not discussed in this dissertation, but a discussion is available in [Fitzgerald et al. \(2002\)](#).

3.2.2 Roles of Methodologies

Figure 3.4 illustrates the roles methodologies play. The roles methodologies play, justify formalized methodologies and influence the method-in-action. The rational roles form the theoretical basis supporting the use of formalized methodologies. Political roles serve to influence the derivation of the method-in-action.



Rational Roles

The rational roles played by methodologies are based on the factors that support the use of systems development methodologies. The rational roles that justify the formalized methodologies and influence the Method-in-Action are the following:

-  Methodologies reduce the complexity of information systems development.
-  Methodologies facilitate project management and control.
-  Methodologies divide labour amongst developers, which reduces the development time and improves quality.
-  A methodology ensures a structured way of development which systematizes development knowledge.
-  A methodology gives standardization to the development process.

Political Roles

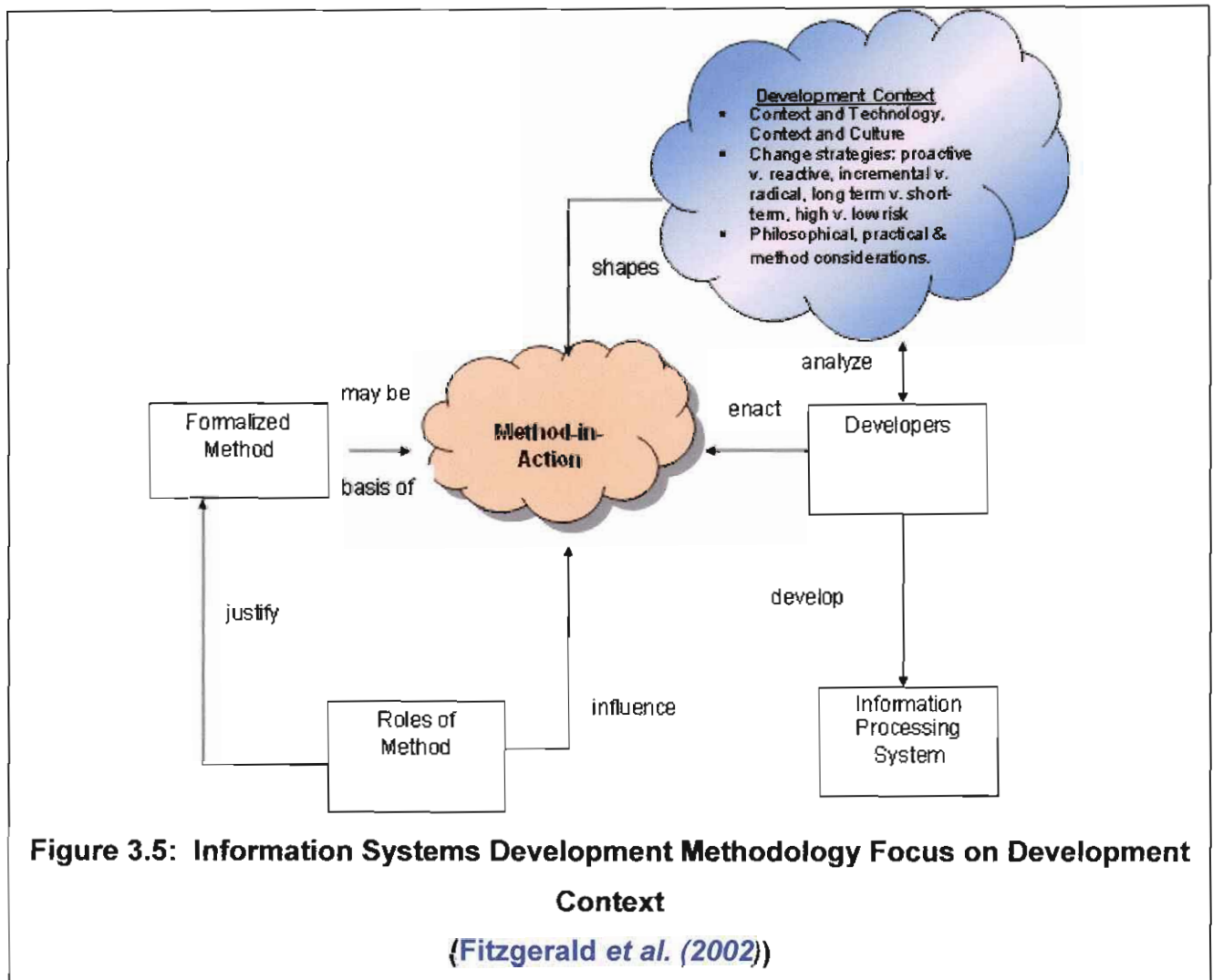
The political roles that justify the formalized methodologies and influence the Method-in-Action are the following:

-  Methodologies make information systems development work more professional.
-  The information systems department is more proactive in strategy formulation, thanks to methodologies.
-  The use of methodologies provides comfort and confidence to the developers.
-  Audit trail of a methodology provides protection in case design decisions turn out to be wrong in the future.

-  Legitimacy factor: Organizations claim to use a methodology to achieve ISO-certification or to attain CMM-compliance.
-  Methodologies are frequently used to provide a power base for method-champions, who might use the methodology to improve their profile within the organization.

3.2.3 Development Context

The foundation of information systems development is the development context. In this section the focus will be on the development context, and the different contexts will be briefly discussed. Figure 3.5 presents the different contexts for information systems development.



An information system lies in a specific context and must be developed within that particular context. A context is always a unique situation and never appears twice. Information systems must be created, designed and developed for a specific situation in a specific context. Thus the context is extremely important when one develops an

information system. Therefore it is complex. The technology, functionality, usefulness, efficiency, and difficulty of use are all characteristics of an information system that need to be considered within a particular context.

The context of an information system could be the environment where the information system will be implemented as well as the environment where the development process will take place. The context is known to be problematic and requires adjustment. An existing context must be transformed into a new and more desirable context. This is done with the help of an information system and is the responsibility of the developer. During the development of information systems throughout the years, the importance of the development context was not always acknowledged. The belief in the early years was that the development of a system must be guided by the idea of the context-free system and the context-free development process. The belief of a context-free development process has also been confronted. This has led to a variety of development methodologies.

Context and Technology

When one studies the different contexts, the question arises: "What is the relationship between changes in context and changes in technology?" New technology is a daily challenge to almost every organization. New technological advancements make it possible to perform organizational tasks in a different way. The internal capability of the organizations change parallel to the technological advancements. The interpretation of the relationship between technology and context results in the possible adoption of different strategies.

Context and Culture

Every organization has some kind of culture. This culture is something which was developed over time and is a collection of experiences uttered in a set of beliefs and values. A culture will pressure what is and what is not possible to do within a specific context. Organizational cultures have a powerful influence on the approach of information systems.

Strategies for Change

Every development project needs a strategic approach. It is never easy to determine a strategy, because of the unclear and difficult detectable differentiation between different strategies. Every context is unique, and every context influences the decision on how change will be approached.

Every context contains tradition and culture of how change is to be approached. There are different strategies which can be followed to accomplish change. These various strategies for change are always blended and cannot be easily defined. Some conflict exists between these various strategies. These conflicting strategies are:

-  Proactive versus Reactive strategies.
-  Problem-solving versus Innovative strategies.
-  Incremental versus Radical strategies.
-  Long-term versus Short-term strategies.
-  High-risk versus Low-risk strategies.

Philosophical, practical and method considerations

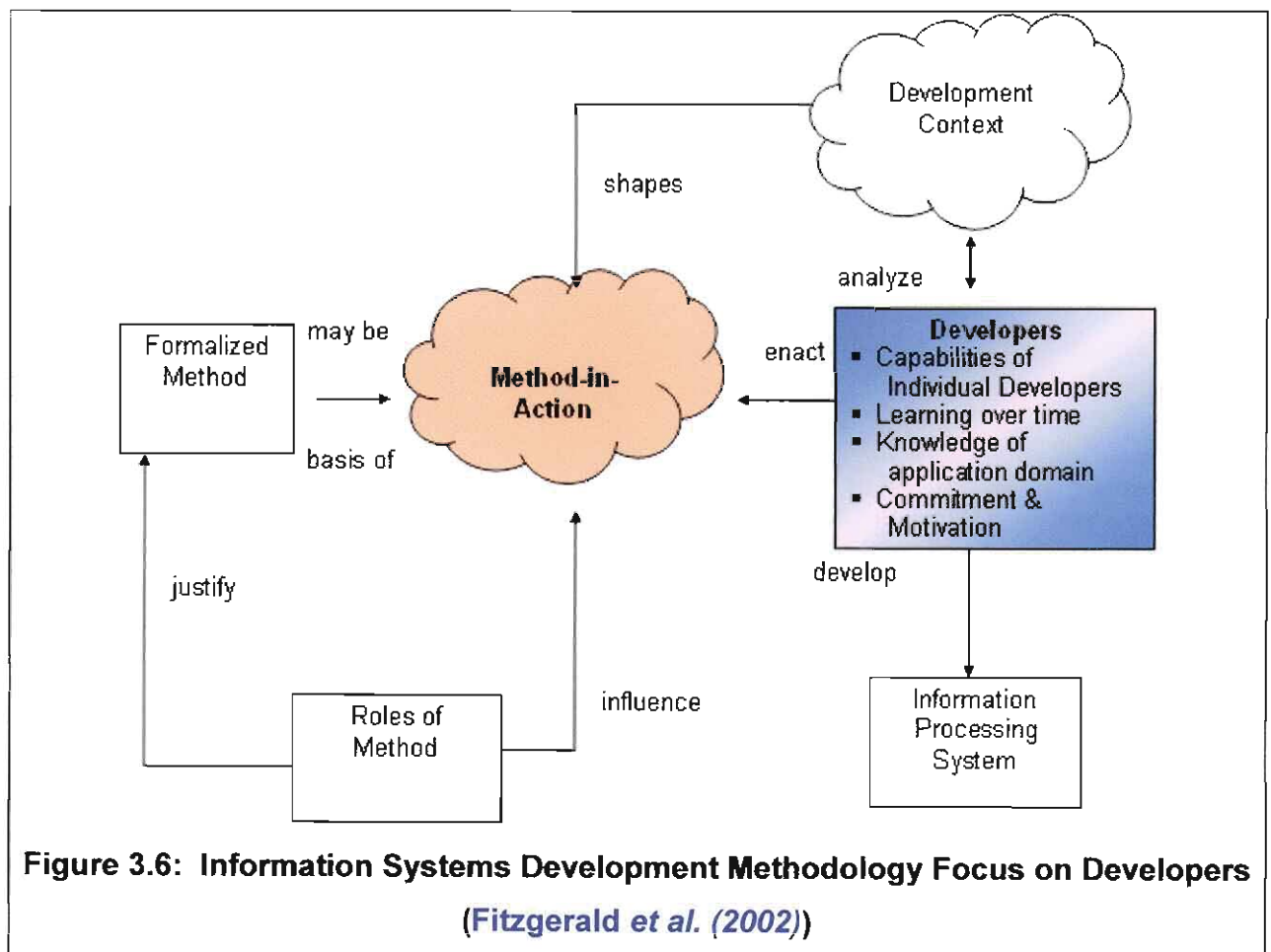
There are some *philosophical* concerns significant to understanding a context in the best possible way. Firstly, it is important to know to what degree it is possible to find a true understanding of a context, and what this might mean. Analysis is always of great value and is very helpful in the development process, but it is not enough. From a philosophical point of view, the system which is developed is always a result of someone's imagination and judgment. The concerns of knowing how to study the context and to what degree, is always a result of judgment based on particular aspects of the context.

Apart from the philosophical consideration, there is also a *practical* matter. To study a context in detail can be a never-ending effort. For this reason and practical considerations, it is significantly important to know what to study and why. Judgment and intentions have to guide practical inquiries. Thus, the study of the context has to be guided by a purpose and also by an idea of what the intention behind a new information system might be.

As noted before, a context is always unique. Thus, to study a context in a *methodical* way is also uniquely associated with the context at hand. To use the same methodology to study different contexts is possible, but it cannot be done without including some kind of modification or adaptation of the methodology, thus a Methodology-in-Action must be configured, based on the requirements of the context.

3.2.4 Developers

It is a logical and known fact that it is people, not methodologies, who develop information systems. Therefore a central role is given to the developer. Methodologies are only guiding principles, an organizing set of foundations, which support developers in their responsibility to develop an information system. As illustrated in Figure 3.6, the developers analyze the development context, uniquely enact with the method-in-action, and develop the information processing system.



Capabilities of Individual Developers

Methodologies lay the focal point on the creation of a framework for the development process, as well as the specification of the procedures, tools and techniques. Much research is concerned with this aspect of methodologies, but very little attention is given to the developer – the one who makes development possible.

It is commonly understood that the developer has to be doing the right thing in an efficient and logical way. This is a clear example on how “being rational” is frequently described in formalized methodologies. Practitioners refer to rationality as an action or a decision which is understandable. When one understands the underlying principle behind an action, the action is said to be rational. One of the vital skills of a developer is the ability to communicate with users and clients. Communication is an essential part of development. Another important ability of developers is their academic skills. Developers consider both creative and analytic skills as essential.

All the complicated confrontations a developer is faced with are never easy to solve. There is no definite measurement to typify a system as accurate for a specific context. The ability used to make this decision is the developer's final judgment. The good judgment of a developer is the heart of any development process. Thus, when *“something cannot be handled in a methodical manner, it is often omitted from the prescriptive methodology”*.

Learning over time

When one studies the literature, it is obvious that there are different views on the use of methodologies. As noted before, some practitioners use a methodology with a positive attitude, while other developers refuse to use a systems development methodology.

There are two main issues:

-  There is a need to establish whether the low degree of methodology use can be said to be the result of an ignorant attitude from the developers.

- ❏ It is required to determine whether a relation exists between the experience of the developers and the likeliness to use a systems development methodology.

Whether or not development experience has an influence on the use of systems development methodologies, is a debate in progress. Some practitioners argue that an experienced developer will recognize the benefits of a methodology and therefore they will use a systems development methodology. Other practitioners argue against this statement. They state that experienced developers will realize the constraints of a methodology and will therefore not use a systems development methodology.

Knowledge of application domain

Regardless of arguments in favour of and against the use of methodologies related to experienced developers, is the fact that knowledge concerning the application environment is essential to guarantee successful system development. According to empirical research done by [Fitzgerald et al. \(2002\)](#), information system managers tend to rate knowledge concerning the application domain higher than technical expertise.

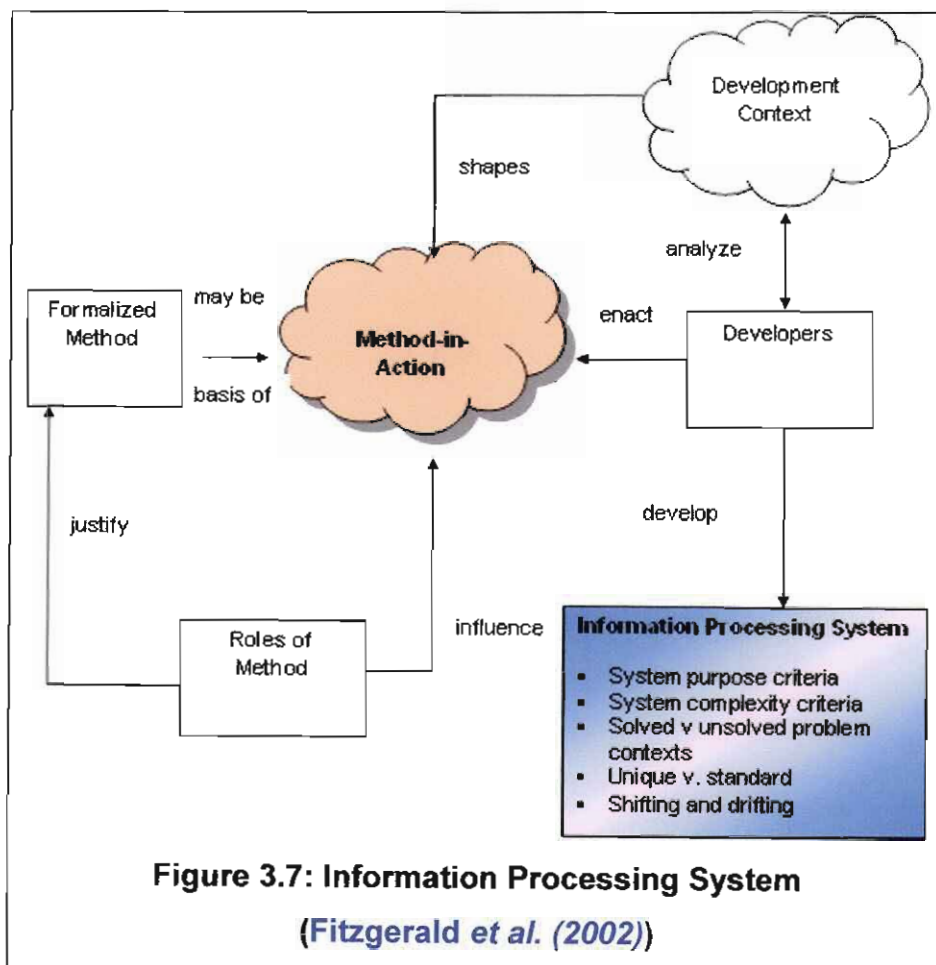
Commitment and Motivation

Commitment and motivation is related to the developer's capabilities mentioned above. Research proved that commitment and motivation is also rated higher than technical expertise, because working after hours is inevitable. An important factor to be considered by information systems managers is that, in order to keep their developers committed, it is important to keep them motivated. Another related factor is that of trust in individual developers.

Without the developer's central role in information systems development, the methodology-in-action is not possible.

3.2.5 Information Processing System

As presented in Figure 3.7, Information processing systems are developed by Developers. Information systems development is aimed at the designing, producing and implementing a system within a context. It is essential to information systems development to be aware of the prosperity and variety of systems. The system to be developed can have a considerable influence on the development process, even if the development process has not yet been initiated.



When a development process is initiated, it is important to understand the characteristics which should be contained by the system-to-be, so that the developer could know what kind of development approach should be followed.

System purpose criteria

It is important to note the purpose to which the intended systems have to respond to. For example, there are significant differences between systems developed for the purpose of entertainment and systems developed for the purpose of business. A system developed for business purposes has the key characteristics of simplicity in structure, control for errors and a simple basic structure, with speed as the main interest. An entertainment system has the key characteristics of friendliness of the user interface, the experience of playing, surprises and challenges. Information systems are mostly popular for their ability to search, explore, navigate, etc. (Fitzgerald *et al.*, 2002; Iivari & Maansari, 1998).

System complexity criteria

Complexity is a characteristic of information systems which will never disappear. This complexity is seen to be blamed on the size of the information system. The larger the size of the system the more complex the system will be. Interaction is a great challenge of information systems, which increases the complexity of the system. The Method-in-Action in a specific context can be enacted when the type of complexity which influences the methodologies has been determined.

Solved versus Unsolved problem contexts

Systems can also be typified as *solved systems* or *unsolved systems*. A solved system is a system which is responsible for administrative duties such as accounts, invoices, payrolls and databases. Unsolved systems represent systems which have never been developed before, due to new technologies or the movement into a new business paradigm. Another aspect which is very close to solved and unsolved systems is the new and old technologies. New technologies reveal new possibilities; hence new unsolved systems are created. Old technologies are systems which have survived the changes in technology and thus result in solved systems.

Unique versus Standard

To some extent, all systems are unique, since they are situated in different contexts. The total socio-technical system is therefore always unique. But, at the same time it is always possible to ignore the uniqueness and to have the context adapt to a standard system.

Shifting and drifting

Most information systems are developed all the way through a process of change with the purpose of attaining an established state. The inspiration is that once systems are confirmed and put into practice, systems are presumed to work and be used over time in the proposed way.

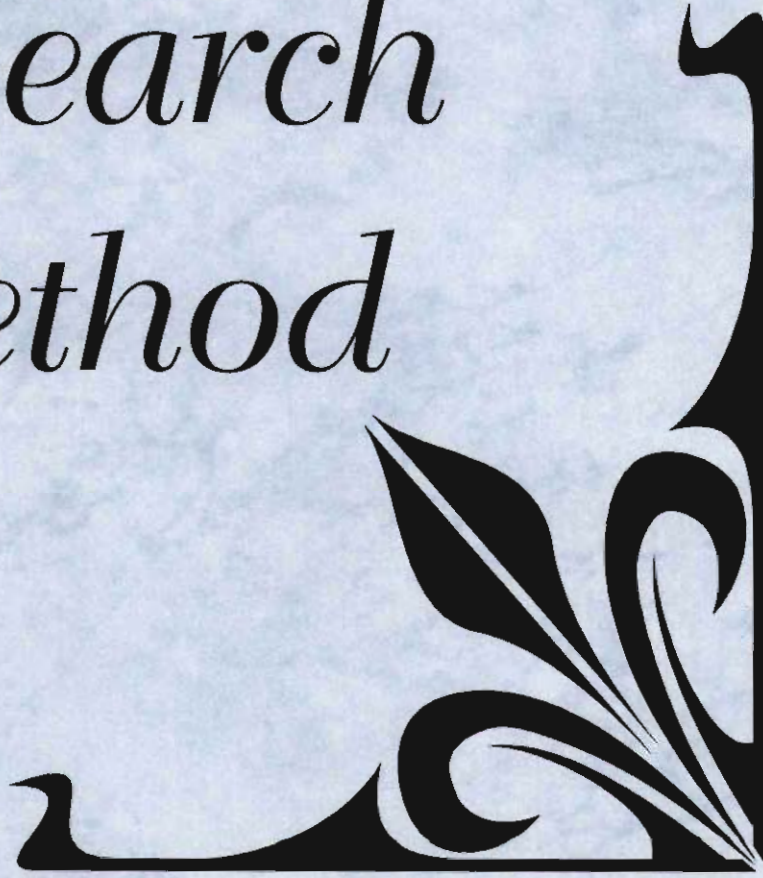
3.3 Chapter Summary

In this chapter, the method-in-action framework as defined by [Fitzgerald *et al.* \(2002\)](#) was discussed. This framework consists of the following components: formalized methods, roles of methods, the development context, the developers, and the information processing system. Each one of these components was discussed in detail.



Chapter 4

Research Method





Chapter 5

Results



CHAPTER 5

RESULTS

5.1 Introduction

The layout of this chapter is visually presented in Figure 5.1. The aim of this chapter is to present the results that were obtained during the case studies. Each case study will be discussed as follows: Firstly, background information of the company will be provided. The results obtained from the interviews and the questionnaires will be presented. The combined results for the three cases will follow with a summary at the end the chapter.

As stated in Chapter 1, the purpose of this research is to investigate the adaptation of systems development methodologies in South Africa. This problem was investigated by addressing the following questions:

-  What are the perceptions of systems developers regarding systems development methodologies?
-  Why do system developers adapt system development methodologies?
-  How do they adapt the methodologies?
-  Is there a difference in the quality of the systems that are developed with these adapted systems development methodologies opposed to those systems that are developed according to a specific formalized methodology?

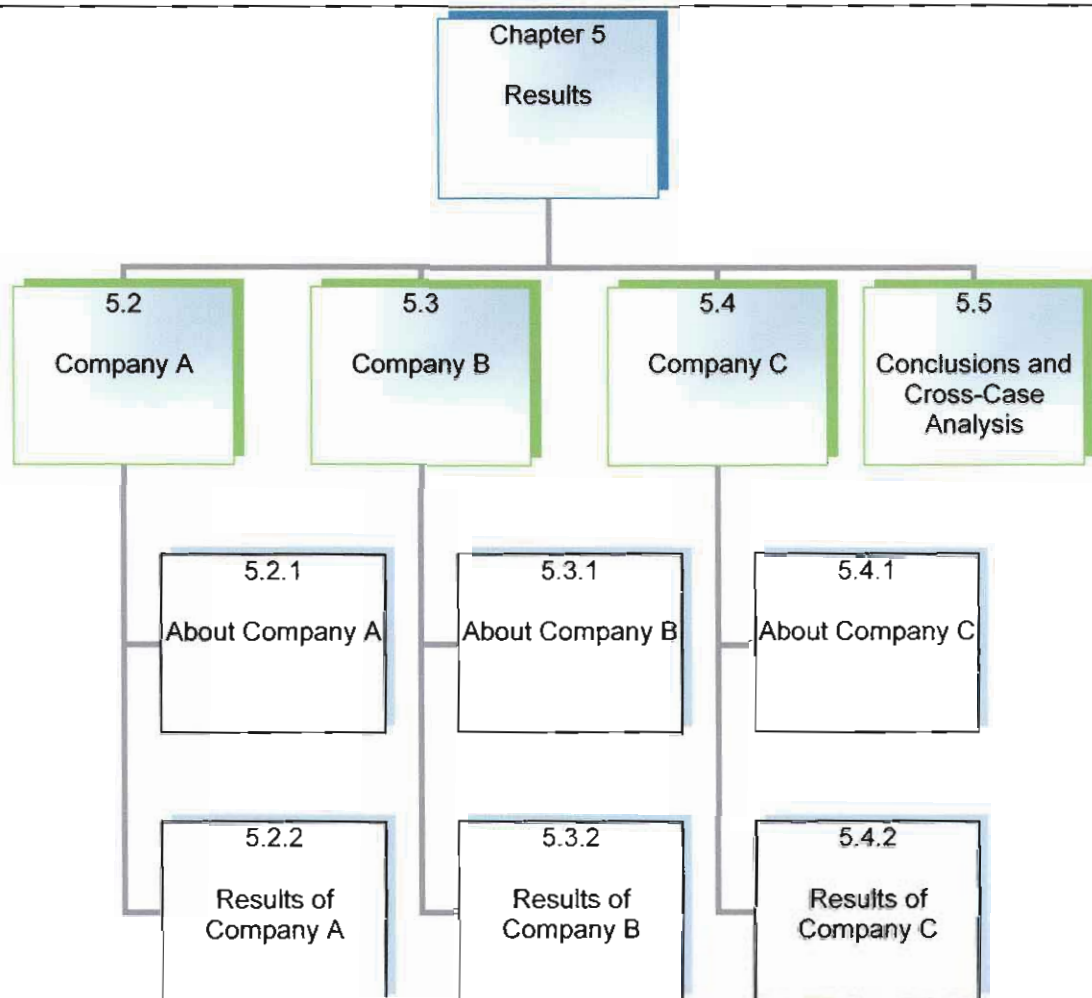


Figure 5.1: Results

In order to address these questions, case studies were performed at three companies in South Africa. Qualitative research methods have been used to collect the data (qualitative interviewing techniques and open-ended questionnaires). To analyze the data, qualitative data analysis methods (content analysis and cross-case analysis) were used, assisted by the software package ATLAS.ti. For each case, content analysis was performed separately on both the transcribed interviews and the questionnaires in order to obtain the results for the organization. This was followed by cross-case analysis on the results of the three organizations in order to obtain the propositions in this study. After the data analysis phases had been completed, the propositions were confirmed by making use of member checking.

In this chapter the results will be presented, structured according to the research questions posed. Firstly, the perceptions of systems developers regarding systems development methodologies will be reported, followed by the reasons why systems methodologies are being adapted will follow. A description of how systems development methodologies are adapted. Finally, the perceived difference between systems developed with formalized methodologies, opposed to those developed with adapted methodologies will be discussed. The results are presented separately for each company according to the above-mentioned structure.

5.2 Case Study 1

5.2.1 Background information for Company A

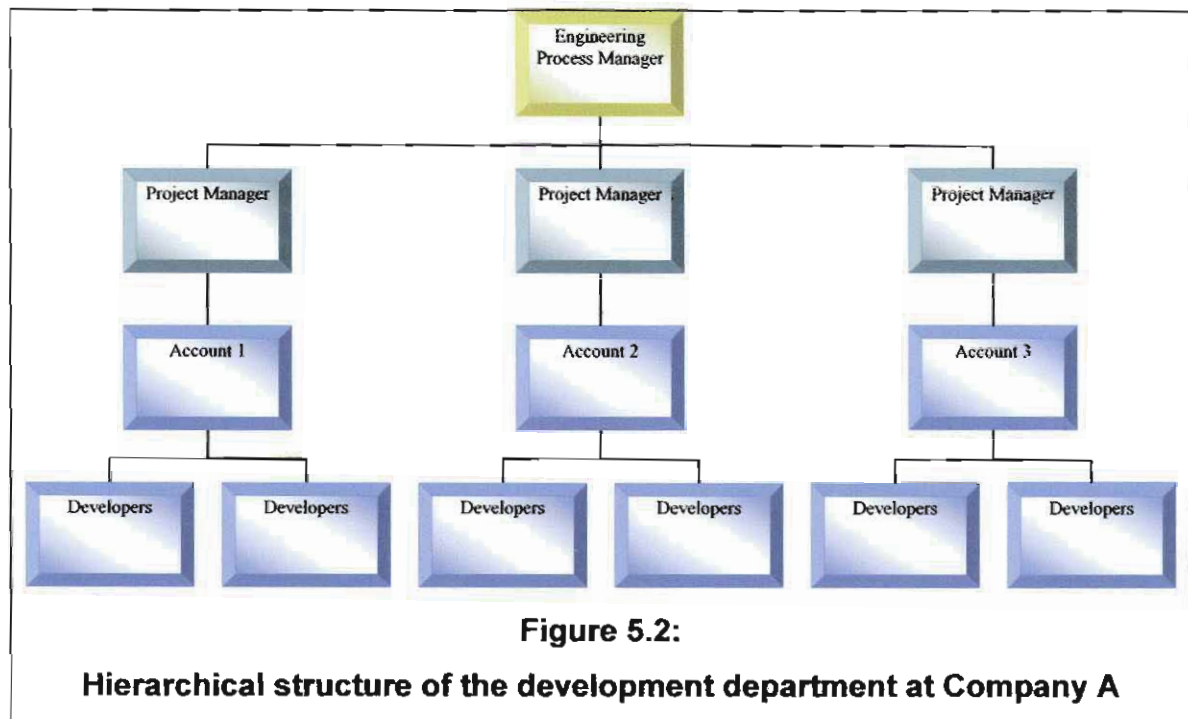
Company A is an international company who strives to lead in the creation, development and manufacture of the industry's most advanced information technologies, including computer systems, software, networking systems, storage devices and microelectronics. Company A's worldwide network of professionals translate these advanced technologies into business value for their customers.

Company A has a clean-desk policy for security purposes – you may not leave your desk if there are any papers lying around. Everyone at company A, except the executives, have an open-plan office. The purpose of the open-plan offices is to enhance communication and improve relationships between employees.

Company A uses an IP – Intellectual Property. It is a database that contains all the work being done. It consists of templates, processes, methods, etc. The purpose of the IP is to enhance re-usability of work that has already been done. This IP is available worldwide for employees of company A. Company A is very enthusiastic about the IP.

The hierarchical structure of the development department is shown in Figure 5.2. Developers at company A are divided into three groups. Each group works on a different account under a different project manager. The project managers report to the process manager.

The process manager of company A is responsible for the achievement of the CMMI levels of the company. At the end of 2005, Company A achieved Level 3 of the CMMI. They are now working towards achieving Level 4.



Even though the developers are divided into groups, each developer works independently. Company A has 40 developers. Some of these developers were hired from software development contracting houses.

The Case Study at Company A was performed in South Africa, but Company A is an international company with approximately 210 branches all over the world.

5.2.2 Data Collection at Company A

Company A was chosen for data collection because it is well known that they use a systems development methodology. The purpose of this dissertation was to investigate whether they adapt the methodology or not and the reasons for the adaptation.

Interviews

Data were collected from Company A by interviewing 7 developers and 1 project manager. A semi-structured format was followed to conduct the interviews. The reason for using a semi-structured format was to collect not only the information sought by the researcher, but also unanticipated information. This goal was achieved by the use of both open-ended and specific questions. (Seaman, 1999) The case study was performed at the premises of Company A and lasted 5 days. Each interview was recorded to maintain data quality, and was handled with great care and confidentiality. According to university policy, no ethical approval is needed for the research done in this dissertation.

The interviews were done anonymously, i.e no names were mentioned during the recording of the interview. The interviews were transcribed by listening to the recordings and typing it into 16 pages of transcripts. The duration of the interviews varied between 15 and 30 minutes, depending on the co-operation and talkativeness of the interviewee. The interviews were member checked by sending the results to the company and incorporated their feedback into the results.

One of the developers at Company A refused to be recorded. He was afraid it will influence his position at the company. He didn't believe that the data collected will be used anonymously and confidential. Due to his lack of trust, his answers to the questions in the interview were very short and uncooperative. This Interview will be eliminated from the results.

Background of Interviewees

AI1 is a very confident individual who started at the company as a student 5 years ago. She has proven herself to be hardworking and ambitious. In only 5 years AI1 has progressed from a software developer to a project manager on one of the company's largest accounts. She is also a Component Business Modeling (CBM) Subject Matter Expert (SME) for Company A's Business Consulting Services in South Africa. AI1 had training in methodologies during her orientation at Company A. She works in various areas within Company A as well as in various business units. Thus, AI1 has great experience of the use of systems development methodologies.

AI2 is a Team Leader at Company A who leads a team of 5 developers. AI2 had a career in development at a previous company where she had worked very closely with the definition of the company's processes and methodologies. Thus, AI2 also has great experience of the use of systems development methodologies.

As explained in Section 2.2 of this chapter, **AI3** refused to co-operate in the study due to a lack of trust. A background check revealed that AI3 has health issues, which could explain his behavior. Due to his uncooperativeness his results will be eliminated from the study.

AI4 refers to two individuals. Both of the interviewees are project managers are working on the same account and requested to be interviewed simultaneously, because they felt that they could add to each others' answers and improve the study. Both of the interviewees have been working at Company A for several years and both of them started off as developers. Thus, they both know a great deal about the use of systems development methodologies. AI4 is responsible for support application portfolios. The type of applications being developed by AI4 are management systems and financial systems. AI4 is also responsible for new development as well as support and improvements on existing systems.

AI5 is a developer at Company A with more than 8 years experience. AI5 is a junior employee.

AI6 is a developer who is not very familiar with the terms and conditions of Company A. AI6 is a developer of a contracting house who works on a contract basis at Company A. Interviewee 6 started working at Company A about 3 months before Case Study A was conducted. Due to her lack of knowledge about Company A, she only participated in 4 questions.

AI7 is a young introvert who started at Company A as an intern after he completed his IT degree. AI7 has finished his internship and has been employed for the past 2 years as a permanent employee of Company A.

AI8 is an introvert who is employed as a developer at Company A. AI8 has several years of experience in development and specifically development at Company A. He has been employed for approximately 6 years at Company A.

A summary of the background information of the interviewees is presented in Tabel 5.1.

	Role in company	Experience
AI1	Project Manager	5 Years experience in Company A.
AI2	Team Leader	Career in development.
AI3		Eliminated from study.
AI4	Project Managers	Been working at Company A for several years and started off as developers.
AI5	Developer	More than 8 Years experience.
AI6	Developer	Contracting house employee. 3 months experience at Company A.
AI7	Developer	2 Years experience at Company A.
AI8	Developer	Approximately 6 years experience at Company A.
Table 5.1: Background of Interviewees at Company A		

Questionnaires

Questionnaires with open-ended questions were also used to collect data at Company A. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. Please refer to Chapter 4 (Table 4.2) for an example of the questionnaire. 16 Questionnaires were handed out and 16 questionnaires were completed and received.

The individuals were asked how long they had been working for the company. The purpose of this question was to know how well they knew the environment. The respondents have been employed for an average of 6 years in Company A.

The roles of the respondents at Company A are as follows:

-  8 Developers
-  1 IT Consultant
-  1 Programmer / Analyst
-  3 Project Managers
-  1 SEPG (Software Engineering Process Group) Manager
-  2 IT Specialists

5.2.3 Results for Company A

Data were collected at Company A by using interviews and open-ended questionnaires. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. The open-ended questionnaires were designed, based on the questions of the qualitative interviews.

This data were analyzed as follows. All interviews were transcribed, and Ms Word documents were created for the questionnaires. Content analysis was performed on the transcribed interviews and the Word documents of the questionnaires separately using the ATLAS.ti software. Propositions obtained after the data analysis of the interviews were

verified with the data obtained from the questionnaires. The results obtained from the two analyses were then combined to form the propositions for the organization.

The following notation is used to indicate whether a result was obtained from an interviewee or a questionnaire: Company-Interviewee/Questionnaire-Number of Individual, i.e. AI3 for Company A, Interviewee 3 or AQ5 for Company A, questionnaire 5.

THE USE OF SYSTEMS DEVELOPMENT METHODOLOGIES IN COMPANY A

Use of Systems Development Methodologies

Five of the seven interviewees stated explicitly that they used a systems development methodology (AI1, AI2, AI5, AI7, AI8). Two interviewees (AI4, AI6) didn't mention it explicitly but based on their responses during the interview the researcher could conclude that they did use systems development methodologies. 15 questionnaire respondents indicated that they are using a systems development methodology (AQ1, AQ2, AQ4, AQ5, AQ6, AQ7, AQ8, AQ9, AQ10, AQ11, AQ12, AQ13, AQ14, AQ15, AQ16). One of the questionnaire respondents (AQ3) indicated that he was not using a systems development methodology due to a lack of knowledge. AQ3 uses the "bottom-up approach and experience" to perform development.

Mandatory vs Voluntary use

Regarding the voluntariness of systems development methodologies use, it is company policy that the systems development methodology must be used. AI1 claims that the use of systems development methodologies is mandatory at company A: "...it is something that we must follow...". This view is also expressed by AQ8 and AQ11. Although the use of the systems development methodology is mandatory, it is not enforced. This is illustrated by

the following remark: “I don’t force people” (AI1). AI2 also indicated that use of the systems development methodology is not enforced: “...if we feel we want to use it” and “We pick out what would be of benefit”. Thus, it could be concluded that although the use of systems development methodologies are mandatory, it is not enforced by senior employees of Company A.

Single vs Multiple Systems Development Methodologies

In company A more than one Systems Development Methodology is used on a single project. AI1 speaks of “a lot of ‘Company A’s’ methodologies”. AI2 mentioned “a number of methodologies” and claims that Company A is using more than one methodology on a single project. AI8 claims that methodologies are combined during some development processes. AQ1 and AQ5 also indicated that they use multiple systems development methodologies to develop systems.

It is evident that company A uses multiple methodologies. A variety of methodologies and systems development approaches were mentioned by the interviewees and the questionnaire respondents, i.e.:

-  GS Method (AI4, AQ2, AQ6, AQ8, AQ11, AQ12)
-  RUP (AI7, AQ1, AQ5)
-  Agile Custom Method (AQ1)
-  SDLC / Waterfall methodology (AQ5, AQ10, AQ13, AQ14, AQ15, AQ16)
-  AMS-MS (Application Management System – Management System) (AQ9, AQ11)

Definition of a Systems Development Methodology

According to [livari et al. \(1999\)](#), there are almost just as many definitions for a systems development methodology as there are methodologies. When one tries to define a systems development methodology, one will notice that there is no universally accepted definition. This debate was discussed in Chapter 2 of this dissertation, but has also been confirmed by the data collected from Company A.

Company A generally uses the term “process” to indicate a systems development methodology. When the Interviewees were asked to define a systems development methodology, their definitions of the term varied. AI1 defined a methodology as **guidelines**, a **process**, as well as **stepped approach**. AI5 also defined a methodology as a **process**. AI6 defined a methodology as a **process** and a **template for a process**. AI7 defined a methodology as **steps**. AI2 defines a methodology as a “...**method** that you follow to perform certain functions”. AI8 defined a methodology as a **standard way of performing systems development**. It seems that in one company no universal definition for the term exists.

PERCEPTIONS OF SYSTEM DEVELOPERS REGARDING SYSTEMS DEVELOPMENT METHODOLOGIES

Advantages of Systems Development Methodologies

The Interviewees of Company A mentioned several advantages of systems development methodologies. These advantages can be grouped as follows: systems development methodologies improve the development process; systems development methodologies improvement of the product; and standardization.

The first group of the perceived advantages of systems development methodologies is that it improves the development process. According to AI5 using systems development methodologies “... is a reflection discipline”. The development process is improved because

systems development methodologies **offer guidance and provide structure** during the development process. This view was expressed by numerous interviewees and respondents of the questionnaires, as indicated by the following remarks:

-  "Ensures a more organized way of development" (AI4)
-  "Ensures guidance" (AI1, AQ1, AQ15)
-  "Ensures a pattern for development" (AI7)
-  "Gives you a procedure to follow" (AI2)
-  "Ensures structure" (AI1, AI7, AI8, AQ2, AQ5, AQ7, AQ13, AQ15)

By using systems development methodologies the development process becomes more **efficient** (AQ15, AQ16). The development process becomes faster and the process is simplified. This was reflected by the following remarks:

-  "Makes the development process easier" (AI5, AQ15, AQ16)
-  "Enhance the development speed" (AI1, AQ6, AQ14)

Management of the development process is also improved. AI1 stated that systems development methodologies "...ensure the managing of the progress". System development methodologies provide "...control of scope and deliverables" (AQ1) and "...improves team work" (AQ14). According to AI4 systems development methodologies "...ensure a professional relationship when handling a client".

Another advantage of systems development methodologies that improve the process are the assistance that is offered with the company's measurements to **comply with CMMI**: "Helps companies with their measurements to comply with CMMI" (AI1, AQ4).

It was also mentioned that systems development methodologies enable re-use of the **Intellectual Property** (AQ4, AQ6).

Accountability is a further advantage offered by systems development methodologies. Systems development methodologies "...protect the developers and the company" (AI4).

The second group of the perceived advantages of systems development methodologies is that it improves the developed product. The use of systems development methodologies “...**ensures better quality**” (AI1, AI4, AI6, AQ9) of the developed system. This improvement can be contributed to the fact that methodologies “...help to investigate user requests” (AQ10) and therefore lead to a “...better understanding of what needs to be done” (AQ15). This insight into the system ensures “... **better use of the system**” (AI6). Furthermore, **maintenance** to the system is simplified (AI2, AQ12, AQ13).

Another important advantage offered by systems development methodologies, is the improvement of **standardization** (AI1, AI5, AQ9, AQ13). Standardization is important to ensure consistency and uniformity amongst different projects (AI1, AI2, AQ4, AQ9). It also leads to “...repeatable successful implementation” (AQ12) of systems.

Disadvantages of Systems Development Methodologies

Systems development methodologies also have several disadvantages. During the Case Study at Company A, the following disadvantages were mentioned:

One of the most important disadvantages is that system development methodologies are very **time consuming** (AI1, AI2, AI4, AI6, AI7, AI8, AQ5), for example, AI2 mentioned that systems development methodologies “takes a lot of time”. Furthermore, systems development methodologies have a **very long learning curve** (AI5).

Some of the interviewees and the respondents of the questionnaires also felt that systems development methodologies are **over-compensating** (AI1, AI2, AI4). They felt that systems development methodologies “...have too much diagrams” (AI2), “...too much documentation” (AI2, AQ4), and “...provides unnecessary additional administration (AI5)..

It was also mentioned by AI6 that systems development methodologies “...**constrain your initiative and creativity**” and that it “...Keep you from being ambitious in your development style”.

AI7 was of the opinion that systems development methodologies are too **costly**.

Another disadvantage of systems development methodologies is that it is **not universally applicable** (AI2, AI4, AI6). Every project is unique and there is no one systems development methodology that could be used for all projects in all environments.

Lastly, systems development methodologies need to be **managed** and guidelines need to be provided on how to use the methodology (AI4, AI6).

WHY SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

On the question whether they use the methodology exactly as it is intended to be used or not, the responses were as follows: 11 of the 16 respondents of the questionnaires indicated that they adapted systems development methodologies (AQ1, AQ2, AQ4, AQ5, AQ6, AQ7, AQ8, AQ9, AQ11, AQ12, AQ16), and 3 of the 7 interviewees indicated that adaptation of systems development methodologies take place (AI1, AI2, AI8). AI2 mentioned that "...each individual can choose what is relevant to the development process".

However, AI5, AI7, AQ10, AQ13, AQ14 and AQ15 contradicted all the other Interviewees and respondents of the questionnaires by indicating that Company A makes no adaptation to their adapted methodologies. According to them the adapted methodologies are being used exactly as it is intended to being used. The contradiction of AI5 and AI7 could be explained by their youth. Both Interviewees are inexperienced, which indicates that they follow a formalized methodology which provides guidance.

One can conclude that the majority of individuals claim that adaptation of the systems development methodology takes place. These individuals were further asked whether they used the adapted methodology exactly as it is, or whether they make adaptations to the adapted methodology. 7 Individuals indicated that they adapt the adapted methodology

(AQ1, AQ4, AQ6, AQ7, AQ8, AQ9, AQ16), while 2 indicated that they do not adapt the adapted methodology (AQ11, AQ12).

Reasons for Systems Development Methodology Adaptation

Company A make adaptations to their system development methodology. The reasons for adaptation mentioned by the individuals will be discussed next.

It was mentioned by AQ1 that adaptation **adds value to the *development process***. The development process becomes more efficient (AQ6, AQ12).

The responses indicated that some systems developers are satisfied with the current methodology and that they would rather adapt the current methodology than using another methodology. For example, it was mentioned by AQ1 and AQ12 that the “current methodology is one of the best known”. However, some developers indicated that the current systems development methodology is a company requirement (AQ2, AQ12) and no other methodology is approved for use (AQ6, AQ11, AQ12). Therefore, adaptation make the current systems development methodologies more ***practical or useful*** (AQ6, AQ12). The use of this adapted current methodology has the advantage that it increases the consistency amongst projects in the organization (AQ1).

Another reason for the adaptation of systems development methodologies is because of ***time limitations***. Limited time and resources lead to the need for adaptation to speed up the development process (AI1, AQ1, AQ7, AQ9). Great pressure exists to finish a project within a specific time constraint. The learning curve for a new methodology is very long (AQ6, AQ7). Therefore, because there is no time to study a new methodology, the road of systems development methodology adaptation is followed.

Every project varies from the previous one. No systems development methodology can handle all ***types of projects*** (AI1, AQ5, AQ12). This calls for the adaptation of methodologies (AI1).

Furthermore, no one methodology can be applicable in every situation and every **environment** (AI1, AQ5, AQ12). Every environment has its own new requirements which need a methodology to be adapted in order to be applicable to the situation.

Some developers expressed the view that systems development methodologies are **over-compensating**. It was mentioned that existing methodologies have too much documentation (AI1, AQ7) and that it was an over-kill (AQ11). The methodology is therefore adapted to make it more applicable.

Company A has achieved level 3 of the CMMI and is currently working towards achieving level 4. AQ1 and AQ11 mentioned that systems development methodologies are adapted to comply with the **CMMI standards**.

During the development process, the requirements for the product often changes. This result in the adaptation of systems development methodologies in order to provide for these **changed requirements** (AI8, AQ9). This leads to increased customer satisfaction (AQ2, AQ5).

HOW SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Systems development methodology adaptation in Company A is mainly done by adding and removing steps. The combining of different methodologies and switching between different methodologies also occur. According to AI1 and AI2, adaptation is being done by **adding steps**, as well as **removing steps** (AQ1, AQ4, AQ7, AQ8, AQ9). According to AI8, adaptation is done by **switching** to rapid development. Another way of adaptation, according to AI8, is the **combining** of different methodologies.

Process of approving Systems Development Methodology Adaptation at Company A

AI1 and AI2 claim that Company A has no formal process for the adaptation of systems development methodologies. AI1 claim that the Project Manager decides on her own about the adaptations that need to be made, while AI2 claims that the team may sit down and discuss the changes they would like to make to the methodology. According to AI1 and AI8 junior staff is not allowed to make adaptations to systems development methodologies – the project management must approve all adaptations that are made.

AI8, AQ1, AQ2, AQ4, AQ5, AQ6, AQ7, AQ9, AQ11 and AQ12 contradicted AI1 and AI2 by claiming that Company A had a formal process for the approval of the adaptation of systems development methodologies. AI8 also stated that adaptation needed to be tested by comparing the results with the goals set by the scope of the system.

Thus, it could be concluded that the process for approval depends on the job role of the Interviewee at Company A. For senior staff, there is no formal process, because they are approving the adaptation to the methodologies. Junior staff needs to follow a formal process to get approval from senior staff for the adaptation of systems development methodologies.

QUALITY OF SYSTEMS DEVELOPED WITH ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES VS QUALITY OF SYSTEMS DEVELOPED WITH FORMALIZED METHODOLOGIES

Very different opinions were viewed regarding the above topic. According to AI1, **adaptation** has a positive influence on quality. This view is also reflected by AQ11 who stated that an adapted methodology produces improved systems, and by AQ7 who stated that an adapted methodology is quicker to use than a formalized methodology. However, AI7, AQ1 and AQ6 contradicted this view by stating that *formalized methodologies* results in better quality products. On the other hand, according to AI2 and AI5, adapted

methodologies and formalized methodologies results in the *same quality* products because one has the power to choose that which would be of benefit.

The following *concerns regarding adaptation* were expressed. AI4 felt that adaptation reduced the quality of large systems. According to AI8, the adaptation of systems development methodologies also has disadvantages. He claims that the adaptation of a systems development methodology increases the duration of the project. AI8 also stated that adaptation has a negative influence on the requirements and the quality of the project.

AQ5, AQ7 and AQ12 indicated that the amount of documentation tend to be more when a *formalized methodology* is being used.

From the above it is clear that no agreement exists between the systems developer's results on the difference between systems developed with a formalized methodology and systems developed with an adapted methodology.

A summary of the above opinions are presented in Table 5.2 . From this summary one can conclude that formalized methodologies result in better quality products, but can increase in documentation. The opinions regarding the adapted methodologies are very contradictory. Two individuals felt that adapted systems development methodologies have a positive impact on quality, while two felt that it reduced quality. One individual felt that adapted systems development is quicker to use, while another one felt that it increases the duration of the project.

Formalized Methodologies	Adapted Methodologies
<u>Positive</u>  Results in better quality products (AI7, AQ1, AQ6)	<u>Positive</u>  Positive influence on quality (AI1, AQ11)  Quicker to use (AQ7)
<u>Negative</u>  Amount of documentation tend to be more (AQ5, AQ7, AQ12)	<u>Negative</u>  Reduces the quality of products (AI4, AI8)  Increases the time of the project (AI8)
Table 5.2: Company A's view on Formalized Methodologies vs Adapted Methodologies	

When one studies the results of Case Study 1 (Company A), it can be summarized by applying the framework of [Fitzgerald *et al.* \(2002\)](#) as shown in Figure 5.3.

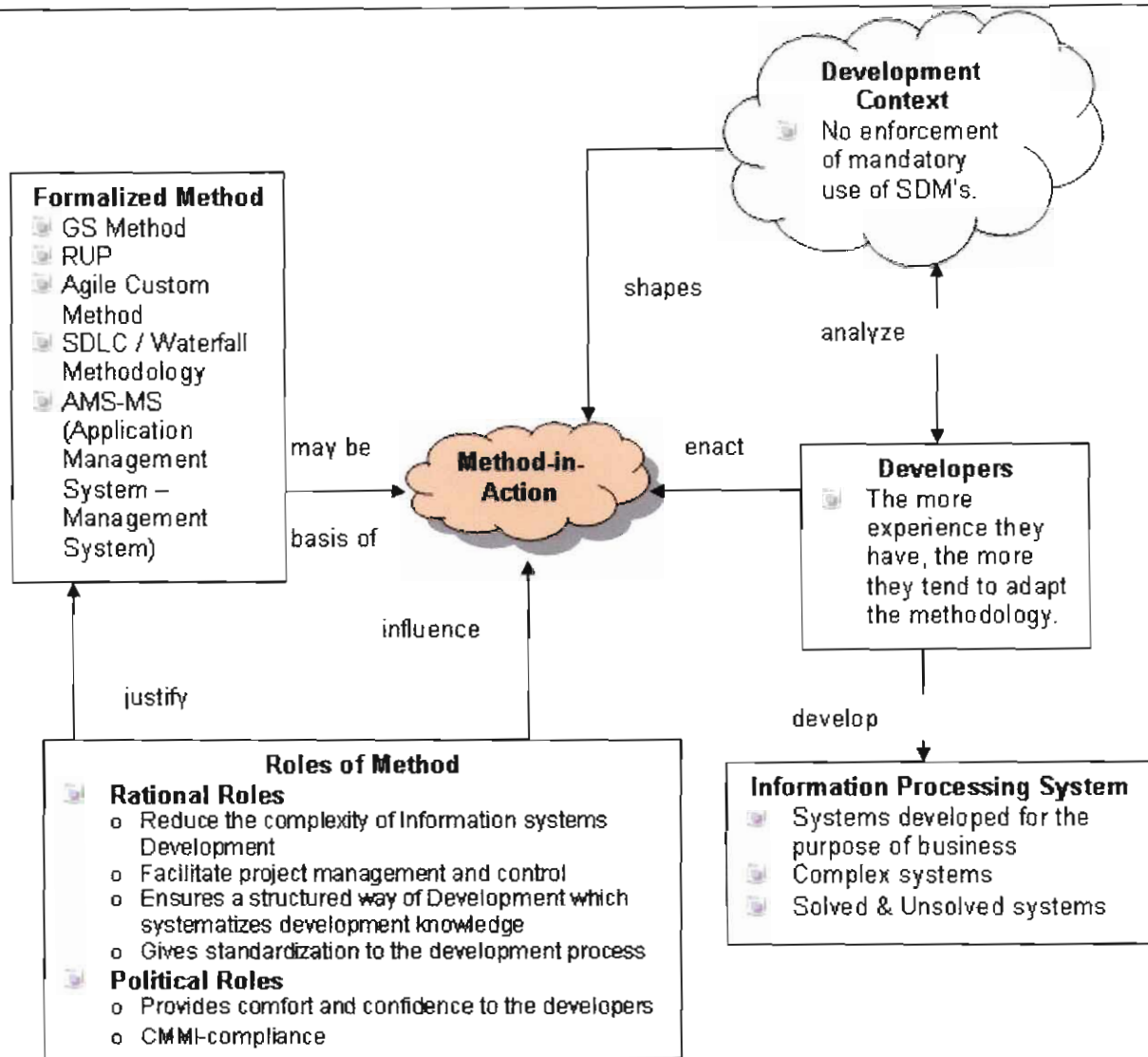


Figure 5.3: Framework applied to results of Company A

5.3 Case Study 2

5.3.1 Background information for Company B

Company B is a company in the banking industry who strives to become southern Africa's most highly rated and respected bank by their staff, clients, shareholders, regulators and communities. They claim to be great at listening, understanding clients' needs and delivering, which makes them different from other companies in the banking industry. Their values include integrity, respect, and accountability, pushing beyond boundaries and to be people-oriented.

A part of Company B's scope includes enabling and delivering solutions to agreed architecture, to provide software and application support to their clients and IT leadership.

Despite achieving their vision of becoming a respected bank, Company B has the aspirations to make the company a great place to work, a great place to bank, a great place to invest, unleashing synergies, world class at managing risk, community of leaders, living their values, leading transformation, be highly involved in the community and environment and be the most respected and aspirational brand.

The Case Study at Company B was performed in South Africa, it has a total of 475 branches all over South Africa. A distribution of the branches according to the regions as defined by Company B is displayed in the following table:

Region	Number of Branches
Kwazulu Natal	89
Johannesburg CBD & South	27
East Gauteng	66
West Gauteng	80
Free State, Vaal & North West	29
Western Cape: CBD & Southern Suburbs	12
Johannesburg East	9
Eastern and Western Cape	80
Western Cape: North & Winelands	24
Johannesburg Far East	4
KZN: Pietermaritzburg & Hinterland	4
Pretoria	4
Johannesburg West & Sandton	6
Unknown Region	7
Limpopo	11
Mpumalanga	8
KZN: Greater Durban & North Coast	6
Eastern Cape & Garden Route	8
Greater East London	1
Table 5.3: Distribution of Company B's Branches	

5.3.2 Data Collection at Company B

Company B was chosen for data collection because it is known that they are a banking organization that already uses a systems development methodology. The purpose of this dissertation is to investigate whether they adapt the methodology or not and, if so, the reasons for the adaptation.

Interviews

Data were collected from company B by interviewing 6 developers and 1 project manager. Each interview was recorded to maintain data quality, and was handled with great care and confidentiality. According to university policy, no ethical approval is needed for the research done in this dissertation.

The interviews were done anonymously (no names were mentioned during the recording of the interview). The interviews were transcribed by listening to the recordings and typing it into 15 pages of transcripts. The duration of the interviews varied between 20 and 60 minutes, depending on the co-operation and talkativeness of the interviewee. The interviews were member checked by sending the results to the company and incorporated their feedback into the results.

A semi-structured format was followed to conduct the interviews. The reason for using a semi-structured format was to collect not only the information sought by the researcher, but also unanticipated information. This goal was achieved by using both open-ended and specific questions. (Seaman, 1999)

Background of Interviewees

BI1 is an extrovert who has been employed for one year and four months at Company B. Company B is his first major corporate job. He was previously an instructor at an academic institution. BI1 is a developer who is responsible for transaction-based developing. The programming language that is used at Company B is COBOL. BI1 has a number of issues regarding Company B. According to BI1, everything is individual-oriented, change requests are a daily problem and some individuals don't do their design properly. BI1 complained about the fact that not everybody prioritizes quality as number one and sees communication between management and developers as a major problem.

BI2 is a junior employee at Company B. He is an introvert who has been employed for one year at this company. His role in the company is a programmer, responsible for the updating of payment systems.

BI3 is a developer at Company B who is responsible for corporate statements and transfers between businesses. BI3 has been employed for one year at company B.

BI4 is a programmer at Company B who is responsible for the file migration systems. BI4 has been an employee at Company B for 1 Year and 3 months.

BI5 is an extrovert who is an analyst programmer at Company B. He works on different projects which are all based on payments. These payments are all based on transactions between banks.

BI6 is a designer/developer at Company B who is currently working on a compliance project. BI6 has been employed for four and a half years at Company B.

BI7 is a project manager at Company B who is responsible for the software development of payment systems. Interviewee 7 has been employed for six years at Company B.

A summary of the background information of the interviewees is presented in Table 5.4.

	Role in company	Experience
BI1	Developer	1 Year, 4 Months
BI2	Programmer	Junior employee 1 Year
BI3	Developer	1 Year
BI4	Programmer	1 Year, 3 Months
BI5	Analyst Programmer	
BI6	Designer/Developer	4 Years, 6 Months
BI7	Project Manager	6 Years
Table 5.4: Background of Interviewees at Company B		

Questionnaires

Questionnaires with open-ended questions were used to collect data at Company B. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. Please refer to Chapter 4 (Table 4.2) for an example of the questionnaire. 21 Questionnaires were handed out to developers and project managers. Only 10 questionnaires were completed and received.

The individuals were asked how long they had been working for the company. The purpose of this question was to know how well they knew the environment. The respondents at Company B have been employed for an average of 2 years and 3 months.

The roles of the respondents at Company B are as follows:

-  4 Developers
-  4 Programmer / Analyst
-  2 Project Managers

5.3.3 Results for Company B

Data were collected at Company B by using interviews and open-ended questionnaires. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. The open-ended questionnaires were designed, based on the questions of the qualitative interviews.

This data were analyzed as follows. All interviews were transcribed, and Ms Word documents were created for the questionnaires. Content analysis was performed on the transcribed interviews and the Word documents of the questionnaires separately using the ATLAS.ti software. Propositions obtained after the data analysis of the interviews were verified with the data obtained from the questionnaires. The results obtained from the two analysis were then combined to form the propositions for the organization.

The following notation is used to indicate whether a result was obtained from an Interviewee or a questionnaire: Company-Interviewee/Questionnaire-Number of Individual, i.e., BI4 for Company B, Interviewee 4 or BQ2 for Company B, Questionnaire 2.

THE USE OF SYSTEMS DEVELOPMENT METHODOLOGY

Use of Systems Development Methodologies

The majority of the interviewees indicated that a systems development methodology was used in Company B (BI1, BI3, BI4, BI5, BI6, BI7). Only BI2 indicated that no systems development methodology was being used in company B. On further investigation, the project manager (BI7) explained that it was possible that this Interviewee could have been working on a small project without a methodology, but that the company was generally using a methodology. Nine of the ten questionnaire respondents indicated that they were using a systems development methodology (BQ1, BQ3, BQ4, BQ5, BQ6, BQ7, BQ8, BQ9

and BQ10). Only BQ2 indicated that no systems development methodology was being used in company B.

Mandatory vs Voluntary use

BI4, BI2 and BI6 mentioned that the use of system development methodologies was "...company policy", indicating mandatory use of system development methodologies.

According to BI1, the personal choice of each individual and the time available were the main factors that influence the use of a systems development methodology, indicating that its use was not enforced.

Single vs Multiple SDM

Various types of methodologies are used at Company B:

- ☐ RUP (BI6, BQ1)
- ☐ Object Oriented Methodology (BQ3, BQ4, BQ7, BQ8, BQ9, BQ10)
- ☐ SDLC (BQ3)
- ☐ SOA (BI3, BI4, BI5, BQ9, BQ10)

Definition of a Systems Development Methodology

As discussed in Chapter 2, there is no universally accepted definition for the term. As in the case of Company A this was also reflected in the data collected from Company B.

Some of the Interviewees' definitions complimented one another's meaning, but some Interviewees' had a totally different perspective on the meaning of a systems development methodology. BI1 defines a methodology as "...a **set of rules** that needs to be followed to complete a project". This view was also expressed by BI3 and BI4 who defined a

methodology as "...a **set of rules** to ensure quality". BI2 defined a systems development methodology as "...something that **makes development easier**". Furthermore, a methodology is defined by BI4 as "...a **standard** to work towards and a **method** that everybody understands what needs to be done". BI5 defines a methodology as "...**researched facts** that need to be taken in consideration when one designs a system". BI6 defines a systems development methodology as "...**guidelines** and **steps** that guide you through the development to the outcome". BI7 also defines a systems development methodology as "...a **set of guidelines and processes**". It can once again be concluded that in one company no universal definition for the term exists.

PERCEPTIONS OF SYSTEMS DEVELOPERS REGARDING SYSTEMS DEVELOPMENT METHODOLOGIES IN GENERAL

Advantages of Systems Development Methodologies

The interviewees and the questionnaire respondents discussed several advantages of systems development methodologies. These advantages were grouped as follows: systems development methodologies improve the development process; systems development methodologies improve the product; and standardization.

The first group of advantages centres around the perception that systems development methodologies improve the development process. It is interesting to note that BI5 defines a methodology as "...researched facts that need to be taken into consideration when one design a system". BI5 further states that "...there is no need to reinvent the wheel". This indicates a form of trust in systems development methodologies and is illustrated by the following remark: "You know it works correctly" (BI4). It is also reflected in the perception that systems development methodologies ensure and improve quality (BI3, BI4, BI5, BQ10). The development process is improved because systems development methodologies **offer guidance and provide structure** during the development process. This view was expressed by numerous interviewees and respondents of the questionnaires, as indicated by the following remarks:

- ☐ “It gives guidance” (BI1, BI6, BI7, BQ1)
- ☐ “It gives structure” (BI1, BI5, BI6, BQ3, BQ6, BQ7, BQ9)
- ☐ “You know what is expected” (BI6)

By using systems development methodologies the development process becomes more **efficient**. System development methodologies make development faster and the process is simplified. Apart from this, it helps to develop the system within budget. This was reflected by the following remarks:

- ☐ “Makes the development quicker” (BI1, BI4, BQ1)
- ☐ “Makes development easier ” (BI1, BI2)
- ☐ “Makes your project more accurate in terms of time and cost” (BI7)
- ☐ “Help you to save money” (BI4)

By using systems development methodologies the **management** of the development process is also improved. This proposition is supported by the following remarks:

- ☐ “Makes delivering the system more punctual” (BI1)
- ☐ “It improves planning “ (BI1, BQ3)
- ☐ “Makes tracking possible” (BI1, BI3, BI6)
- ☐ “It makes your project more predictable” (BI7, BQ8)
- ☐ “Gives improved project management” (BI1)
- ☐ “It provide control measurements” (BI1, BQ5)

Accountability is a further advantage offered by systems development methodologies. Systems development methodologies “makes the developer more confident” (BI2).

The second group of perceived advantages of systems development methodologies is that it **improves the developed product**. The use of systems development methodologies ensure and improve quality (BI3, BI4, BI5, BQ10) of the developed system. This improvement can be contributed to the fact that methodologies “...help to minimize errors” (BI3). It also “...makes the reviewing of programs possible”

(BI2). Furthermore, maintenance of the system is simplified (BI5, BQ2) and reusability is possible (BI5, BQ9).

Another important advantage offered by systems development methodologies, is the improvement of **standardization** (BI4, BI5, BQ9, BQ10). Standardization is important to ensure consistency and uniformity amongst different projects (BI4, BI5, BI6, BI7).

Disadvantages of Systems Development Methodologies

Systems development methodologies also have several disadvantages. During the Case Study at Company B, the following disadvantages were mentioned:

One of the most important disadvantages is that system development methodologies are very **time consuming** (BI2, BI3, BI6). In some cases using system development methodologies may even “...slow the implementation process” (BI7).

Furthermore, system development methodologies are very **complex**, and the concepts are difficult to implement (BI5). Training is needed, which results in productivity loss when everybody goes for training (BI4, BI6, BI7).

Some of the interviewees and the respondents of the questionnaires also felt that systems development methodologies are **over-compensating** (BI6, BI7). BI7 felt that systems development methodologies can be seen “...as a lot of red tape”.

It was also mentioned by BI4 that systems development methodologies “...are **restrictive** in some ways”.

BI3 was of the opinion that systems development methodologies “...**increase costs**”. According to BI5 methodologies “...sometimes provide expensive solutions”.

Another disadvantage of systems development methodologies is that it is ***not universally applicable*** (BI4, BI5). Every project is unique and there is no one systems development methodology that could be used for all projects in all environments.

Interesting to note is that some interviewees considered the *negative attitude* of system developers towards system development methodologies as a disadvantage (BI1, BI4). The following remark illustrates this negativity: “ ..the concepts are boring” (BI5).

WHY SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Company B makes adaptations to their systems development methodologies, and these adaptations are then tested at Company B. BI1, BI3, BI4, BI5, BI6, BI7, BQ1, BQ3, BQ6, BQ7, BQ8, BQ9, BQ10 claims that adaptations are indeed being made to systems development methodologies, while BQ2 and BQ5 claim the opposite. BI1, BI3, BI4, BI6 and BI7 state that these adaptations are tested, although BI1 indicated that it is only tested 80% of the time due to a lack of sufficient time.

The individuals were asked whether they used the adapted methodology exactly as it is, or whether they make adaptations to the adapted methodology. BI3, BI4, BI5, BI6, BI7, BQ1, BQ3, BQ7, BQ8, BQ9 and BQ10 claimed that adaptations were being made to the adapted methodology, while BQ6 indicated that they did not adapt the adapted methodology.

Reasons for Systems Development Methodology Adaptation

It was mentioned by several individuals that adaptation adds great ***advantages to the system*** (BI5, BI7, BQ1, BQ8, BQ9), and that it adds “...great value to the ***development process***” (BQ1, BQ5). According to BI5 “...there is always room for improvement”. By adapting the system development methodology “...the reusability and maintainability” of the system is improved (BI5).

Financial concerns also play a very important role during the adaptation of systems development methodologies (BI3, BI4, BI5, BQ9, BQ10). By adapting the system development methodology **financial gains can be obtained** (BI6, BQ1, BQ9). When a company changes to another methodology, software need to be changed, which result in expenses (BI5).

The responses indicated that some systems developers are satisfied with the current methodology and that they would rather adapt the current methodology than use another methodology. For example, it was mentioned by BQ1 and BQ3 that the "current methodology is one of the best known", while BI3 and BI6 felt that "...the base methodology is industry standard". However, some developers indicated that the current systems development methodology is a company standard (BI3, BI4, BI6, BQ5) and no other methodology is approved for use (BQ5). BI4 mentioned that "...it is easier to stick with what you know", because research of other systems development methodologies is too time consuming (BI4, BQ8). Furthermore, there is a lack of knowledge about other methodologies (BI5, BI7). According to BI5, commercially-available methodologies are only theoretically applicable. Therefore, adaptation makes the current systems development methodologies more **practical or useful**. However, opposed to the above discussion, BI6 felt that you lose value and usefulness of a methodology due to adaptation.

Another reason for the adaptation of systems development methodologies is because of **time limitations**. Limited time and resources lead to the need for adaptation to speed up the development process (BI1, BQ3, BQ5, BQ6). Great pressure exists to finish a project within a specific time constraint. The learning curve for a new methodology is very long. New methodologies need new learning curves and training, thus, your quality is better when adaptation is done (BI5, BQ7).

Every project varies from the previous one. No systems development methodology can handle all **types of projects** (BI3, BQ2). BI4 claims that the project type and the possibility to adapt it to the organization's needs influence the use of a systems development methodology.

Furthermore, no one methodology can be applicable to every situation, in other words, it is **not universally applicable** (BQ1, BI4, BI5). There is a necessity for change (BI3) to try to fit your needs and situation (BI4, BI6, BI7, BI3) with the systems development methodology.

Every project has a **different environment** (BI3, BQ1, BQ3, BQ7). According to BI3, the environment and the requirements are the factors that influence the use of a methodology. According to BI5, "... your business has rules which make it unique and the current methodology is not 100% implementable". The methodology has to fit with the existing procedures (BI1), and the existing systems (BI4).

Some developers expressed the view that systems development methodologies are **over-compensating** (BI6, BI7). The methodology is therefore adapted to make it more applicable.

During the development process, the requirements for the product often changes. This result in the adaptation of systems development methodologies in order to provide for these **changed requirements** (BI3, BI6). This leads to increased customer satisfaction (BI3, BQ3).

There may also be a **political motivation** to adapt the system development methodology (BI5). Some individuals' careers are based on the choice to adapt (BI5).

HOW SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Systems development methodology adaptation is mainly done by adding and removing steps, although some other intuitive methods are mentioned. BI1 claims that the systems development methodology is *ignored* when the company is in a crisis situation. BI4 and BQ6 adapt a methodology in **any possible (ad hoc) way** that might work, while BI5 adapts a methodology in the spur-of-the-moment. According to BI3 and BI6, adaptations are made

by **adding** and **removing steps** (BQ1, BQ3, BQ8). BI6 mentioned that the methodology is reviewed and streamlined and only relevant parts that add value to the system are being used. BI7 claims that a methodology is adapted by making only a few process changes. BI7 also agrees with BI3 and BI6 that certain parts may be excluded from the methodology.

Process of approving Systems Development Methodology Adaptation at Company B

A formal process exists at Company B for the adaptations made to systems development methodologies, but the detail about the process are not clear to all Interviewees. BI1, BI3, BI4, BI5, BI6, BI7, BQ1, BQ3, BQ5, BQ6, BQ7, BQ8 and BQ10 claim that a formal process is followed at Company B when adaptations needs to be approved.

According to BI1 the process is sometimes ignored by employees of the company because it is too time consuming. This is supposed to be approved by the project manager and the change management. The approval by the project manager was also mentioned by BI3, BQ3 and BQ9. According to them the project manager approves the adaptations and then gets approval from the management structure.

According to BI4 team discussions are held to discuss the changes. All changes must be documented together with their advantages and disadvantages (BI5). According to BI4, BI5, BI7 and BQ9 the design forum approves these changes, where after the Architecture team enforce the changes to the necessary departments (BI4, BQ9, BQ10). These methodologies are then added to the processes.

BI6 claims that the PCB (Project Control Board) reviews the adaptations, after which they discuss and consult the adaptations made to the methodology. In the end the process owner does the final sign-off (BI7, BQ3, BQ5, BQ8).

According to BI3 adaptations are only approved if the risk factor doesn't increase. BI5 also claims that the adaptations are approved if the risks are minimal. BI4 claims that adaptations are approved if it is beneficial to the project, cost effective and if there is a time

improvement. BI6 states that although the adaptations are approved, consideration should be given to possible loss of value in the adaptation.

QUALITY OF SYSTEMS DEVELOPED WITH ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES VS QUALITY OF SYSTEMS DEVELOPED WITH FORMALIZED METHODOLOGIES

The use of an adapted systems development methodology is mainly recommended at Company B, although two interviewees and one questionnaire respondent recommended a formalized methodology. BI3, BI4, BI5, BI7, BQ1, BQ3, BQ5, BQ7, BQ8, BQ9 and BQ10 recommended the use of adapted systems development methodologies. BI1 and BI6 recommended the use of both formalized and adapted methodologies, while BQ6 recommended the use of a formalized methodology.

Although formalized and adapted methodologies have their advantages and disadvantages, each individual had his own perspective on which methodology was the best. When asked to explain the difference between systems developed with formalized systems development methodologies opposed to systems developed with adapted methodologies, different views were expressed.

BI1 claimed that a formalized methodology would result in a better end-product, provided one had sufficient time, the design was done properly and the methodology was followed.

According to BI3, a formalized methodology would take more time, resulting in adaptation to streamline the process. BI3 claims that an adapted systems development methodology would be quicker. According to BI4, systems which have been developed with a formalized methodology, could never be adjusted when updates were needed.

BI5 claimed that it was very difficult to make such a comparison, because no single system was being developed with different methodologies, and one could not compare a home

loan system to a cheque-account system. BI5 stated that an adapted methodology was based on business' principles and requirements.

According to BI6, a formalized methodology provided a reference to work with. BI6 had a problem with adapted methodologies, because one sometimes chose to leave parts out and realize later that these should have been included in a previous phase.

BI7 emphasized quality as the main difference between formalized methodologies and adapted methodologies. According to BI7 and BQ8 formalized methodologies tended to add more quality assurance, whilst an adapted systems development methodology often was of poorer quality. This was in contrast to both the individuals' recommendation of using adapted systems development methodologies.. A possible explanation could be that they were willing to accept a poorer quality system in order to obtain the other advantages of adaptation.

BQ1 argued that formalized methodologies were easy to track and follow. BQ3 stated that adapted methodologies enable faster delivery times, but formalized methodologies enable more stabile systems.

Although BQ5 recommended adapted methodologies, BQ5 argued that any methodology gave more control and accurate time estimation.

BQ6 stated that formalized methodologies gave less errors, less confusion among developers and less unnecessary coding, but that adapted methodologies speed up delivery times.

BQ9 stated that adapted methodologies were better suited to all projects, while BQ10 argued that formalized methodologies resulted in stand-alone systems.

A summary of the above opinions are presented in Table 5.5. From this summary one can conclude that formalized methodologies result in better quality products, more stabile systems and that it provide guidance and control. On the negative side, it is time-

consuming and it results in stand-alone systems. Furthermore it is difficult to make changes to the system.

The opinions regarding the adapted methodologies indicated that they enable faster delivery times and that they are suited for most products. Furthermore they fit the business' rules and requirements. However, without realizing the consequences, too much adaptation may cause problems later in the development process.

Formalized Methodologies	Adapted Methodologies
<u>Positive</u> - Results in better quality products (BI1, BI7, BQ6, BQ8) - Enables more stabile systems (BQ3) - Provides guidance and control (BI6, BQ1) <u>Negative</u> - Takes more time (BI3). - Difficult to make adjustments to system (BI4) - Results in stand-alone systems (BQ10)	<u>Positive</u> - Enables faster delivery times (BI3, BQ3, BQ6) - More based on the business' rules and requirements (BI5) - Better suited for all projects (BQ9) <u>Negative</u> - Sometimes you decide to leave parts out and later on you realize the value it would have had in previous phases. (BI6)
Table 5.5: Company B's view on Formalized Methodologies vs Adapted Methodologies	

When one studies the results of Case Study 2 (Company B), it can be summarized by applying the framework of [Fitzgerald et al. \(2002\)](#) as shown in Figure 5.4.

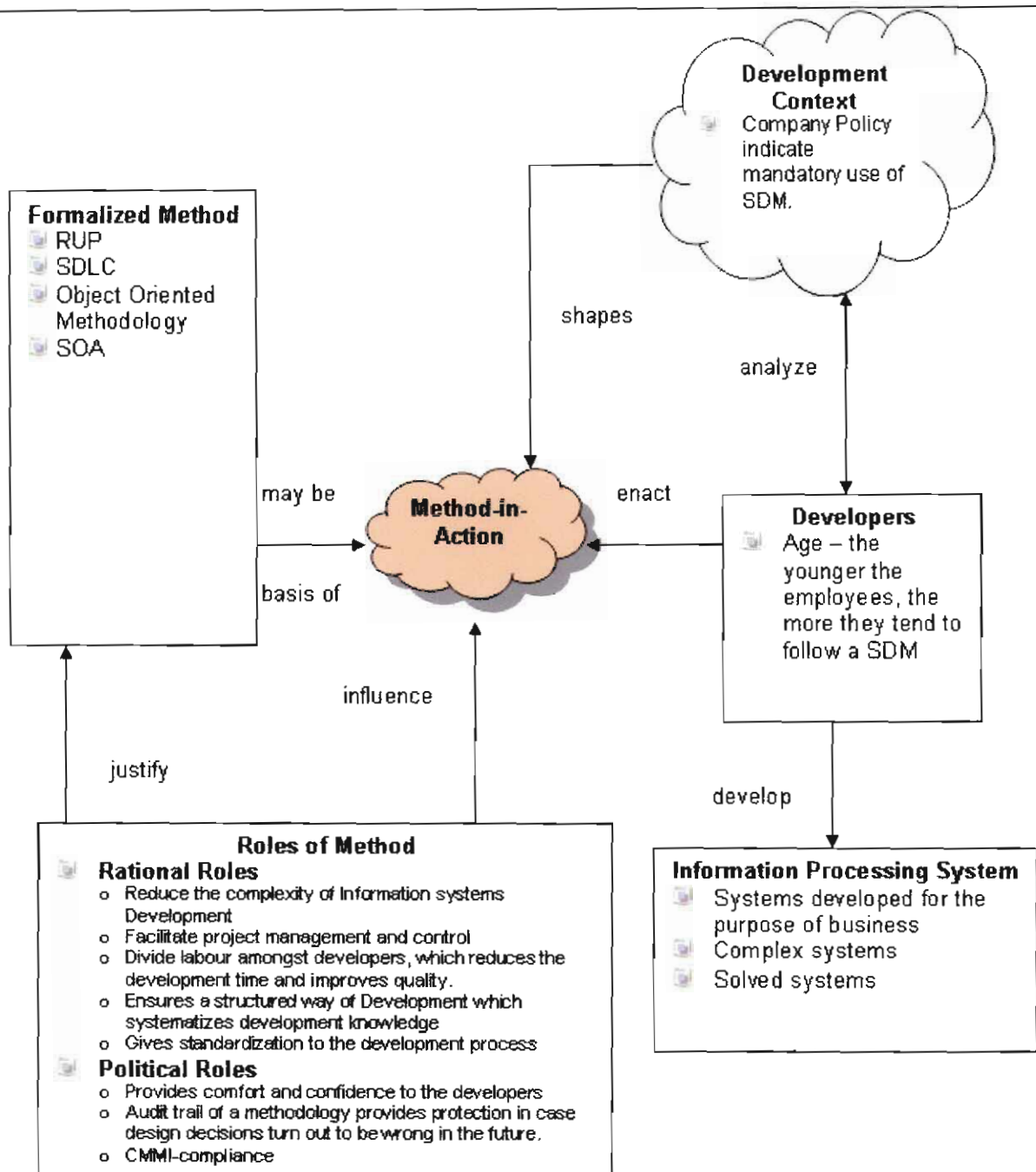


Figure 5.4: Framework applied to results of Company B

5.4 Case Study 3

5.4.1 Background information for Company C

Company C is a focused research-driven higher education academic university in South Africa that consists of three campuses, managed by an Institutional office. Company C is an institution where one can improve one's career opportunities, do research to improve one's business or to expand one's own field of interest. Company C offers a wide range of research projects, tuition programs and services. Company C strives to prepare students for the future, educate them in being real business individuals.

Company C also has an IT department which manages the organization's network and computer-related problems. This department has recently, in cooperation with the project office of the university, implemented a new system to maintain the university's electronic processes. The development and implementation of this new system was done in conjunction with a consultant company. The development and implementation of this system was used to conduct Case Study 3.

Company C consists of an Institutional office which serves the three campuses. Each campus has some autonomy. Company C also provides telematic learning systems for students who are not able to study on one of these campuses.

5.4.2 Data Collection at Company C

Company C was chosen for data collection because it is known that they already use a systems development methodology. The purpose of this dissertation was to investigate whether they adapt the methodology or not and the reasons for the adaptation.

Interviews

Data were collected from Company C by interviewing 3 individuals. All three individuals acted the role of project manager with one of them also having the part of system analyst and developer. Although their jobs seemed to be similar, each individual had own responsibilities which will be made clear once the data have been processed and the results summarized. A semi-structured format was followed to conduct the interviews. The reason for using a semi-structured format was to collect not only the information sought by the researcher, but also unanticipated information. This goal was achieved by the use of both open-ended and specific questions. (Seaman, 1999). The case study was performed at the premises of the main campus of Company C and lasted 1 day.

Each interview was recorded to maintain data quality, was handled with great care and confidentiality and the interviews were done anonymously (no names were mentioned during the recording of the interview). According to university policy, no ethical approval is needed for the research done in this dissertation.

The interviews were transcribed by listening to the recordings and typing it into 8 pages of transcripts. The duration of the interviews varied between 20 and 30 minutes depending on the co-operation and talkativeness of the interviewee. The interviews were member checked by sending the results to the company and incorporated their feedback into the results.

Background of Interviewees

CI1 has been an employee at Company C for 10 years. She is the manager of the project office. She has recently been working on the Oracle project, but is mainly a project manager.

CI2 has been an employee at Company C for about 21 years. She is a business analyst. Her most recent project was the replacement of the student systems which is known as the Oracle project.

CI3 has been an employee at Company C for 6 years. He is an advisor to the vice-chancellor. His most recent project was the coordination of the replacement of the student systems, which is known as the Oracle project.

A summary of the background information of the interviewees is presented in Table 5.6.

	Role in company	Experience
CI1	Project Manager	10 Years
CI2	Business Analyst	21 Years
CI3	Advisor for Vice-Chancellor	6 Years

Table 5.6: Background of Interviewees at Company C

Questionnaires

Open-ended questionnaires were used to collect data at Company C. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. Please refer to Chapter 4 (Table 4.2) for an example of the questionnaire. 6 Questionnaires were handed out to developers and project managers. Only 2 questionnaires were completed and received.

The individuals were asked how long they have been working for the company. The purpose of this question was to know how well they knew the environment. The respondents of the questionnaires at Company C have been employed for an average of 8 years.

The roles of the individuals at Company C are as follows:

-  1 Project Manager
-  1 Director: Project management

5.4.3 Results for Company C

Data were collected at Company C by using interviews and open-ended questionnaires. The data obtained from the open-ended questionnaires were used to verify the data that were obtained from the interviews. The open-ended questionnaires were designed, based on the questions of the qualitative interviews.

This data was analyzed as follows. All interviews were transcribed, and MS Word documents were created for the questionnaires. Content analysis was performed on the transcribed interviews and the Word documents of the questionnaires separately using the ATLAS.ti software. Propositions obtained after the data analysis of the interviews were verified with the data obtained from the questionnaires. The results obtained from the two analyses were then combined to form the propositions for the organization.

The following notation is used to indicate whether a result was obtained from an Interviewee or a questionnaire: Company-Interviewee/Questionnaire-Number of Individual, i.e. CI2 for Company C, Interviewee 2 or CQ1 for Company C, Questionnaire 1.

THE USE OF SYSTEMS DEVELOPMENT METHODOLOGIES

Use of Systems Development Methodologies

It can be concluded that a systems development methodology is being used by company C. According to CI1, CI2, CI3 CQ1 and CQ2, a systems development methodology is being used by Company C.

Single vs Multiple SDM

Multiple systems development methodologies are used in Company C. The types of methodologies used are as follows:

-  Adapted version of AIM (CQ1)
-  RAD modification (CQ1)
-  Waterfall (CI1, CI2, CI3, CQ2)

Definition of a Systems Development Methodology

Once again, different definitions for a systems development methodology were mentioned by the individuals. A number of the components of a systems development methodology (please refer to Chapter 2, Section 2.2.1) could be noted in the definitions of the Interviewees of Company C. CI1 defined a systems development methodology as a **set of tools** to help to develop the system or project in a structured way. CI2 and CI3 defined a

methodology as a **process** to go through to satisfy the user's requirements. It can once again be concluded that in one company no universal definition for the term exists.

PERCEPTIONS OF SYSTEMS DEVELOPERS REGARDING SYSTEMS DEVELOPMENT METHODOLOGIES IN GENERAL

Advantages of Systems Development Methodologies

The interviewees and the questionnaire respondents discussed several advantages of systems development methodologies. These advantages were grouped as follows: systems development methodologies improve the development process; and systems development methodologies improve the product.

The first group of advantages centres around the perception that systems development methodologies **improve the development process**. CI1 and CQ1 stated that by using methodology "...the probability of achieving success is very high". The development process is improved because systems development methodologies **offer guidance and provide structure** during the development process. This view was supported by the following remarks:

-  "It gives guidance" (CI1, CI2)
-  "It gives structure" (CI1, CI2)
-  "Provides discipline" (CI3)

By using systems development methodologies the development process becomes more **efficient**. System development methodologies make development faster. Apart from this, it helps to develop the system within budget. This was reflected by the following remarks:

-  "Saves time" (CI1, CI2, CQ1,CQ2)
-  "Help you to stay within budget" (CQ1)

By using systems development methodologies the **management** of the development process is also improved. This proposition is supported by the following remarks:

-  "Help you to reach the goals" (CQ1)
-  "Provides better planning " (CI2)
-  "It gives control measurements" (CI2)
-  "Facilitates communication" (CI1)

The second group of the perceived advantages of systems development methodologies is that it **improves the developed product**. The use of systems development methodologies ensure and improve quality (CI1, CQ1) of the developed system.

Disadvantages of Systems Development Methodologies

Systems development methodologies have several disadvantages. During the Case Study at Company C, the following disadvantages were mentioned:

One of the most important disadvantages is that system development methodologies are very **time consuming** (CI2).

Furthermore, system development methodologies are very **complex**, and to use it effectively, some expertise is required (CI2).

Some of the interviewees and the respondents of the questionnaires also felt that systems development methodologies are **over-compensating** (CI1).

It was also mentioned by CI1 that systems development methodologies cause "...some individuals to lose their intuition", and can therefore be regarded as being **restrictive**.

WHY SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Company C makes adaptations to their systems development methodologies, and according to CI2 adaptations are tested at Company C. CI1, CI2, CI3, CQ1 and CQ2 claims that adaptations are indeed being made to systems development methodologies. CI1 and CQ2 also claim that adaptations are being made to the adapted methodology.

Reasons for Systems Development Methodology Adaptation

It was mentioned by CI1 that adaptation "**...adds value to the system**".

Financial concerns also play a very important role during the adaptation of systems development methodologies (CI1, CI2).

Another reason for the adaptation of systems development methodologies is **time limitations**. Limited time and resources lead to the need for adaptation to speed up the development process. Great pressure exists to finish a project within a specific time constraint (CI1, CI2, CQ2). Some individuals fall back on their experience and adapt the methodology (CI1, CI3), in order to make it more "...practical in the situation" (CQ2).

Every project varies from the previous one. No systems development methodology can handle all **types of projects**. Every project has its own unique requirements (CI1, CI3).

CI2 claims that the project type and the project size cause the adaptation of a systems development methodology.

Every project has a **different environment**. According to CI1, the environment required rapid development which lead to adaptation of the methodology. Therefore, adaptation was required to make the methodology more "...appropriate to the situation" (CI3).

During the development process, the requirements for the product often changed. This resulted in the adaptation of systems development methodologies in order to provide for these **changed requirements** (CI1, CI2, CI3).

It was also mentioned that methodology was adapted because the developers had "**a lack of knowledge**" about the methodology (CI3).

HOW SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Systems development methodology adaptation is mainly done by adding and removing steps, as well as modifying some steps. According to CI1, adaptations could also be done by **removing steps, combining steps or modifying steps**. CI2, CQ1 and CQ2 also claim that adaptation is being done by **removing steps**. According to CI3, adaptations are being made by substituting one methodology with another methodology. This could be seen as the **combination** of two methodologies – using one half of the one methodology for the first part of the project and then using another methodology for the second half of the project. CI1 also claims that systems development methodology adaptation is done by making an interpretation between two methodologies, which can be regarded as the **combination** of system development methodologies.

Process of approving Systems Development Methodology Adaptation at Company C

A formal process exists at Company C for the adaptations made to systems development methodologies. CI1, CI2, CI3, CQ1 and CQ2 claim that a formal process is followed at Company C when adaptations need to get approved. According to CI1, discussions are held on a detailed level up to a strategic level. CI2 claims that the business must decide whether the adaptation is being approved or not. According to CI3 a steering committee decides about the adaptations.

QUALITY OF SYSTEMS DEVELOPED WITH ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES VS QUALITY OF SYSTEMS DEVELOPED WITH FORMALIZED METHODOLOGIES

CI1, CI2, CI3, CQ1 and CQ2 recommend the use of adapted systems development methodologies.

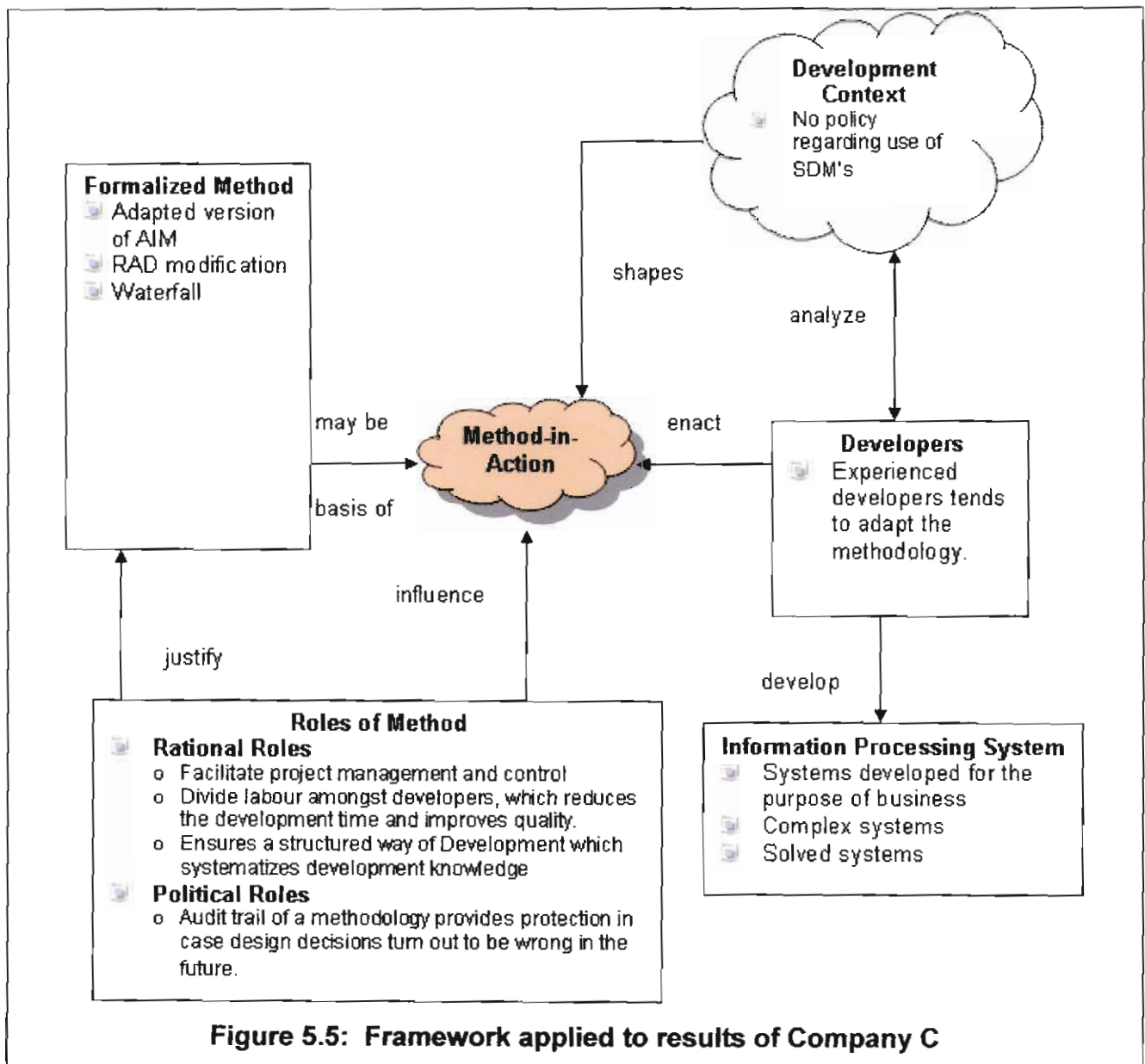
Although formalized and adapted methodologies have its advantages and disadvantages, each individual had its own perspective about which methodology is the best. When the individuals were asked what the differences were between systems developed with formalized systems development methodologies opposed to systems developed with adapted methodologies, different views were expressed.

CI1 was unable to give an opinion, but mentioned that a methodology could be adapted without losing any quality. CI2 stated that the only difference would be the time it would take to complete the project, the cost of the project and the complexity of the project. Thus, the difference does not lie in the methodology that is used, but in the project and its complexity. CI3 claims that there does not have to be any difference between a formalized methodology and an adapted methodology. CQ1 argued that a formalized methodology is too time consuming and therefore recommends the use of an adapted methodology.

The opinions discussed above are summarized in Table 5.7.

Formalized Methodologies	Adapted Methodologies
Too time consuming (CQ1)	Doesn't reduce quality (CI1)

Table 5.7: Company C's view on Formalized Methodologies vs Adapted Methodologies



5.5 Conclusions and Cross-Case Analysis

Data were collected from the companies by making use of interviews and open-ended questionnaires. This data was analyzed as follows: all interviews were transcribed, and MS Word documents were created for the questionnaires. Content analysis was performed on the transcribed interviews and the Word documents of the questionnaires separately using the ATLAS.ti software. Propositions obtained after the data analysis of the interviews were verified with the data obtained from the questionnaires. The results obtained from the two analyses were then combined to form the propositions for the organization.

After the data for each case was analyzed, cross-case analysis was performed to obtain the final results. The cases were studied to see what similarities or differences were held in the data. The results obtained from this analysis are summarized in Appendix B, and are discussed below.

THE USE OF SYSTEMS DEVELOPMENT METHODOLOGIES

Use of Systems Development Methodologies

It could be concluded that systems development methodologies are being used by Company A, Company B and Company C. This was expected, since the organizations were chosen because it was known that they use systems development methodologies.

Mandatory vs Voluntary use

In both Company A and Company B the use of systems development methodologies are mandatory, but it is not enforced.

Single vs Multiple Development Methodologies

Company A, Company B and Company C indicated that multiple systems development methodologies are being used. It is interesting to note that all three companies mentioned that they use the traditional systems development lifecycle. It seems that although there is a movement to use object-oriented and agile methodologies, the more traditional approaches are still used.

Definition of a Systems Development Methodology

It is evident from the results that no universal definition for the term existed in even one company.

PERCEPTIONS OF SYSTEMS DEVELOPERS REGARDING SYSTEMS DEVELOPMENT METHODOLOGIES IN GENERAL

Advantages of Systems Development Methodologies

Company A, Company B and Company C mentioned several advantages of systems development methodologies: In accordance with [Avison and Fitzgerald \(2006\)](#), these advantages can be grouped as follows: systems development methodologies improve the development process; systems development methodologies improve the developed product (system) and standardization.

The first group of the perceived advantages of systems development methodologies is that it improves the development process:

-  The development process is improved because systems development methodologies **offer guidance and provide structure** during the development process. This view was expressed by Company A, Company B and Company C.
-  By using systems development methodologies the development process becomes more **efficient** (Company A, Company B and Company C). The development process becomes faster and the process is simplified.
-  **Management** of the development process is also improved (Company A, Company B and Company C).
-  **Accountability** is a further advantage offered by systems development methodologies (Company A and Company B).

Only Company A mentioned that systems development methodologies help them to comply with CMMI. This could be explained by the fact that this company is the only one that has achieved Level 3 of the CMMI.

The above advantages were also discussed by [Avison and Fitzgerald \(2006\)](#) and [Fitzgerald et al., \(2002\)](#).

The second group of the perceived advantages of systems development methodologies is that it improves the developed product:

-  The use of systems development methodologies **ensures better quality** of the developed system (Company A, Company B and Company C).
-  Furthermore, **maintenance** to the system is simplified (Company A and Company B).
-  Only Company B mentioned the advantage of **reuse**. This can be explained by the fact that the use object-oriented methodologies dominate in this company.

Another important advantage offered by systems development methodologies, is the improvement of **standardization** (Company A and Company B). Standardization is important to ensure consistency and uniformity amongst different projects. It also leads to repeatable successful implementation of systems.

Once again these advantages were also discussed by [Avison and Fitzgerald \(2006\)](#) and [Fitzgerald et al., \(2002\)](#).

Disadvantages of Systems Development Methodologies

Systems development methodologies also have several disadvantages. The following disadvantages were mentioned by Company A, Company B and Company C:

-  One of the most important disadvantages is that system development methodologies are very **time consuming**. Furthermore, systems development methodologies have a very long learning curve.
-  Some of the interviewees and the respondents of the questionnaires also felt that systems development methodologies are **over-compensating**.
-  It was also mentioned by Company A, Company B and Company C that systems development methodologies **constrain your initiative and creativity**.

Company A and Company B was of the opinion that systems development methodologies are too **costly**.

Another disadvantage of systems development methodologies mentioned by Company A and Company B is that it is **not universally applicable**. Every project is unique and there is no one systems development methodology that could be used for all projects in all environments.

Company B and Company C mentioned that systems development methodologies are very **complex**.

These disadvantages are confirmed by the arguments and pressures against systems development methodologies as mentioned by [Fitzgerald \(1998\)](#), [Avison and Fitzgerald \(2006\)](#) and [Fitzgerald et al., \(2002\)](#).

WHY SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Systems development methodologies are adapted by Company A, Company B and Company C. Reasons for adaptation will be discussed next.

Reasons for Systems Development Methodology Adaptation

It was mentioned by Company A, Company B and Company C that adaptation adds great ***advantages to the system and the development process***.

Another reason for the adaptation of systems development methodologies mentioned by Company A, Company B and Company C is ***time limitations***. The learning curve for a new methodology is very long, and extra documentation have to be produced. This has been confirmed in the literature by [Fitzgerald \(1998\)](#).

Every project varies from the previous one. No systems development methodology can handle all ***types of projects*** (Company A, Company B and Company C). This finding indicates that organizations are moving in a contingency direction, as discussed by [Avison and Fitzgerald \(2006\)](#).

During the development process, the requirements for the product often changes. This result in the adaptation of systems development methodologies in order to provide for

these **changed requirements**. (Company A, Company B, and Company C). This has been confirmed in the literature by [Parnas & Clements \(1986\)](#)

According to Company B and Company C, **Financial concerns** also play a very important role during the adaptation of systems development methodologies. By adapting the system development methodology financial gains can be obtained. This finding seems to be unique, since no evidence could be found.

The responses indicated that some systems developers are satisfied with the current methodology and that they would rather adapt the current methodology than using another methodology. However, some developers indicated that the current systems development methodology is a company standard and no other methodology is approved for use. According to Company A and Company B, adaptation makes the current systems development methodologies more **practical or useful**. [Fitzgerald et al. \(2002\)](#) also provide a detail discussion of this finding.

Furthermore, no one methodology can be applicable in every situation, in other words it is **not universally applicable**. Every project has a **different environment**. (Company A, Company B, and Company C). This has been confirmed by [Russo et al., 1995](#); [Avison et al., 1992](#); and [Sakthivel, 1992](#)

Company A, Company B and Company C expressed the view that systems development methodologies are **over-compensating**. The methodology is therefore adapted to make it more applicable. This finding is in accordance to [Avison and Fitzgerald \(2006\)](#) and [Fitzgerald et al. \(2002\)](#).

HOW SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

A very interesting finding is that Company A, Company B and Company C made further adaptations to the adapted methodologies. This finding confirms the two ways of

adaptation as discussed by Aydin *et al.* (2005), namely static adaptation and dynamic adaptation. All three companies indicated that a formal process exists for the approval of the adaptation of the systems development methodologies. This represents the static adaptation of systems development methodologies. Dynamic adaptation takes place when the individual developers make further adaptations to the methodology during the development of the system.

Systems development methodology adaptation is mainly done by adding steps and removing steps. The combination of different methodologies and switching between different methodologies also occur. Company B indicated that methodologies could be adapted in any possible way (ad-hoc) on the spur-of-the-moment.

Process of approving Systems Development Methodology Adaptation

It is evident that a formal process exists for the approval of systems development methodology adaptation, although the details about the process are not always clarified. Company A's process for approval depends on the job role. Senior staff does not have to follow any formal process to get adaptation approved, while junior staff has to get approval for systems development methodology adaptation. Company B's project manager is supposed to approve the adaptation, but the approval process is clearly not enforced due to limited time. Company C has a formal approval process where discussions are held on a detailed level to a strategic level.

QUALITY OF SYSTEMS DEVELOPED WITH ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES VS QUALITY OF SYSTEMS DEVELOPED WITH FORMALIZED METHODOLOGIES

Very different opinions were expressed regarding this topic. It is clear that there is no agreement between the systems developer's results on the difference between systems developed with a formalized methodology and systems developed with an adapted

methodology. The different viewpoints are summarized in Table 5.8. These results indicate that developers realize that formal systems development methodologies produce systems of a higher quality. However, because it is so time-consuming, they are prepared to accept a lower quality system in order to gain a faster delivery time.

Formalized Methodologies	Adapted Methodologies
<u>Positive</u> - Formal SDM: Results in better quality products (Company A, Company B). <u>Negative</u> - Formal SDM: time-consuming; stand-alone systems; difficult to make changes to the system (Company B, Company C). - Formal SDM: Amount of documentation tends to be more (Company A).	<u>Positive</u> - Adapted SDM: faster delivery times; suited for most products; fit the business' rules and requirements (Company B) - Adapted SDM: doesn't reduce quality (Company C)
Table 5.8: Summary of viewpoints on Formalized Methodologies vs Adapted Methodologies	

5.6 Summary

The aim of this chapter was to present the results that were obtained during the case studies. Each case study was discussed. For each case, background information of the company was provided and the results obtained from the interviews and the questionnaires were presented. The combined results for the three cases ended the chapter.

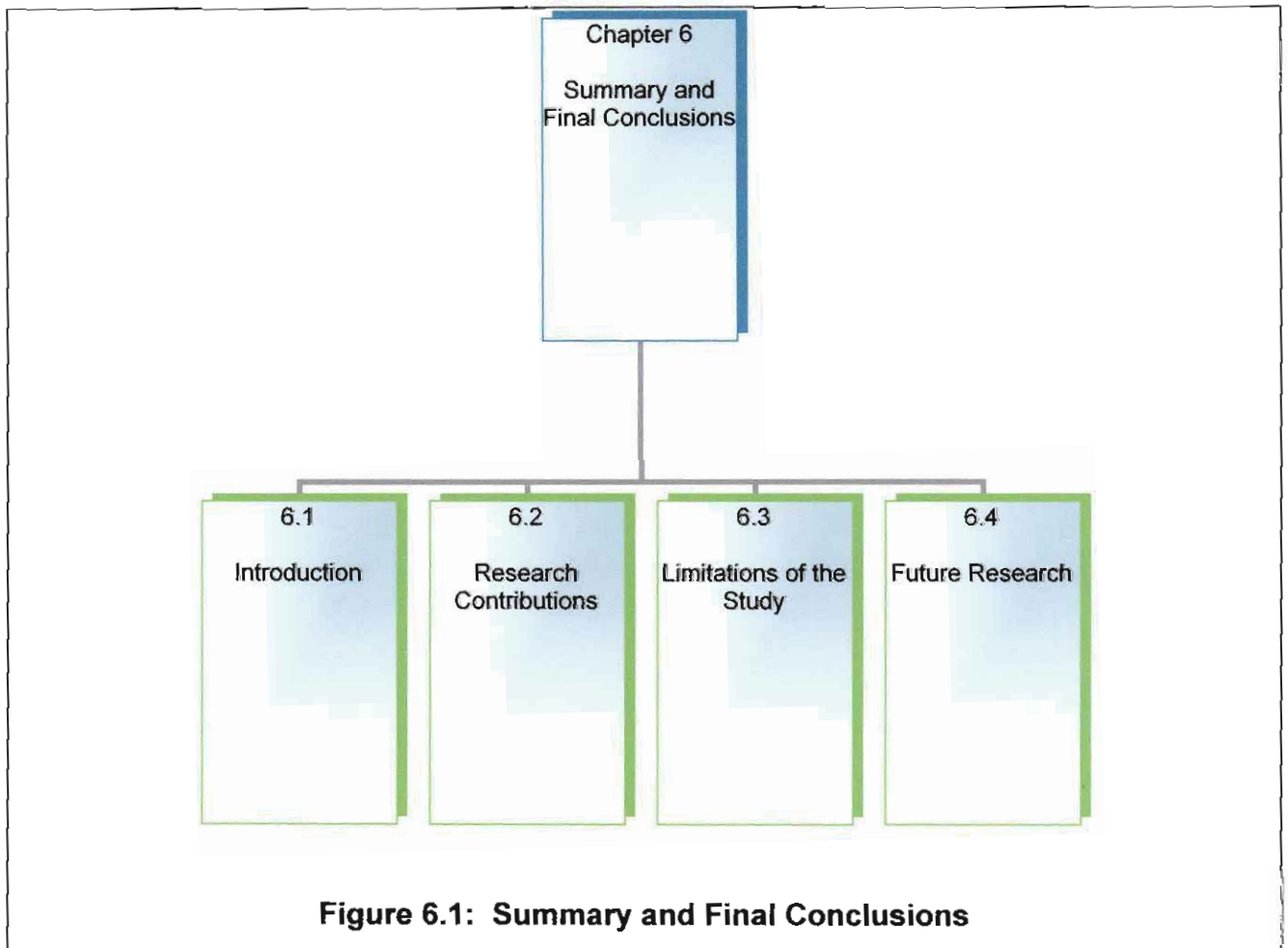
Chapter 6

*Summary and
Final Conclusions*

CHAPTER 6

SUMMARY AND FINAL CONCLUSIONS

6.1 Introduction



The quality of the systems development process is important in the development of high quality information systems. Systems development methodologies are important in the development process, and some individuals believe that adapted methodologies result in higher quality systems.

Organizations are pressurized to use systems development methodologies, whether it is by the competitiveness of the industrial market, or by company policies. Arguments and pressures in favour and against the use of methodologies exist, but despite the arguments against systems development methodologies, organizations are still using methodologies with positive results – even if it means they have to adapt the methodology.

The purpose of the research is to investigate the adaptation of systems development methodologies in South Africa. This problem was investigated by addressing the following research questions:

-  What are the perceptions of system developers regarding systems development methodologies?
-  Why do system developers adapt system development methodologies?
-  How do they adapt the methodologies?
-  Is there a difference in the quality of the systems that are developed with these adapted systems development methodologies opposed to those systems that are developed according to a specific formalized methodology?

6.2 Research contributions

By addressing the adaptation of systems development methodologies, our understanding of the adaptation of systems development methodologies in South Africa was increased. As discussed in Chapter 1, very little research has been done on the topic.

WHAT ARE THE PERCEPTIONS OF SYSTEM DEVELOPERS REGARDING SYSTEMS DEVELOPMENT METHODOLOGIES?

Advantages of Systems Development Methodologies

In this study several advantages of SDM were mentioned by the systems developers. These advantages were grouped as follows: systems development methodologies improve the development process; systems development methodologies improve the developed product (system) and standardization.

The first group of the perceived advantages of systems development methodologies is that it improves the development process:

-  The development process is improved because systems development methodologies **offer guidance and provide structure** during the development process.
-  By using systems development methodologies the development process becomes more **efficient**. The development process becomes faster and the process is simplified.
-  **Management** of the development process is also improved.
-  **Accountability** is a further advantage offered by systems development methodologies.

The second group of the perceived advantages of systems development methodologies is that it improves the developed product:

-  The use of systems development methodologies **ensures better quality** of the developed system.
-  Furthermore, **maintenance** to the system is simplified.

Another important advantage offered by systems development methodologies, is the improvement of **standardization**. Standardization is important to ensure consistency and uniformity amongst different projects. It also leads to repeatable successful implementation of systems.

Disadvantages of Systems Development Methodologies

Systems development methodologies also have several disadvantages.

-  One of the most important disadvantages is that system development methodologies are very **time consuming**. Furthermore, systems development methodologies have a very long learning curve.
-  Some of the interviewees and the respondents of the questionnaires also felt that systems development methodologies are **over-compensating**.
-  Systems development methodologies **constrain your initiative and creativity**.

Company A and Company B was of the opinion that systems development methodologies are too **costly**.

Another disadvantage of systems development methodologies mentioned by Company and Company B is that it is ***not universally applicable***. Every project is unique and there is no one systems development methodology that could be used for all projects in all environments.

Systems development methodologies are very **complex**.

WHY SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Systems development methodologies are adapted. Reasons for adaptation will be discussed next.

Reasons for Systems Development Methodology Adaptation

Adaptation adds great ***advantages to the system and the development process***.

Another reason for the adaptation of systems development methodologies is ***time limitations***. The learning curve for a new methodology is very long, and extra documentation have to be produced.

Every project varies from the previous one. No systems development methodology can handle all ***types of projects***.

During the development process, the requirements for the product often changes. This result in the adaptation of systems development methodologies in order to provide for these ***changed requirements***.

Financial concerns also play a very important role during the adaptation of systems development methodologies. By adapting the system development methodology financial gains can be obtained. This finding seems to be unique.

Adaptation make the current systems development methodologies more **practical or useful**.

Furthermore, no one methodology can be applicable in every situation, in other words it is **not universally applicable**. Every project has a **different environment**.

Systems development methodologies are **over-compensating**. The methodology is therefore adapted to make it more applicable.

HOW SYSTEMS DEVELOPMENT METHODOLOGIES ARE ADAPTED

Further adaptations are made to the adapted methodology. This represents the static adaptation of systems development methodologies. Dynamic adaptation takes place when the individual developers make further adaptations to the methodology during the development of the system.

Systems development methodology adaptation is mainly done by adding steps and removing steps. The combination of different methodologies and switching between different methodologies also occurs.

Process of approving Systems Development Methodology Adaptation

It is evident that a formal process exists for the approval of systems development methodology adaptation, although the details about the process are not always clarified.

THE DIFFERENCE IN THE QUALITY OF THE SYSTEMS THAT ARE DEVELOPED WITH ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES OPPOSED TO THOSE SYSTEMS THAT ARE DEVELOPED ACCORDING TO A SPECIFIC FORMALIZED METHODOLOGY

Very different opinions were viewed regarding this topic. It is clear that there is no agreement between the systems developer's results on the difference between systems developed with a formalized methodology and systems developed with an adapted methodology. The different viewpoints are summarized in Table 6.1. These results indicate that developers realize that formal systems development methodologies produce systems of a higher quality. However, because it is so time-consuming, they are prepared to accept a lower quality system in order to gain a faster delivery time.

Formalized Methodologies	Adapted Methodologies
<u>Positive</u> - Formal SDM: Results in better quality products. <u>Negative</u> - Formal SDM: time-consuming; stand-alone systems; difficult to make changes to the system. - Formal SDM: Amount of documentation tends to be more.	<u>Positive</u> - Adapted SDM: faster delivery times; suited for most products; fit the business' rules and requirements. - Adapted SDM: doesn't reduce quality.
Table 6.1: Summary of viewpoints on Formalized Methodologies vs Adapted Methodologies	

6.3 Limitations of the Study

Since this study followed a qualitative approach, it is not possible to generalize the findings for all South African companies. However, the aim of the study was to get a deeper understanding of how and why systems development methodologies are adapted. This goals were accomplished.

6.4 Future Research

A future research project could be to verify the results with a quantitative research approach. Another possibility would be to use grounded theory in addition to cross-case analysis, and to collect more data.

Very different views regarding the difference in quality of systems developed with formalized methodologies opposed to those developed with adapted methodologies were noticed. It was difficult to find similarities in the data. This topic clearly needs to be investigated further.

It was also mentioned by some individuals that they switch between methodologies while developing a system. Other individuals combined different methodologies. It is unclear on what these decisions are based. Further research could clarify this situation.

Appendix A

*Summary of
Literature Survey*

APPENDIX A

SUMMARY OF LITERATURE SURVEY

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Sciencedirect	Systems Development Methodology	January 1980-April 2006	57	6	1988 (1), 1992 (1), 1995 (1), 1998 (1), 2002 (1), 2006 (1)
Sciencedirect	Systems Development Methodology Adaptation	January 1980 – April 2006	0	0	-
Sciencedirect	Methodology Adaptation	January 1980 – April 2006	1	0	-
Sciencedirect	Information Systems Development Methodology	January 1980 – April 2006	10	3	1988 (1), 1992 (1), 2006 (1)
Sciencedirect	Information Systems Development Methodology Adaptation	January 1980 – April 2006	0	0	-

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Sciencedirect	Systems Development Method	January 1980 – April 2006	36	4	1995 (1), 1998 (2), 2005 (1)
Sciencedirect	Systems Development Method Adaptation	January 1980 – April 2006	0	0	-
Sciencedirect	Method Adaptation	January 1980 – April 2006	9	0	-
Sciencedirect	Information Systems Development Method	January 1980 – April 2006	10	2	1998 (1), 2005 (1)
Sciencedirect	Information Systems Development Method Adaptation	January 1980 – April 2006	0	0	-
Sciencedirect	Systems Development Method Tailoring	January 1980 – July 2006	0	0	-
Sciencedirect	Systems Development Methodology Tailoring	January 1980 – July 2006	0	0	-

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Sciencedirect	Information Systems Development Method Tailoring	January 1980 – July 2006	0	0	-
Sciencedirect	Information Systems Development Methodology Tailoring	January 1980 – July 2006	0	0	-
Scopus	Systems Development Methodology	January 1980 – April 2006	69	6	1996 (1), 1997 (1), 1998 (1), 1999 (1), 2000 (1), 2006 (1)
Scopus	Systems Development Methodology Adaptation	January 1980 – April 2006	46	2	1999 (1), 2004 (1),
Scopus	Methodology Adaptation	January 1980 – April 2006	318	3	1999 (1), 2004 (1), 2005 (1)
Scopus	Information Systems Development Methodology	January 1980 – April 2006	11	3	1997 (1), 1999 (1), 2000 (1)

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Scopus	Information Systems Development Methodology Adaptation	January 1980 – April 2006	20	1	1999 (1)
Scopus	Systems Development Method	January 1980 – April 2006	70	2	1998 (1), 2005 (1)
Scopus	Systems Development Method Adaptation	January 1980 – April 2006	144	3	2004 (2), 2005 (1)
Scopus	Method Adaptation	January 1980 – April 2006	68	2	1989 (1), 2005 (1)
Scopus	Information Systems Development Method	January 1980 – April 2006	15	2	1996 (1), 2005 (1)
Scopus	Information Systems Development Method Adaptation	January 1980 – April 2006	1	1	2005 (1)

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Scopus	Systems Development Method Tailoring	January 1980 –July 2006	22	6	1997 (2), 1998 (1), 2003 (1), 2004 (2)
Scopus	Systems Development Methodology Tailoring	January 1980 –July 2006	21	4	2002 (1), 2004 (3)
Scopus	Information Systems Development Method Tailoring	January 1980 –July 2006	6	1	1998 (1)
Scopus	Information Systems Development Methodology Tailoring	January 1980 –July 2006	7	1	2004 (1)
Ebscohost	Systems Development Methodology	January 1980 – April 2006	25	6	1992 (2), 1995 (1), 1996 (1), 1997 (1), 2003 (1)
Ebscohost	Systems Development Methodology Adaptation	January 1980 – April 2006	0	0	-

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Ebscohost	Methodology Adaptation	January 1980 – April 2006	1	0	-
Ebscohost	Information Systems Development Methodology	January 1980 – April 2006	3	2	1997 (1), 1992 (1)
Ebscohost	Information Systems Development Methodology Adaptation	January 1980 – April 2006	0	0	-
Ebscohost	Systems Development Method	January 1980 – April 2006	6	0	-
Ebscohost	Systems Development Method Adaptation	January 1980 – April 2006	0	0	-
Ebscohost	Method Adaptation	January 1980 – April 2006	13	0	-

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Ebscohost	Information Systems Development Method	January 1980 – April 2006	1	0	-
Ebscohost	Information Systems Development Method Adaptation	January 1980 – April 2006	0	0	-
Ebscohost	Systems Development Method Tailoring	January 1980 – July 2006	0	0	-
Ebscohost	Systems Development Methodology Tailoring	January 1980 – July 2006	0	0	-
Ebscohost	Information Systems Development Method Tailoring	January 1980 – July 2006	0	0	-

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
Ebscohost	Information Systems Development Methodology Tailoring	January 1980 – July 2006	0	0	-
ISI Web of Knowledge	Systems Development Methodology	Latest 5 Years	4	1	2003 (1)
ISI Web of Knowledge	Systems Development Methodology Adaptation	Latest 5 Years	0	0	-
ISI Web of Knowledge	Methodology Adaptation	Latest 5 Years	1	0	-
ISI Web of Knowledge	Information Systems Development Methodology	Latest 5 Years	1	1	2005 (1)
ISI Web of Knowledge	Information Systems Development Methodology Adaptation	Latest 5 Years	0	0	-
ISI Web of Knowledge	Systems Development Method	Latest 5 Years	3	1	2005 (1)

Database Searched	Keyword(s) Used	Publication Dates	Number of Results Found	Number of Results Available & Applicable To This Dissertation	Years Applicable
ISI Web of Knowledge	Systems Development Method Adaptation	Latest 5 Years	0	0	-
ISI Web of Knowledge	Method Adaptation	Latest 5 Years	8	1	2005 (1)
ISI Web of Knowledge	Information Systems Development Method	Latest 5 Years	1	1	2003 (1)
ISI Web of Knowledge	Information Systems Development Method Adaptation	Latest 5 Years	0	0	-

Appendix B

*Summary of
Results*

APPENDIX B

SUMMARY OF RESULTS

	Company A	Company B	Company C
The use of Systems Development Methodologies			
Use	 Majority of interviewees and questionnaire respondents indicated that a SDM is used.	 The majority of interviewees and questionnaire respondents indicated that a SDM is used.	 The majority of interviewees and questionnaire respondents indicated that a SDM is used.
Mandatory vs Voluntary Use	 Although the use of SDM is mandatory, it is not enforced by senior employees.	 Although the use of SDM is mandatory, it is not enforced.	
Single vs Multiple Systems Development Methodologies	Uses multiple SDM:  GS Method  RUP  Agile Custom Method  SDLC/ Waterfall methodology  AMS-MS	Uses multiple SDM:  RUP  Object Oriented Methodology  SDLC  SOA	Multiple systems development methodologies are used.  Adapted version of AIM  RAD modification  Waterfall
Definition of Systems Development Methodology	No general definition:  Guidelines  Process  Stepped approach  Template for a process  Steps  Method  Way of performing systems development	No general definition:  Set of rules  Something that makes development easier.  Standard to work towards  Method  Researched facts that need to be taken in consideration when one designs a system.	No general definition:  Set of tools  Process

	Company A	Company B	Company C
		- Guidelines - Steps - Processes	
Perceptions of systems developers regarding Systems Development Methodologies in general			
Advantages of Systems Development Methodologies	<u>Development process is improved</u> - SDM offer guidance and provide structure. - Development process becomes more efficient. - Management of the development process is improved. - Help to comply with CMMI. - Re-use of the Intellectual Property. - Accountability.	<u>Development process is improved</u> - Trust in systems development methodologies. - Offer guidance and provide structure. - Development process becomes more efficient. - Management of the development process is improved. - Accountability.	<u>Development process is improved.</u> - Offer guidance and provide structure. - Development process becomes more efficient. - Management of the development process is improved.
	<u>Improves the developed system.</u> - Better quality. - Better use of the system. - Maintenance to the system is simplified. Standardization is important to ensure consistency and uniformity amongst different projects.	<u>Improves the developed system.</u> - Ensure and improve quality. - Maintenance of the system is simplified. - Reusability is possible. - Improvement of standardization.	<u>Improves the developed system.</u> Ensure and improve quality.

	Company A	Company B	Company C
Disadvantages of Systems Development Methodologies	- Very time consuming. - Very long learning curve. - Over-compensating. - Constrain initiative and creativity. - Too costly. - Not universally applicable. - Need to be managed.	- Time consuming. - Complex. - Over-compensating. - Restrictive. - Increase costs. - Not universally applicable. - Negative attitude.	- Time consuming. - Complex. - Over-compensating. - Restrictive.

Why systems development methodologies are adapted

Reasons for Systems Development Methodology Adaptation	Majority of individuals indicate that adaptation takes place. - Adaptation adds value to the development process. - Adaptation makes the current systems development methodologies more practical or useful. - Time limitations. - No SDM can handle all types of projects. - No one SDM can be applicable in every situation and every environment. - Over-compensating. - To comply with the CMMI standards.	Majority of individuals indicate that adaptation takes place. - Adds advantages to the system. - Adds value to the development process. - Financial concerns. - Adaptation makes the current SDM more practical or useful. - Time limitations. - No SDM can handle all types of projects. - Not universally applicable. - Every project has a different environment. - Over-compensating.	Majority of individuals indicate that adaptation takes place. - Adds value to the system. - Financial concerns. - Time limitations. - No SDM can handle all types of projects. - Different environment. - Changed requirements. - Lack of knowledge.
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	Company A	Company B	Company C
	Requirements for the product often changes.	- Changed requirements. - Political motivation.	
How systems development methodologies are adapted			
How systems development methodologies are adapted	- Adding steps. - Removing steps. - Combination of different methodologies. - Switching between different methodologies.	- Adding steps. - Removing steps. - Any possible (ad hoc) way.	- Combining steps. - Removing steps. - Modifying some steps.
Process of approving	- Process for approval depends on the job role of the individual. - Senior staff: there is no formal process, because they are approving the adaptation to the SDM. - Junior staff: Need to follow a formal process to get approval from senior staff.	- Formal process. - Process sometimes ignored by employees - too time consuming. - Supposed to be approved by the project manager and the change management. - Team discussions. - Design forum. - Architecture team. - PCB (Project Control Board).	- Formal process. - Discussions are being held on a detailed level up to a strategic level. - Business must decide. - Steering committee decides.

	Company A	Company B	Company C
Difference in the quality of the systems that are developed with adapted systems development methodologies opposed to those systems that are developed according to a specific formalized methodology			
	- Formal SDM: Results in better quality products. - Formal SDM: Amount of documentation tend to be more. - Adapted SDM: Contradictory opinions.	- Formal SDM: better quality products; more stabile systems; provides guidance and control. - Formal SDM: time-consuming; stand-alone systems; difficult to make changes to the system. - Adapted SDM: faster delivery times; suited for most products; fit the business' rules and requirements.	- Formal SDM: too time consuming. - Adapted SDM: doesn't reduce quality.

Appendix C

*Interview
Questions*

APPENDIX C

INTERVIEW QUESTIONS

GENERAL

1. *How long have you been working for this company?*
2. *What is your role in this company?*
3. *What is the nature of the account/project that you are working on?*
4. *How would you define a Systems Development Methodology?*
5. *Does the use of a methodology have any value? Why?*
6. *Do you use a methodology to develop your systems? (If Yes, ask Questions 7, 9 - 11, 22 – 26. If No, ask Questions 8, 25 – 26.)*
7. *Why do you use a methodology?*
8. *Why do you not use a methodology?*
9. *What methodology do you use to develop your systems?*
10. *Which factors have an influence on the use of methodologies?*
11. *Do you use the methodology exactly as it is intended to be used? (If Yes, ask questions 12, 25-26, If No, ask questions 13 – 21, 25 – 26.)*
12. *Why do you not adapt the systems development methodology?*

WHY DO SYSTEM DEVELOPERS ADAPT SYSTEM DEVELOPMENT METHODOLOGIES?

13. Why do you adapt the systems development methodology?
14. What inspired you to go through with the adaptation process?
15. Why did you not try another formalized methodology instead of adapting the methodology you used?

HOW DO THEY ADAPT THE METHODOLOGIES?

16. In which way did you adapt the methodology?
17. What process must be followed to get this adaptation approved?
18. On what grounds is the adaptation approved?
19. Who approved the adaptation?
20. Do you use this adapted methodology exactly as it is, or do you still make adaptations to it when you are developing a system?

IS THERE A DIFFERENCE IN THE QUALITY OF THE SYSTEMS THAT IS DEVELOPED WITH THESE ADAPTED SYSTEMS DEVELOPMENT METHODOLOGIES OPPOSED TO THOSE SYSTEMS THAT ARE DEVELOPED ACCORDING TO A SPECIFIC FORMALIZED METHODOLOGY?

21. What is the difference(s) between the systems developed with the formalized methodology against the system developed with the adapted methodology?

CLOSING QUESTIONS

22. Would you recommend using a methodology exactly as it is, or would you recommend adapting a methodology?
23. What are the advantages of a SDM?

24. What are the disadvantages of a SDM?

25. *Any experiences you would like to share with me that you think could add to my research?*

26. *Any questions or comments on your part?*



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