Using a System Dynamic approach to understanding the socialisation process of IT graduates

Ricardo Tjikongo

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Supervisor: Mr Walter Uys

Co-Supervisor: Dr Felix Olu Bankole

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ABSTRACT

This study analyses the process that an IT refurbishing organisation used to socialise 15 IT graduates to the norms of the working world. In addition, 5 IT industry and 2 governmental agency interviews were used, and 60 online job advertisements were analysed to develop a System Dynamic model. The main motivation for this study was to develop a system dynamics model of the graduate socialisation process, in an attempt to understand the cause and effect of practical exposure, to bridge the IT skill-expectations gap. The main source of data for the model was from a-priori coding and content analysis of job adverts, online blogs and reports created by the students, supported by a review of the existing literature.

System dynamics modelling and simulation uses computer generated software to test the behaviour of real world cross discipline problems over time (Sterman 2000). System dynamic studies have been conducted in project management, education, engineering, geography, sustainable fuel development and agriculture, etcetera. System dynamics is a flexible approach, as it uses both qualitative and quantitative data to model and address a problem situation, gathering data from intellectual and observation experiences, as well as written and verbal databases.

This research advises on the successful integration of IT graduates into industry by identifying the relevant casual relationships. It recognises that graduates are genuinely interested in a career in IT, despite initial difficulties of adapting to a new career. The study was further strengthened by showing that organisational and governmental requirements vary and that they occasionally recruit based on these varying requirements. Primary and secondary data was combined to model a casual loop diagram as well as a stock and flow diagram, which could benefit curriculum advisors in academia, professors, human resource managers in industry and most importantly recently graduated IT graduates.

KEYWORDS

IT skills gap, IT expectations gap, System dynamics, Psychological contract, Knowledge creation, Organisational Socialisation Tactics, Socialisation, Academia, IT Industry , Government

DECLARATION

I declare that this study, "Using a System Dynamic approach to understanding the socialisation process of IT graduates" is my own original work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Signed …….

Ricardo Tjikongo December 2013

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

MCSE – Microsoft Certified Solutions Expert
MCTS - Microsoft Certified Technology Specialist
MCITP - Microsoft Certified IT Professional
CCNA- Cisco Certified Network Associate Routing & Switching
MS SQL - Microsoft SQL Server
IIS - Internet Information Services
MS DNS – Microsoft Domain Name Service
IP – Internet Protocol
VOIP- Voice over Internet Protocol
R&D- Research and development
Ceteris paribus – All things equal
Dmnl – Dimensionless

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

1.1 MOTIVATION FOR THE STUDY

Organisational Socialisation (OS) is known as "the process through which a new organisational employee adapts from outsider to integrated and effective insider" (Cooper-Thomas & Anderson 2006 p.492). For this to take place, graduates need to be introduced to work in an interactive way inside an organisational setting. In the last 5-10 years however, the numbers of qualified and knowledge competent graduates (from here on graduates and newcomers are interchangeable) were, and still are, not supplied by academia in the numbers required from the IT industry and government. Filling the unemployment gap with competent and skilled professionals is very difficult and has been for quite some time, not only in South Africa, but around the world as well. Academia, on the other hand, says that organisations should make their needs more explicit so that they can be catered for. This inequality, known as the ICT skills gap, is a consistent topic for discussion in several debates, conferences and publications.

The author was not drawn to a single theory that can define the study in a succinct manner, simply because the research has too many aspects for one theory to explain. The use of multiple theories explains the subjective knowledge transfer of the stockholders involved. The researcher developed a conceptual framework from three theories that have their own concepts. However, when introduced together they show a paved way for the socialisation of graduates. The theories demonstrate the stakes graduates and Industry/Government have in the relationship.

Firstly, the study introduces the psychological contract of graduates towards their employers. These contracts are different from those of experienced professionals, as their needs and circumstances differ (Neill & Adya 2007). Secondly, employers use their requirements to socialise the graduates using different socialisation tactics. The employer, too, has a stake in the contract with their employee, since they are responsible for the setting up the expectations that the graduates need to succeed (Neill & Adya 2007).

Finally, upon entering the organisation as newcomers, the graduates start learning, sharing, creating and using knowledge, whether they do so knowingly or not. They enter into a spiral of knowledge creation that converts what they learn explicitly and tacitly from socialisation to externalisation through to combination until such time they are fully integrated and internalised as knowledge workers (Nonaka 1994). Following the theoretical framework, the system dynamics model is achieved by modelling the qualitative concepts and factors System dynamics methodology.

The study focused on socialising 15 post graduates studying towards a diploma in information and communication technology application and infrastructure management (PGD ICT AIM) at the University of the Western Cape under the capaciti1000 programme. Graduates were exposed to two weeks of practical work, and results were coded using qualitative software NVIVO 10. Graduates documented the events of the socialisation period on an online blog. Additional data were collected through 4 Industry, 2 Governmental agency interviews, and 60 online job advertisements from IT Web and PNET. The additional data were used to show the existing requirements, currently demanded core competencies within IT, and the industry's adherence to their own requirements.

1.2 RESEARCH PROBLEM/QUESTION

Graduate employability considers not only the theoretical/book awareness, but also the soft, hidden tacit knowledge. The main research question in this research is, "what do IT graduates need to learn in order to fit into the competitive IT environment?"

A general three-fold assumption is made. First, industry and government assume that graduates coming straight out of University do not have the necessary skill set required (Yongbeom et al. 2006). Second, academia contends that the requirements from industry are not clear cut, and consequently, they do not know what industry wants (Harman 2010). Academia are left to conclude that industry is not interested in academic research and curriculum design as contributors to graduate employablity (Harman 2010). Finally, graduates lament that industry requires experience, which, they feel, is an unreasonable expectation from a student who has

been busy studying for 3-4 years, sometimes even longer. These are the factors that lead to the research question, which leads, in turn, to the methodology and analysis.

In the last 5-10 years there have been constant complaints from industry and government alike, that recent graduates straight out of a University (Classroom) setting are not ready and do not have the necessary skills and competencies required by professional practitioners in the real world (Vakalisa 2005). Tertiary institutions, on the other hand, argue that the dynamic environment of business and its disciplines are causing tremendous pressure on educators to keep up (Lafrance 2010). A normal interview span is about 30-60 minutes, and this is the only time a potential employer has to access a possible candidate. Lafrance (2010) further elaborates that, due to the recent economic crisis, industry has been forced to bend backwards in order to survive and thus it is difficult to blame them.

The apparent skills gap can thus be explained as the disparity between the skills possessed and the quality of the abundance of skills gained by IT graduates which are required by the IT practitioners (Aasheim et al. 2009).

The problem statement to be proposed in this study is that there is a gap between supply and demand in IT graduates.

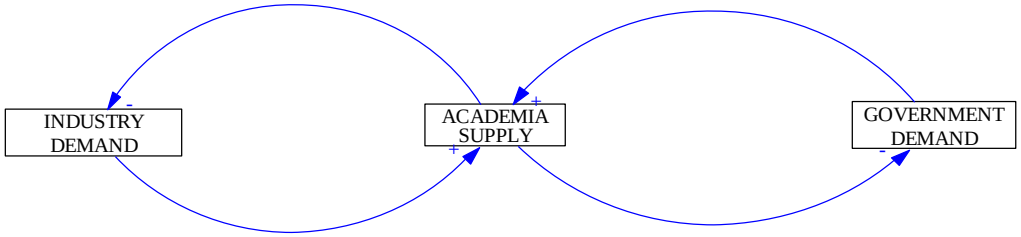


Figure 1. Industry- academia misalignment

The figure above was created using Vensim PLE, a software for creating system dynamic models. It shows a rather simple model and depicts the increased demand of Industry and Government and how academia is under supplying. What skills (hard and soft) and

competencies, including interpersonal skills, operational and leadership skills, personal skills, are required by industry/government?

The skills required and the ones that are available are misaligned. There is an under supply in most industries and this is more evident in the IT sector (King & Mayor 2012). Furthermore, as mentioned before, this has been the consensus, not just in Information Technology (IT) but in all other industry sectors. Skills shortage is a major issue all over the world. Information Scientists (Qi 2011) acknowledge that polishing and equipping graduates for employment are the most lasting factors in higher education in almost every country.

Narrowing that down to a South African context, Daniels (2007) demonstrates that in the IT sector, Government and industry are constantly calling for student graduates with the knowledge and skills required to meet the demands of a rapidly changing Information Technology and Information Systems (IT/IS) environment. The disequilibrium in South Africa is mentioned further by Mekofer & Murphy (2009), who state that, for organisations to be successful, there needs to be a constant injection of knowledgeable and skilled workers into this rapidly developing and very intensive economy.

Moreover, due to the dynamic nature of the IT industry, expectations mismatch is one of the highest compared to other sectors (Scholtz et al. 2010; Evans 2003). Agility is considered vital to a fast paced free-enterprise Industry. Knowledgeable individuals are an important asset to any organisation that wants to gain a competitive advantage over their rivals. Learning theory alone, graduates find it difficult to adjust when they enter the working environment, let alone find a job. Graduates should be able to mix theory and practice, therefore ensuring that they not only develop but also cope with change (Weligamage & Siengthai 2003).

As mentioned before, the main research question is, “what do IT graduates need to learn in order to fit into the competitive IT environment”? A subsidiary question could be, “Does the IT industry really hire based on the competencies they require from IT Graduates”?

1.3 STRUCTURE OF THE THESIS

The thesis explores the means of bridging the skill expectation gap between theory and practice in order to illustrate the tacit aspects that graduates fail to grasp, and which the industry/government require (Figure 2).

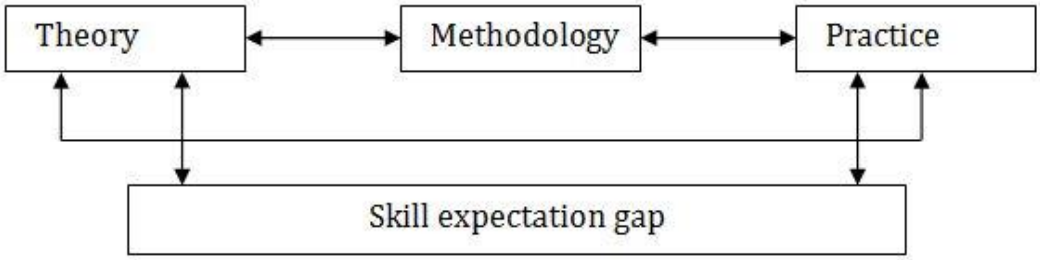


Figure 2. Theory and practice relationship

In an attempt to increase the weak innovation supply from academia and feed the expertise demand to industry and government, these are the tacit aspects that recent graduates coming out of universities need to learn in order to become successful in the working environment (post final interview). The simple answer to this question would be a list of core-competencies and skills required by industry and government. However, the empirical data gathered did not show this as being sufficient. There is a vast difference between practical and theoretical knowledge. The application of theory in practice is just the first step that gets the ball rolling when it comes to creating value in industry and government as a graduate.

The PGD ICT AIM graduates were each socialised for a specific skills set consistent with their different personality traits. However, the integration process was similar for all the graduates involved. Industry employs a mixture of formal, non-formal, random, collective versus individual, tactics, which are explained in further detail in Chapter 3.

1.4 AIM OF THE RESEARCH

The aim of this research is to encourage the interaction between the three stakeholders (IT Industry–Academia and Government) through a proposed model which will show tacit aspects that graduates need in the working environment.

1.5 RESEARCH OBJECTIVES

The research intends to address four main objectives in this study namely:

Firstly, to gain an understanding of the relationship between the triple helix, namely: the IT professional supply from the University and skills demand from the IT industry through to the service sector of government.

Secondly, to understand the socialisation of Non-IT graduates into the IT discipline, as well as using advertisements on IT recruitment websites to outline the core skills, competencies and knowledge (theoretical and practical).

Thirdly, to use modelling and interactive simulations to represent the complex relationship/environment in which academia and industry/government function, using system dynamics tool Venism PLE.

Finally, possibly the most important objective of the study is not to solve the problem, but to give an understanding of the environment graduates will enter once they leave the comfort of the tertiary institution.

1.6 RESEARCH QUESTIONS

These objectives are explored by focussing on the following key research questions.

1. Can causal relationships be used to advise on successful IT graduate socialisation?
2. Are graduates adequately prepared by academia for the working world?
3. Does the industry hire graduates based on their requirements from academia?
4. Can system dynamics be used as a methodology to model these dynamic aspects?

1.7 CHAPTERS OUTLINE

Chapter 1 (this chapter), introduces the concepts of the IT skills expectations gap, the research problem, objectives and questions.

Chapter 2 gives a succinct review of all the literature read surrounding the concepts in the study. This theoretical base introduces research conducted in socialisation, psychological contract, knowledge creation and system dynamics.

Chapter 3 introduces the conceptual framework created by combing the three existing frameworks of psychological contract development, Organisational Socialisation tactics and knowledge creation.

Chapter 4 presents the two research phases in the study, Phase I: Case Study, and phase II: System dynamics modelling and simulation, and demonstrates the System Dynamics methodology which will be used in the study. It documents (summarizes) the discussions, and shows the traits that the PGD ICT AIM graduates possess when the different socialisation tactics are used. It shows what organisations require from graduates, by introducing and supporting the dynamic model, created after endogenous and exogenous factors were extracted from chapter 4 (qualitative data analysis).

Chapter 5 presents the findings and discussions from both phases I and II. It shows the data analysis, model development and simulation.

Chapter 6 draws conclusions from the study and makes recommendations.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature on the socialisation of Information Technology (IT) graduates and newcomer adjustment in industry and government. It outlines the use of concepts in the study to make the reader aware of the nature of industry or government versus that of academia graduate socialisation relationship. This chapter was deemed essential to this study, as a good literature review should be able to justify the use of particular literature, validate the reason for choosing a particular method of study and clearly show that the research contributes something new to the field of study (Hart 1998). It forms a concise summation of all the literature reviewed, and form the basis of the input to the system dynamic model.

The main aim of the chapter was to help the reader to comprehend all the concepts and link these to themes in the dissertation. It provides an up to date, succinct but informative review of the environment that newcomers need to know, understand and thrive in. The literature review forms a backbone to the whole study, pointing out the conceptual framework used, by combining the psychological contract theory, the theory of organisational socialisation (organisational tactics) and the SECI knowledge creation. It incorporates a brief history of the theories and displays them in a systemic conceptual manner which is easy to relay to any reader.

Furthermore, the literature review discusses the relations between the concepts. It discusses the socialisation tactics and psychological contract fit, the socialisation tactics and system dynamics fit, the SECI knowledge creation to socialisation tactic fit, SECI knowledge creation and psychological contract fit, the SECI knowledge creation to system dynamics fit, the psychological contract to system dynamics fit.

2.2 METHODOLOGY FOLLOWED FOR THIS LITERATURE REVIEW

A systems approach from Levy & Ellis (2006) was used as a frame. The study proposed a framework which allowed the researcher to effectively analyse the literature. Stages of the systemic literature review include: 1. Input (gathering and screening), 2. Processing (following Bloom's taxonomy) namely, *knowing the literature, comprehending the literature, applying, analysing, synthesizing and evaluating* and 3. Outputs (writing the literature review).

The literature search began with a simple keyword search of the principal terminology on Google scholar. Articles surrounding system dynamics, systems thinking, IT industry socialisation, SCEI knowledge creation, organizational socialisation tactics, academia and IT industry gap, graduate skills and graduate employability were searched for. More factors, including synonyms of the words, were used to gather articles. The main articles were selected based on importance as well the number of citations the article had at the time.

After the keyword search, the researcher conducted a forward and backward search on the main articles in online databases to find journal articles from the seminal authors and main references. Thereafter, a triangulation of the main authors was made in order to limit the author-centric, pioneering view. Articles were limited to the last 10 years; however, in the case that important articles beyond 10 years were to be included in the literature review, reference was made to be the founding authors.

2.3 BLOOM'S TAXONOMY

In the late 1940's, Bloom along with a group of educators from the American Psychological Association (APA) set out to derive an assortment based on the levels of intelligence, thinking and learning showed by graduates. This became the taxonomy of three domains: The cognitive (Knowledge) domain, the Affective (Attitude) domain, psychomotor (Skills) domain (Forehand 2010). About 15 years later, the first domain gained more exploration. In 1956, Bloom et al. completed the *Taxonomy of Educational objectives: The classification of Educational Goals. Handbook I: Cognitive Domain,* better known today as Bloom's taxonomy (Bloom et al. 1956).

The Taxonomy explored 6 aspects of the cognitive domain, which became widely used for teaching and learning in Information Systems.

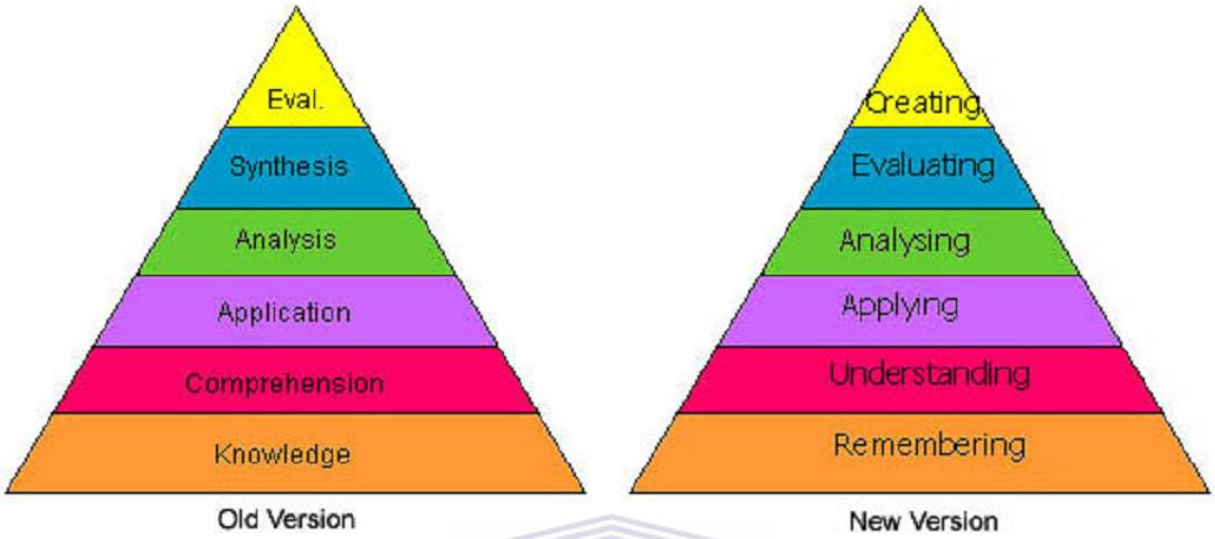


Figure 3. Bloom's Taxonomy (Forehand 2010 p.3)

The taxonomy became the anchor for guiding novice and experienced researchers on how to conduct an effective literature review in support of information systems research (Levy & Ellis 2006). However, as it was based on learning, one level could not be achieved until the prior had been mastered and some researchers found this difficult. Bloom's taxonomy is highly applicable to socialisation of graduates within the IT industry as the post graduate application and infrastructure (PGD ICT AIM) course incorporated cognitive apprenticeship where learning was made visible to graduates through abstract tasks in a dynamic context. The teaching approach afforded the graduates the opportunity to engage in collaborative learning through peer to peer engagement. The data analysis will test the chosen frameworks to figure out if the approach worked.

2.4 CHALLENGES FACED IN THE LITERATURE REVIEW

Achieving the literature review was no easy undertaking. Gathering and ploughing through the heaps and heaps of journal articles, books, newsletters and internet sources was challenging. The

back and forth motion from printing, reading and summarizing of sources was a gruelling and tiresome process to a point where the researcher almost gave up. However, conducting a systems approach to writing and constantly achieving written literature was believed to be necessary and helpful. Creating a concept map for the authors made the process less confusing, more bearable and manageable.

2.5 SKILLS GAP

According to Sharf & Khan (2005), a skill is something that can be acquired by constant training to gain competency. There are two types of skills; hard (technical skills, hands on skills) and soft skills (communication, verbal or written skills, self-efficacy) (Fajar & Hidajat 2012). However, the IT industry, and more specifically the project management side, prefer soft skills (Stevenson & Starkweather 2010).

The uneven professional skills gap and skills demand for transferable skills has been a constant problem, not just in South Africa, but for developed and developing countries all over the world (Scholtz et al. 2010; Sharf & Khan 2005). The Skills gap is not exclusive to the ICT/IT field. According to the Johannesburg centre for software engineering 2013 annual JSCE ICT skills survey, about 9 out of every 10 organisations in different sectors lack some sort of skills set. However, it is clearly evident in the Information Systems (IS) industry, according to Evans (2003) & Evans (2006). The ICT/IT/IS skills gap (titled "IT skills gap" from here on) can be defined as the "disparity between the quality and adequacy of skills possessed by IS graduates" or between a job seeker and the skills "required by the IT/IS industry" (Scott et al. 2002). This worldwide situation has been highlighted in a number of articles, and authors have written extensively about the skills gap and, more specifically to this thesis, the IT skills gap (Merkofer & Murphy 2009; Rudzajs & Penicina 2010; Ras et al. 2010; Scott et al. 2002; Chookittikul et al. 2011; Lafrance 2010; Scholtz et al. 2010; Kochan et al. 2012).

In some cases, even with the unemployment rate of South Africa at 25.2% in the second quarter of 2013 (Statistics South Africa 2013), businesses advertise positions but posts still remain unfilled while professionals cannot get jobs. Why this case? It is because of the skills gap (King

& Mayor 2012). The dynamic nature of the IT skills gap in particular, is extremely difficult to assess as it is a vicious unpredictable cycle.

The lessons learnt from the relationship between academic supply and industry or government demand from the IT industry have changed slightly over the years. Studies in the 90's tend to have focused more on the interaction between tertiary and high school, as well as having bridging subjects that would make the transition much smoother (Von Hellen et al. 1999). Nowadays, rapid changes to technology and shifts in academic perceptions to industry requirements have shifted the lessons. The lessons learnt have shifted more to collaboration of industry, academia and government (Yongbeom et al. 2006). Collaboration starts from high school learner to tertiary student then graduate and finally goes through to organisational employee. Nowadays, graduates are told to be innovative and creative in order to be noticed (Bridgstock 2011; Simon & Jackson 2013). Employees sometimes also take on graduates before they officially finished their studies. This way, they can attract and retain graduates through rigorous recruitment tactics (Lobo & Wilkinson 2008).

2.6 EXPECTATIONS GAP

While some studies argue that the skills gap is the major reason for the employment imbalance, other studies such as the one by Alexander et al. (2009) consider the 'expectation gap' as the cause. The expectations gap is the gap that exists, or is perceived to exist, between theory and practice. It defines what is taught in academia and what is needed in industry and government. Alexander et al. (2009) goes on to say that due to the ever increasing demand for knowledge workers from industry and government, a whole range from basic non-technical to specialized highly technical skills are in increasing demand. Why is it that, despite the fact that unemployment continues to rise, people with the experience and skills are still left without a job? (Johannesburg centre for software engineering 2011).

The expectations gap is therefore important to this study, as recent graduates are not expected to have certain skills coming straight out of a university setting. However, they are rather expected to have knowledge from their university degree (theoretical degree) (Alexander et al. 2009). Taylor (2012) supports Alexander et al. (2009) by stating that academia are not in the industry of

training for skills development, but they rather educate the student to get ready for the working environment. According to academia, the more educated the student the better their chances of succeeding in the competitive IT environment (Simon & Jackson 2013). Therefore, academia mainly focuses on theory and not practice.

There are a number of factors influencing the expectations gap in the IT environment. The factors are shown below in a word cloud (Figure 4). Figure 1 shows the expectations that are highly coveted by the IT industry and government. It displays these expectations from the IT industry along with attributes and competencies combined from several sources (Barber et al. 2012; Villiers et al. 2012; Chookittikul et al. 2011).

The author created the word cloud to visualise the expectations demanded. The factors with the largest font are required the most. As the font decreases, the degree of demand for the expectations becomes less.

Figure 4. Skills expected from industry

The second word cloud (Figure 5) shows what IT industry and government expect from of the newcomer after he/she has adjusted to the role. These are, in fact, the skills experienced professionals possess already (Lafrance 2010; King & Mayor 2012; Gallagher et al. 2004). The

word cloud includes self-efficacy (believing in one's self), role clarity and job performance indicators.

Figure 5. Outcome of skills used in industry

The two word clouds are the result of themes and concepts gathered from literature. Although the map in itself is not comprehensive, these skills are the generic IT skills that are required by the IT industry and government and possessed by IT practitioners.

2.7 INDUSTRY AND ACADEMIA COLLABORATION

In an attempt to bridge the IT skill expectations gap, researchers have increasingly called for collaboration amongst the stakeholders involved. Governmental and non-governmental organisations have set up programs to try and bridge this gap (Taylor 2012). However, these agencies should try and incorporate graduates as early as undergraduate level (Simon & Jackson 2013). Taylor (2012) claims that collaboration not only increases the real-world knowledge of students but also teaches them techniques that they will use throughout their career.

In an engineering setting, the study of (Banal-Estañol et al. 2011) claims that even the smallest amount of exposure to industry has an effect on applied research. Jarzabek (2006) had similar

findings five years before, in a research project for software engineering. The study revealed that industry collaboration allowed for ideas to be validated and teaching styles could be improved upon, based on past failures. Academia can then in turn enhance their curricula to nurture the talent pool (Mekofer & Murphy 2009).

2.8 THEORIES IN INFORMATION SYSTEMS

A theory in IS can be viewed in a number of ways. In the words of Gregor (2002), a theory in IS seeks to "answer a human need to make sense of the world and to accumulate a body of knowledge that will aid in understanding, explaining, and predicting the things we see around us, as well as providing a basis for action in the real world".

In order give a model/map for to the whole study, three theories were used, namely: the psychological contract theory, organisational socialisation tactics and the knowledge creation theory. All the theories are explained in detail in chapter 3. Before the theories are explained, the nature of theories in IS has to be pointed out. The taxonomy from Gregor (2006) was used to state the main types of theories in IS. The study shows five primary goals that theories seek to answer.

There is the (1) theory for analysing and description, (2) theory for explanation, (3) theory for prediction (4) theory for explanation and prediction finally (5) the theory for design and action.

The first view of a theory in IS is analysis and description (AD) which seeks to examine constructs and its surroundings. The theory purely seeks to answer "what" questions surrounding the concepts and its environment. Theories such as the unified theory of acceptance and use of technology (UTUAT) by Venkatesh et al. (2003) is one such theory.

The others are Technology Adoption Model (TAM) (Venkatesh & Bala 2008) and the Diffusion of Innovation (DOI). These kinds of theories are testable theories. TAM and DOI analyse and describe behaviour from a consumer's perspective. The DOI was used to test the Berry and Berry model for the degree and types of innovation (Walker et al. 2011). In regards to this study the psychological contract is also an analysis and description type theory (Abdullah et al. 2011).

With its roots in human resources, the theory is used in IS to simply describe the type of psychological contracts available for recent graduates.

The second type of theory seeks to explain the causality of an argument (Gregor 2006). The theory of explanation intends to gain deeper insight into the problem; they answer "how" and "why" type questions. Herbert's theory of administrative behaviour (1976) is one such theory. Lamb & Kling (2003) made use of the theory to present the interaction of users as social actors and how organisations can shape Information and Communications Technology (ICT) and its related practices.

With regards to this study, a theory towards organisational socialisation (OS) is appropriate, as it can accommodate subjective qualitative data to test the different tactics of how companies integrate (socialise) recent graduates, the tactics, better known as continuums, identified by (Tuttle 2002) are namely:

1. Collective versus individual,
2. Formal versus informal,
3. Sequential versus random,
4. fixed versus variable,
5. Serial versus disjunctive, and
6. Investiture versus divestiture.

The third type of theory is the predictive theory which aims to foresee the future to some extent (Gregor 2002; Gregor 2006). The theory explains what will be seen in the future but does not explain why. The real option theory (Webber 2001) is an example of such a theory. The theory originates from an economic background, but can also be applied in IS research to represent strategic investment techniques to make business decisions that affect investment projects, not only now but in the future.

The fourth type of theory in IS, is the explanation and prediction (EP). It is a mix of theory two and three. The EP theory can be used to show how things should be practiced, through explaining "what", "why", "how", "where", "when" type questions (Gregor 2006). This type of theory tends to follow a prescribed methodology which is assumed to be the best. The knowledge creation theory described by Nonaka et al. (2000) is an example of a EP theory. The desirable

end goal in the theory is internalisation. The process begins with socialisation and individuals move spirally in a clockwise direction into externalisation to combination and then finally into internalisation. The theory was used in this study to predict the working nature graduates will face in the real world.

The final type of theory in IS, is the design and action (DA). The DA theory shows the process of creating something (Gregor 2006). For example, a learning management system (LMS) for university graduates could be designed in a number of different ways. On the one hand, using a behaviourist theory would be more suitable if the author wishes to be more direct (Ally 2004). On the other hand, a constructivist theory would be advisable for praxis (Moallem 2001). The former deals with how the student responds to the learning material (stimuli). The latter is the way in which a student constructs and builds on top of previous knowledge.

Although all these types of theories may be different they are all important in IS. They provide diverse opinions and angles to react to research in IS (Gregor 2006).

2.9 COMPARING SOCIALISATION, ORGANISATIONAL SOCIALISATION TACTICS AND INTEGRATION

Socialisation is the process whereby individuals or a group of individuals are introduced into a new setting by senior members of the institution or organisation (Austin 2002). Organisations introduce individuals through knowledge sharing interactions and communication in order to ease the growth of newcomers into that new setting (Fang et al. 2011). Van Maanen (1978) refers to organisational socialisation tactics as "the ways in which the experiences of an individual in transition from one role to another are structured for him by others in the organization" (p. 230). Socialisation tactics are methods used to integrate individuals.

Integration and socialisation although used interchangeably, is not the same thing. Integration entails exactly what is done in the socialisation process. It includes the policies, practices, experiences and the exposure the organisation introduces to the newcomer (Bauer & Erdogan 2012). For instance, an organisation can use formal and informal tactics to introduce newcomers to group work. Assessing the way that newcomers are introduced into the organisation by using

different organisational tactics gives a deeper and richer analysis for the research (Bauer & Erdogan 2012).

As a method of integration, organisational socialisation (OS) tactics allows individuals to learn the inner workings of their new organisation much faster (Saks & Gruman 2011). With regards to this study, the tactics were utilised to measure the process the graduates were exposed to during their time at the organisation.

2.10 PSYCHOLOGICAL CONTRACT

Before entering into a contractual agreement, both employer and employee have what they call a psychological contract (TPC). It is better known as a non-verbal "contract" that exists between the employee and employer. A mutual obligation is strung by work done by the employee and tenure guaranteed by the employer (Robinson 1996). Different companies have different PC's with their employees and these are seldom the same across companies (Robinson 1996). By linking PC and OS tactic theories, it is easier to get the best fit between employee and employer commitments. The requirements of both organisation and employee are better understood; therefore, these two theories were part of the three chosen in the conceptual framework for this study

As opposed to new hires, experienced professionals are exposed to different OS tactics; therefore, each has a different type of PC. (Lee et al. 1992). A successful socialisation process is measured once the full cycle from outsider to insider is completed. The theory of OS is important to this study as it shows a direct relation: the relation of "what people learn about their work roles in organizations is often a direct result of how they learn it" (Van Maanen & Schein 1979 p.209).

Handzic & Chaimungkalanont (2004) used both informal and formal forms of socialisation, and their results showed that informal means of socialisation may have a much more powerful effect on creativity if done properly. King & Sethi (1998) examined OS tactics and adjustment variables to confirm which one affects role adjustment best. Filstad (2011) found that OS tactics introduce newcomers positively into the new organisation, allowing them to play an active part

in interacting with colleagues and projects, which will in fact increase their commitment and ease their integration process.

Whichever form of integration or socialising process they use, one common factor is that they all use these processes to manage knowledge to gain a competitive advantage.

2.11 SECI KNOWLEDGE CREATION THEORY

Knowledge in an organisation can make the difference between a successful organisation and a mediocre under achieving organisation. Nonaka (1994) defines knowledge as the organised flow of information created from beliefs and commitment. Individuals enter an organisation with new unprocessed knowledge known as information. The organisation uses this 'individual' information by exposing individuals through social interaction to create knowledge (Nonaka & Toyama 2003). It is the creation of new knowledge and not the reconstruction of old knowledge (Zaman et al. 2011). The two types of knowledge are tacit and explicit. Tacit (silent, unseen) subjective knowledge is as important, if not more important, than explicit (objective) knowledge individuals are exposed to (Nonaka et al. 2000). Horwitz et al. (2003) agree with Nonaka et al. (2000) that sharing both tacit and explicit knowledge is "important in building both intellectual and social capital, accessible by others in the organisation". There is a third type of knowledge which combines of the two, known as implicit knowledge, and which is tacit knowledge converted to explicit knowledge (Zaman et al. 2011). However, this thesis will only concentrate on tacit and explicit knowledge.

Nonaka (1987) argues that the continuous dialogue between tacit and explicit knowledge creates knowledge. The process of moving from tacit to tacit and then tacit-explicit, then explicit to explicit and finally back to tacit again is the process known as knowledge creation. Companies have their own discrete ways of integrating new employees, and these are known by different names, such as knowledge sharing, employee adjustment, social learning, etcetera.

2.12 CONCEPT FIT

This section will introduce the concept fit in the study. It will display the results of previous studies and how the concepts were used together.

2.12.1 SOCIALISATION TACTICS AND PSYCHOLOGICAL CONTRACT FIT

The psychological contract can be explained as the contract that exists between employee and employer that motivates workers to perform, knowing that the employer will do the same and reward the employee through remuneration, promotion etc. (Rousseau 2004). Robinson (2012, p. 574) sees this contract as embodying the "perceptions of what they owe to their employers and what their employers owe to them". The term "psychological contract" was first initiated to categorize the relationships between subjective contractual agreements and has evolved in meaning. Contracts are seen as mechanism put in place for the two parties to co-exist despite having incomplete knowledge of each other's intentions.

History shows that individuals tend to apply to companies that share common features, principles and values as themselves; in turn, companies also tend to reciprocate this when they recruit new hires (Cable & Parsons 2001). Cable goes on to suggest that the socialisation process should be used to develop the organisational role responsibilities that newcomers need to understand to know their career. In addition Cooper-Thomas et al. (2012) postulate that older techniques of socialisation have changed over the years.

Newcomers and experienced professionals differ not only in absorbing the socialisation tactics, but also by the techniques they use to adjust to their new environment. Allen (2006) argues that without organisational socialisation, newcomer turnover rates will increase and that collective, formal, sequential, fixed, serial and investiture tactics are likely to decrease turnover and increase newcomer loyalty. Therefore, companies that are willing to make use of the knowledge resources will have completive advantage. The person-job (PJ), and person-organisation (PO) fit emphasized by Saks et al. (2007) states that there is an indirect relation between socialisation tactics and the perceptions of PJ fit in emotions and self-efficacy. The study continued by stating

that if organisations want to leverage on new hires, they need to make PJ fit perceptions more attractive so that employees can create positive emotions to reinforce newcomer beliefs.

2.12.2 SECI KNOWLEDGE CREATION THEORY AND SOCIALISATION TACTICS FIT

Role adjustments in socialisation form a topic that has been extensively researched, in all spheres of the industry. Within Information Systems, King & Sethi (1998) describe the way in which newcomers adjust to their roles and the impact of socialisation as having 3 outcomes: role orientation, role ambiguity and role conflict. Role orientation is perceived to have a positive influence as the newcomer goes through the process and becomes internalised (Saks et al. 2007). Both ambiguity and conflict are perceived as having a negative influence on socialisation. King et al. (2005) dives deeper into the research and identifies two tactics (investiture and serial tactics) as being as having a direct effect on role adjustment and organisational attachment. Outcomes of socialisation tactics are stronger for newcomers as they go through socialisation to internalisation than for seasoned professionals (Saks et al. 2007). However, employees start off engaging with the employer based on their perceived obligations. When the psychological contract is unbalanced, employees who had been socialising with mentors and spending time in training tend to engage in more socialisation activities. Those that have balanced relationships spend less time on socialisation activities (Payne et al. 2008).

2.12.3 SECI KNOWLEDGE CREATION MODEL AND PSYCHOLOGICAL CONTRACT FIT

Knowledge attraction, creation and management practices are of vital importance for a firm's competitive advantage, not only for professionals but more so for limiting newcomer turnover rates (Horwitz et al. 2003). Knowledge sharing is one of the critical success factors for knowledge management, as organisational factors play a vital role in individual knowledge management through positive psychological contract (Min et al. 2010).

2.12.4 SOCIALISATION TACTICS AND SYSTEM DYNAMICS FIT

No literature was found on the explicit combination, contribution and use of socialisation theory and methodology.

2.12.5 SECI KNOWLEDGE CREATION AND SYSTEM DYNAMICS FIT

Literature on the SECI knowledge creation and system dynamics fit is scarce. However, there are a few authors that have used the methodology and theory together. Yim et al. (2004) found that this combination facilitates the achievement of competitive advantage through strategic knowledge management objectives and knowledge management initiatives. This integration targets real live business problems and behaviour over time; managers and decision makers are able to learn from the system as they go along, and in doing so, tacit knowledge becomes explicit. Zouaghi (2011) displayed two simple balancing loops which concur with the findings of Yim et al. (2004) to an extent. However, Zouaghi (2011) extends his findings into a supply chain setting, and claims that the collaboration has a positive influence on tacit knowledge generation and, in turn, this increases inter-organizational memory.

2.12.6 PSYCHOLOGICAL CONTRACT AND SYSTEM DYNAMICS FIT

Similarly to the Socialisation tactics and System dynamics fit, there is no explicit interaction and use of the psychological theory and system dynamics. This study will be arguably the first to combine the two, in order to get a specific result.

2.13 CHAPTER SUMMARY

This chapter introduced the literature surrounding the concepts in this study. It discussed the methodology used to write up the review, followed by the bloom's taxonomy that discussed this methodology. Further, it highlighted the challenges faced by the author while writing up the

review. In addition, it introduced the concept of skills and expectations gaps as well as collaboration between industry and academia.

Additionally, before combining the three theories of organisation socialisation tactics, the psychological contract and the SECI knowledge creation theory, each of them were discussed separately. Thereafter, they were discussed in pairs. Specifically, these pairs were the socialisation tactics and psychological contract fit, the SECI knowledge creation to socialisation tactic fit, SECI knowledge creation and psychological contract fit, the socialisation tactics and system dynamics fit, the SECI knowledge creation to system dynamics fit, and the psychological contract to system dynamics fit.

CHAPTER 3 THEORETICAL FRAMEWORK

3.1 INTRODUCTION

This chapter introduces a conceptual framework for the use of model development for the socialisation process of recent graduates. The conceptual framework uses the combination of three theories. Although these theories represent socialisation empirically (Neill & Adya 2007; Filstad 2011; Ikujiro Nonaka & Lewin 2012), combining the theories depicts the integration process in more detail. Because graduates and the industry have different psychological contract needs, organizations use different tactics. Through the use of these organisational socialisation tactics, knowledge is created through a spiral process until such a point that the graduate is fully internalized. The framework also illustrates the epistemological assumptions on which the interpretive research methods for this study, described in chapter 4, section 4.6.1 are based

This chapter combines the revisited literature from the literature review in chapter 2 and presents it in a more holistic and simplistic way. The framework reveals the lens used to analyse the epistemological data, industry interviews and online job adverts in chapter 6. Because the process of integration is continuous, the system (framework) cannot be viewed separately.

This chapter begins with the socialisation process as a continuous feedback system from the initial offer until the graduate is fully internalised as an employee.

Influential authors and their studies were considered; however, over time their theories have been critiqued, re-worked and augmented. Certain factors have been added and reduced through the years, and therefore most recent theories were used.

One important aspect to note with the combination and application of the three theories is that different researchers used different theories separately which led to similar conclusions. The conclusions are based on different epistemological and philosophical assumptions, since researchers have divergent perspectives.

However, combining the theories will assist organisations looking to capitalize on the human aspect of their knowledge resources. They may want to consider that employees will probably have very different Psychological Contract perceptions (PC's) at various stages of employment, and knowing this may assist in the integration stage of newcomers (Neill & Adya 2007). It should be noted that for the purpose of this study, only the emergence of the newcomer PC will be studied; organizational needs will be highlighted, but a specific PC will not be discussed.

3.2 THE PSYCHOLOGICAL CONTRACT

The psychological contract is the implicit agreement held by both the organisation and the employee. Shaped by the organisation, the psychological contract is entered on a needs basis (Rousseau 1995). Known for its reciprocal benefit for both employer and employee the PC was originally erected to explore the more personal nature of the relationship that exists between the two. Levinson (1962), Argyris (1960), and Schein (1980) were the authors that initiated the idea, and later it was extended by Rousseau (1995), Robinson & Rousseau (1994), Shore & Tetrick (1994), and Rousseau (2004) on trust, security, violation, breach etcetera. Their work has richly contributed to our understanding of the PC and its stages today.

Although there are infinite forms of PC agreement, they all depend on two dimensions, performance requirements and the time frame (Neill & Adya 2007). Both the organisation and employee have different reasons for wishing to take up a contract (Rousseau 1995). The organisation and employee will enter into a psychological contract in the presence of formal or non-formal employment contract agreements (Shore & Tetrick 1994).

3.2.1 *TYPES OF PSYCHOLOGICAL CONTRACTS*

This subsection discusses the types of psychological contract found when individuals enter an organisation.

3.2.2 *THE ROLE OF THE INDIVIDUAL*

As mentioned above the PC is based on two dimensions, performance requirements and time frame. Rousseau (2004) characterised three types of PC's that Neill & Adya (2007) later extended to four, which were used to test the two dimensions of the individuals PC. These are transactional, relational, balanced and transitional.

Transactional: These types of PC's are very monetary and short-term driven. Employees may enter the contract simply to gain working experience over a summer holiday and have enough money for holiday activities, such as with a 2 week internship or learnership. With limited involvement and narrow duties, if the job does not fulfil their requirements the employee may tend to seek employment elsewhere (Rousseau 2004).

Relational: The total opposite of the transactional contract. The relational contract is very broad and long-term. The two parties have their roles clearly identified, and the relationship is mutually exclusive. It goes as deep as affecting personal and family life. Workers do not tend to be as concerned about monetary benefits as the transactional employees. However, being focused more on the work, they therefore put a lot of time and energy into making the relationship last as long as possible (Hui et al. 2004). For instance, a banker who has been with the same company for 12 years depends on the support of the bank as much as the bank values his/her input.

Balanced: A mixture of transactional and relational, the balanced contract rewards employees for a job well done. Based on development and economic benefits from the employee's side, and the organisation demanding commitment and long-term performance, the balanced contract seems to suit most PC holders (Rousseau 2004). As a case in point, a recent graduate, who was employed by an organisation under a graduate program, was trained and developed by the organisation for a future leadership position.

Transitional: This contract is perhaps not even a PC (Neill & Adya 2007). This agreement is seen in the initial application stage with low performance requirements and a short term time frame.

The following table illustrates the relationship between performance requirements and time invested in the types of psychological contracts.

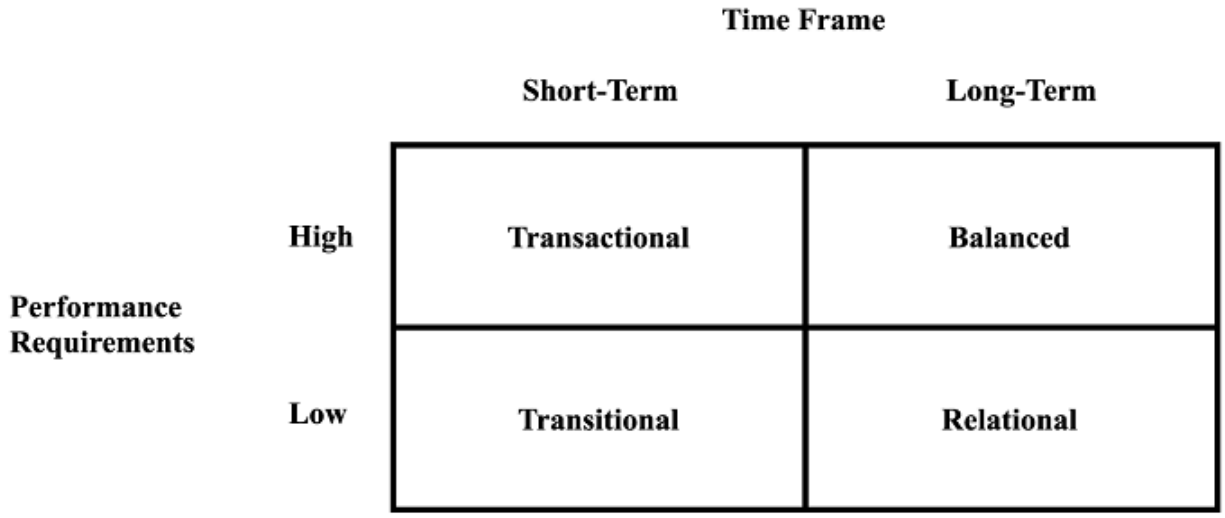


Figure 6. The Types of Psychological Contracts (Neill & Adya 2007 p. 414)

The role of the organisation

The organisation is an entity made up of a number of people. Depending on the size of the organisation, newcomers would interact with tens, hundreds or even thousands of people on a daily basis to form his/her contract (Shore & Tetrick 1994). Rousseau (2004) says that early engagement of individuals from recruitment and socialisation up to the first day of work has an effect on the PC, as the individual now has expectations about the organisation.

3.3 PSYCHOLOGICAL CONTRACT FOR NEWCOMERS TOWARDS THIS STUDY

The PGDAIM graduates in this study were exposed to two weeks of short term mutual benefit, through training and first hand work. Both the graduates and the company had a short-term signed contract that was highly monetarily beneficial to the company, but not to the student. Newcomers often do not have any type of industry experience, and therefore enter a contract for other purposes besides the monetary benefit; they aim to maximize their benefits through gaining knowledge, training, networking, etcetera. "For many newcomers, insufficient tenure with the organization will most likely result in PC perceptions of a more transactional nature, and for many individuals, insufficient time to establish trust and commitment" (Neill & Adya 2007 p. 423).

A balanced contract is also applicable to newcomers as both parties can reach an agreement if economic and performance measures are met in the long term. Knowledge sharing is important for companies who want to leverage on the personnel investment. Merging and balancing the sum of "knowledge acquired externally and internally, constitutes a sustainable resource for maintaining competitive advantage" (Md. Islam et al. 2012 pp. 286).

Table 1: Sample of organisation-individual needs. Extended from Silverthorne (2004 p. 595)

Organisational Needs	**Individual Needs**
Loyalty to the organisation	Good Salary
Employee Cooperation	Job Security
Creativity	Interacting with other people
Following Directions	Experience
Quality work and positive outcomes	Good supervision
Commitment to objectives	Stimulating work
Good working relationship with colleagues	Feeling of achievement
Respect senior authority	Being involved in organizational environment
Satisfying employees	Ability to take responsibility for own work
	Good working conditions

Table 1 shows a brief but relevant list of the different needs of both the organisation and the individual. The PC is the first stage of the conceptual framework and is used to identify organisational factors that may be considered and could influence cooperative knowledge sharing within the newcomer stage. The list will be fed into the system dynamic model.

3.4 PSYCHOLOGICAL CONTRACT FRAMEWORK

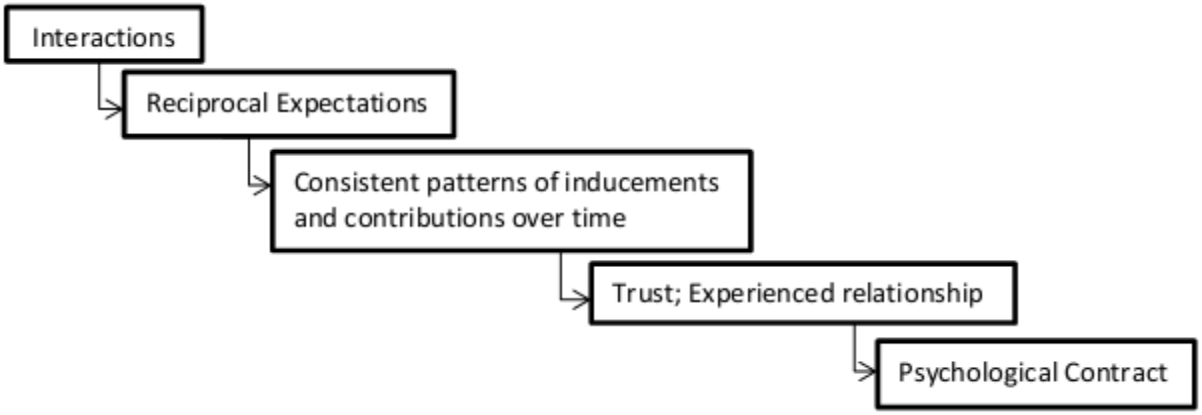


Figure 7. Development of an individual's Psychological contract (Rousseau 1989 p.125)

Figure 7 shows the development of a newcomer's PC. The framework presented by Rousseau (1989) starts off with the interactions between individual and organisation, based on their respective needs as presented in table 1. Thereafter, a reciprocal expectation is believed to exist.

The expectations are reinforced by patterns which promise that employees will be rewarded with retention based on their hard work. As the relationship grows, trust develops, and individuals tend to have more faith in the organisation and management. After each stage, the newcomers form their own PC; transactional, balanced, relational or transitional.

3.5 ORGANISATIONAL SOCIALISATION TACTICS

Organisational socialisation (OS) tactics are the methods constructed by the organisation to assist newcomers to adapt to the socialisation process and ease their transformation from one role to another (Simosi 2010). OS is the known as an "adolescent" phase used by management and social scientists to describe the stages through which newcomers or new staff participate in an organisation and acclimatize (Van Maanen & Schein 1977). Simosi introduced three phases of socialisation that were used in the 1970's namely: "freezing, changing and refreezing". However, the socialisation process has changed since then, and for this research, tactics are considered. The

author proposed 6 continua/tactics to test the socialisation of newcomers as they move through the hierarchy of the organisation. They are as follows:

3.5.1 COLLECTIVE VERSUS INDIVIDUAL

This tactic socialises newcomers into groups so they share common learning practices and experience growth together. Alternatively, they are exposed to individual tasks separate from the other organisational members (Filstad 2011). For instance, they might complete a group assignment for marks or be given a task to complete alone.

3.5.2 FORMAL VERSUS INFORMAL

The formal method exposes new employees to a structured learning experience in group activities with joint learning experiences to reduce uncertainty and increase trust. Alternatively, individuals can be segregated and to learn more though tacit understanding (Saks & Gruman 2011). For example, individuals either learn in a classroom on specific topics related to the work, or learn on the go at any time without structure.

3.5.3 SEQUENTIAL VERSUS RANDOM

With the sequential tactic, newcomers receive clear guidelines on the learning process that they will be taken though. Alternatively, the process can be an ambiguous learning curve, very ad hoc, inexplicit and unplanned (Cooper-Thomas 2009). For example,, recruits are given dates in advance on which they will receive training throughout the year, or they may be surprised by an unplanned lecture from a senior executive.

3.5.4 FIXED VERSUS VARIABLE

On the one hand, the fixed tactic is linked to the sequential, as this tactic requires newcomers to complete a certain task within a given time period. On the other hand, the variable tactic has no

timetable given to newcomers as to when a certain stage of the socialisation process has been achieved (Cooper-Thomas et al. 2012). For example, fixed modules learnt within a specified time period contrast with the variable tactic illustrated by a final university project that can be handed in anytime until the year end.

3.5.5 SERIAL VERSUS DISJUNCTIVE

Newcomers are paired up with mentors and role models to ease the socialisation process. However, disjunctive tactics can mean that recruits are simply left alone to make sense of the integration process alone. Examples include a cognitive apprenticeship (job shadowing) or learning by trial and error.

3.5.6 INVESTITURE VERSUS DIVESTITURE

The investiture tactic is where newcomers receive positive reinforcing and supporting comments from insiders. Conversely, in the divestiture tactic, the recruits are blown away with negative and unsupportive comments. Thereafter, insiders rebuild them in the form of the organisation's requirements. However, the words "Well done" can have a very positive effect on the work that newcomers do as opposed to harsh demeaning words (Cooper-Thomas et al. 2012; Saks & Gruman 2011; Filstad 2011; Anakwe 1999).

The tactics are further grouped into two, namely institutionalised and individualised tactics. These tactics are dependent on three concerns: the context, content and social concerns. Institutional tactics include the collective, formal, sequential, fixed, serial and investiture tactics. Individualised tactics are individual, informal, random, variable, disjunctive and divestiture tactics. Examples in the context include classroom work or fieldwork. Projects or reports are encompassed under the content and interactive tactics, where engagements with senior members are highlighted in the social concerns. This can be visually represented as follows:

Tactics mainly concerned with:	Institutionalized:	Individualized:	Measures:
Context	Collective	Individual →	Provision of common learning experience
	Formal	Informal →	e.g. set training programme
Content	Sequential	Random →	Structured career programme
	Fixed	Variable →	Timetable for career progression
Social	Serial	Disjunctive →	Provision of role models
	Investiture	Divestiture →	Support from experienced org. members

Figure 8. Jones's Socialisation tactics (Filstad 2011 p. 379)

3.6 KNOWLEDGE CREATION THEORY

The knowledge creation theory is a spiralling model, which creates knowledge through four segments. It should be noted that the conceptual framework should be considered continuous from PC into the Socialisation, Externalisation, Combination and Internalisation (SECI) model holistically. Before defining the SECI model, it would be helpful to highlight knowledge, the dimensions of knowledge and knowledge itself. Knowledge is considered to be "justified true belief", and this means that knowledge is dynamic and context specific. Knowledge is created through interaction and conversation, and can be both explicit and tacit (Nonaka et al. 2000; Nonaka & Toyama 2003).

On the one hand, explicit knowledge can be transferred from one individual to the next by using words, numbers and letters in an organized manner, as in the case of lectures in a lecture hall. On the other hand, tacit knowledge is the hidden non-verbal language that can only be gained if an

individual is fully committed to a certain task, such as apprenticeship (Nonaka 1994). In the socialisation process, newcomers are exposed to both types of knowledge.

Influential studies from Nonaka (1987; 1994) were influential in developing the SECI model to highlight organisational innovation and creativity and how this creates knowledge. The theory was extended by adding the concept of "ba" which means "place" in Japanese (Nonaka et al. 2000;Nonaka & Toyama 2003;Nonaka & Lewin 2012). "Ba" can be a virtual or physical space or a context that is shared where knowledge is created. The concept, which was initiated by a Japanese philosopher named Kitaro Nishida in 1921, was among the first to compare the "action world with the dialectical world" (Nishida 1970). However, within this study the model will be used to show how newcomers spiral from Socialisation through to Internalisation.

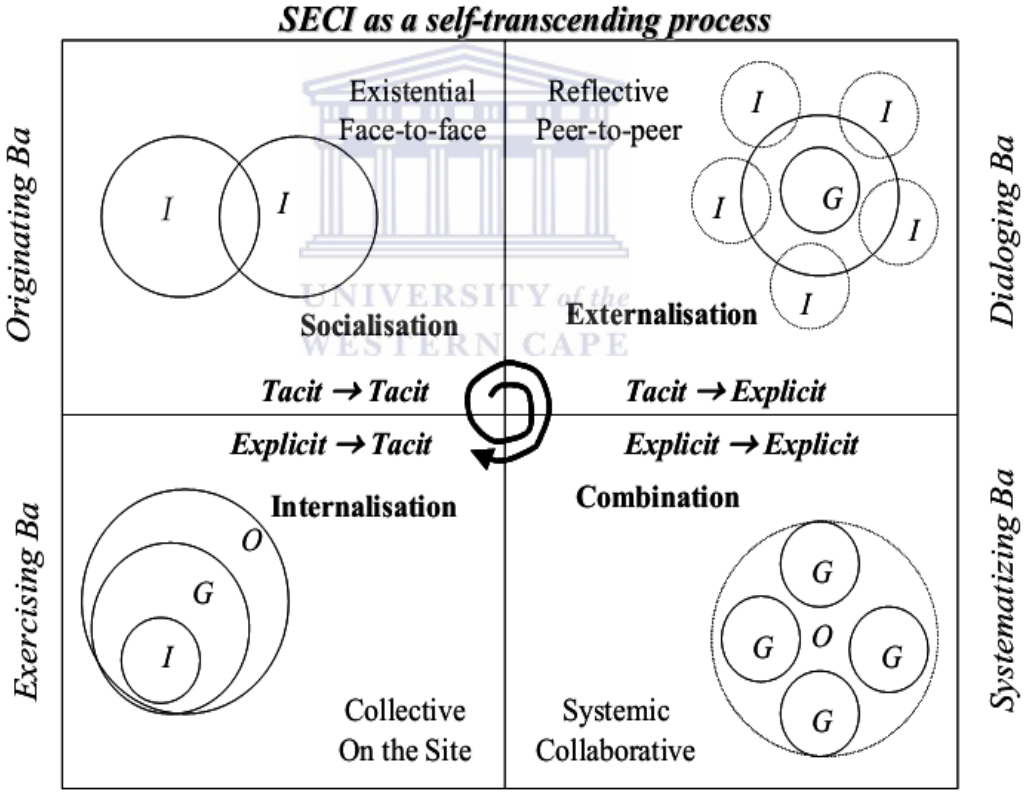


Figure 9. SECI knowledge creation process source (Rice & Rice 2005 p. 672) (I=Individual O=Organisation G=Group).

3.6.1 SOCIALISATION

Figure 9 shows the knowledge creation theory, which has four quarters: The socialisation tactic represents how tacit knowledge is gained through a shared experience, from individual to individual, tacit to tacit and face to face. Direct face to face interaction creates knowledge, although tacit knowledge is very difficult to gain. However, time and constant interaction with the environment are some of the quickest ways to gain experience (King et al. 2005). For instance, knowledge is gained through walking and talking with experienced professionals in and around the organisation or even having a casual chat with customers, suppliers at the workplace, etcetera.

3.6.2 EXTERNALISATION

This is the first conversion of tacit to explicit knowledge. Tacit knowledge is expressed through externalisation, where individuals collaborate to form a group. Tacit knowledge is reflected and articulated through peer to peer interaction such as presentations, pictures, videos, etcetera (King et al. 2005). By means of sharing this knowledge with others, newcomers are expected to start gaining explicit knowledge.

3.6.3 COMBINATION

Explicit knowledge is collected, broken down and applied in an organisational setting. These smaller groups collectively form the organisational environment. It is systematically combined and shared amongst the members collaborate and knowledge is transferred from tacit to explicit knowledge within the environment. This is the beginning of knowledge creation from synthesizing into exercising (Rice & Rice 2005).

3.6.4 INTERNALISATION

This quadrant forms the exercising stage, where there individual, group and organisation exercise the knowledge on site. The synthesized, explicit knowledge which was combined and shared throughout the organisation is now being internalised by the employees. King et al. (2005) says that this is the stage of "praxis" where the employees put their knowledge into action and this action becomes routine. Employees therefore learn by doing as they exercise their acquired skills. If this is not understood, the process starts again from the tacit knowledge (socialisation) stage, and the spiral continues.

3.7 KNOWLEDGE CREATION WITHIN THIS STUDY

The PGD ICT AIM graduates came in as newcomers to the working environment, so their knowledge creation process begins at the socialisation stage. Coming straight out of a university setting they are unable to already have the tacit knowledge of the environment they enter. They simply come in with theoretical knowledge and are socialised by the organisation, using different tactics. These tactics will be discussed next.

3.8 INTEGRATED PSYCHOLOGICAL CONTRACT, SOCIALISATION TACTICS AND KNOWLEDGE CREATION FRAMEWORK

Initiated by different PC's, both employer and employee will enter into the contract for their own various reasons. They will meet a reciprocal consensus of the organisation-person fit, beginning from their first interaction. Once the newcomer has established a PC (transactional, balanced, relational or transitional), the orgnisation will use socialisation tacitcs to integrate the newcomers. The organisation does this through institutionalized or individualized tactics, based on socio-economic demands. While they are adapting to the organisation, the newcomer will be gaining knowledge and rotating that knowledge through the segments of the SECI model. Newcomer and seasoned empolyees share eplicit and tacit knowledge while moving through the spiral, until such a point that the newcomer is fully internalised. If the newcomer is not

internalised by the time the socialisation proess is complete he/she may move back to the PC development stage and reconstruct their PC.

Figure 10, below, graphically illustrates the full conceptual framework.

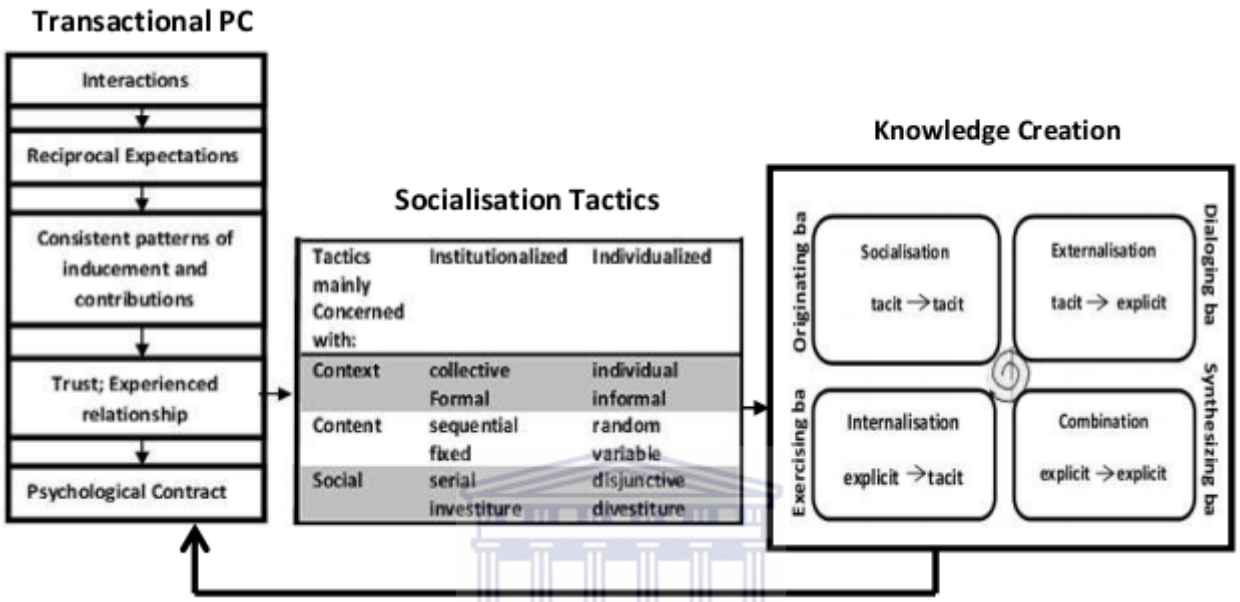


Figure 10. Conceptual Framework

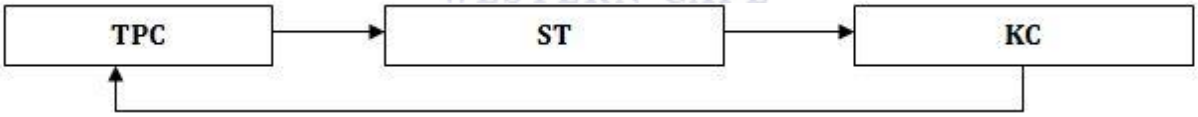


Figure 11. Short-key conceptual framework

Figure 11 reduces the framework in figure 10 to a short-key conceptual framework which can be used to represent the full framework.

3.9 CHAPTER SUMMARY

This chapter introduced the conceptual framework that will act a lens towards the study. First it addressed the psychological contract that both employer and graduate have when entering into an

employment agreement. Secondly, it discussed the organisational socialisation tactics (Van Maanen & Schein 1977). Thereafter, the knowledge creation model from (Nonaka et al. 2000) was addressed. Finally, the conceptual framework was developed from the three threories. After the psychological contract is created from the oganisation-person needs fit, graduates enter the environment and are exposed to the organisation through different methods used by the organisation. They then start gaining and sharing knowledge both collectively and individually. Finally, all the theories were combined to extract a holistic cycle of socialisation. Newcomers can rebuild their contract if they re-negotiate their PC with the employer, extend their time-frame and increase performance. The process should be seen as continuous; thus the flow from one theory to the next is fluent.

CHAPTER 4 RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

The purpose of this chapter is to discuss the research design, including the philosophical and methodological foundation for this study. The research plan consists of two phases, a case study and the development of a system dynamics methodology. The study moves from a qualitative approach (case study) to a quantitative approach in the simulation of the system dynamics model.

The method and methodology originate from different philosophical backgrounds, and this chapter introduces various philosophical assumptions in social sciences, relating them towards this study. The research used an exploratory direction of enquiry, beginning with a deductive method of reasoning that is guided by the framework in chapter 3 and moving into an inductive approach as new themes emerge from the data.

Though knowledge in itself may be discovered by accident, the most sought-after way of gathering knowledge is through research. Yet it may be controversial; some authors see knowledge as being a social construct as opposed to anything else (Meeham 1988). By nature, some research can be problematic, since human interaction happens in different social contexts, environments contain the researcher, sample sizes change and so do organisations, and so on. However, knowledge is a step by step endeavour that can be tested and replicated by known methodology as this chapter will explain.

4.2 QUALITATIVE AND QUANTITATIVE RESEARCH APPROACHES

Two types of approach are used in Information Systems research. Qualitative research, as explained by Myers (1997), uses data gathered from a specific set of methods such as interviews, documents, focus groups, participant observation (primary data) or resembling historical data or archival data (secondary data). Qualitative data are mainly texts and languages. The qualitative approach uses data to probe the research question (Kaplan & Dennis 1988). The role of

qualitative research is to understand a phenomenon rather than generalize. This type of data is non-random and has a small set of participants. It exposes experiences, motivates, captures believes, values, views and interprets them directly (Jacoby & Siminoff 2008).

The quantitative approach uses methods such as survey questionnaires and consumer surveys. These methods are used mainly for statistical analysis and represent quantitative data numerically. They measure rather than attempt to understand the depth, transferability, credibility and conformability of the human perspective (Kaplan & Dennis 1988).

4.2.1 RESEARCH DESIGN

According to Yin (2009), the research design shapes the structure of the study, methods of data collection and building of the conceptual framework. Yin (2009) states that there are 4 types of research designs in case study research: exploratory, descriptive and emancipatory and explanatory.

The exploratory research design focuses on phenomena that are barely understood, due to the little information available. The scope in these types' of phenomena is very broad and the problem can be very subjective. Thus interpreted differently due to its flexibility (Yin 2009). For illustration, what are the critical reasons of a new type of technology failing to be adopted in rural settings?

The main stake in Descriptive design is to provide accurate and valid documentation for the factors or variables in the research (Marshall & Rossman 1999). For instance, is there a correlation between attitudes, behaviour and perceived behaviour towards adopting cloud computing in developing countries?

Emancipatory design promotes social action through group interaction (Yin 2009). For example, how are campaigns used to understand the use of (electronic-skills) e-skills, in order to promote (electronic-literacy) e-literacy in South Africa?

The explanatory purpose of enquiry aims to understand causal relationships that exist in a phenomenon (Marshall & Rossman 1999). The design identifies the environment of the problem,

which is the relationship between, academia, IT industry and government. It shows what methods are within that environment which may aid the research.

In this study the author employs the explanatory research design. Data collection employed both primary and secondary methods, which are discussed in the data collection section 4.15.

4.3 SOCIAL SCIENCE

In order to understand the philosophical paradigm for this study, the researcher had to explore the nature of social science first. The reason for this is that social science deals with the subjective and objective nature of human interaction and mostly the interaction between humans and their environment (Hirschheim 1985). This can be a confusing scenario, since the assumptions of social science and natural science are closely linked. The only way for the researcher to fully grasp and fit the study was to go back and understand the nature of assumptions in the environment of social science. Once the paradigms of this specific study are constructed it is possible to affect the research.

4.4 PHILOSOPHICAL ASSUMPTIONS IN SOCIAL SCIENCE

Social scientists have developed a number of philosophical assumptions over the years. However, Burrell & Morgan (1979) group the main assumptions into four. The authors claim that social scientists gather information either though implicit or explicit means. The four research assumptions are namely: ontology, epistemology, human nature and methodology.

Ontology – At the root of this first assumption is the need to answer pressing questions such as whether ‘realty only exists in one’s head or simply exists in nature’ (Burrell & Morgan 1979). It aims to understand if realty is a social reality or a norm, by studying the nature of existence and nature.

Epistemology – Known for its thorough study of knowledge and all its surrounding facets, this second assumption is also known as the theory of knowledge. Social scientists like Orlikowski and Baroudi (1991), Klein and Meyers (1999), Walsham (2006), and Myers (1999), all aim to

understand human beings. They use methodologies to understand how industry experts and academics alike acquire and share gathered knowledge.

The third set of assumptions within social science is that of human nature. Researchers seek to comprehend questions surrounding human beings and their interaction with their environment, interpreting answers from human nature formed by questions which where posed in a way of seeing all human life as both subjective and objective in nature. This duality sees humans as by-products of constant interaction with their external environment (Burrell & Morgan 1979).

The fourth and final set of assumptions within social science is methodology. Methodological assumptions are self-explanatory in nature as they follow a stringent way of conducting thorough investigation. The above three assumptions can lead social scientists into following a set of methodologies. Methodologies are set to keep boundaries and retain investigations for observing reality according to certain laws in nature (Burrell & Morgan 1979). Hirschheim (1985) states that methodological research in information systems requires a set of principles of which have to be followed.

Having identified the sets of assumptions any researcher can use in the nature of social science, it is important to figure out the methods that can be used along with different tools and techniques, and why these combinations where chosen as opposed to others, as without these measurements, academic rigor and duplication for further investigation cannot be met.

4.5 PHILOSOPHICAL PERSPECTIVES TOWARDS THIS STUDY

With regards to this study, because of the diverse nature of the philosophical background, and because social science methods of enquiry deal with “humans”, “acquisition of knowledge” and “sharing” that knowledge, epistemological assumptions can be used as a form of reasoning. Different philosophers have concurred on various epistemological methods. This being said, interpretivism, critical research and positivism have been identified as epistemological assumptions within qualitative research (Myers 1997).

4.5.1 EPISTEMOLOGICAL ASSUMPTIONS

There are several generic epistemological assumptions within information systems research.

Positivism

Positivism assumes reality as being objective. Objective reality exists; however, it only takes place outside the mind. Researchers use this method to test theories because it includes quantifiable measures removed from the researcher. Investigators test theories and break them down to the simplest possible component, unlike interpretivism which studies the whole situation. Thus it can be considered mainly as being uprooted from deductive reasoning and slightly inductive. Orlikowski & Baroudi (1991) describe positivism as having a clear theoretical basis when it comes to drawing inferences as it has to do with the essence of understanding the phenomena under investigation. However, it does have some limitations. Although it is good as a theory tester and for describing reality, scientists are forced to use prescribed measures because it is too inflexible (Myers 1997).

An example of positivistic studies is provided by Dube & Pare (2003) who used a case study methodological approach to investigate the rigor of information systems' positivistic research.

Interpretivism

The nature of study within epistemological studies in information systems is interpretive. Interpretivism and positivism are similar in the sense that they both assume reality. However, each does this in its own distinct way. Interpretivism assumes that reality includes human interaction and is more flexible, unlike positivism. It is subjective rather than objective, and sees knowledge as a social construct, built up through constant human or organisational interaction, which thus cannot be understood independently (Orlikowski & Baroudi 1991). Interpretivism sees reality as a means to make sense of the world through an interpersonal voice, as opposed to the detached view of positivism. Researchers like Klein and Meyers (1999) and Walsham (2006), used this method to explain deep insights into a phenomena under investigation, and to

gather hidden knowledge that cannot be extracted from being separate from instruments, as can be viewed in Burrell & Morgan (1979). Finally, interpretivism can be seen in different contexts such as education, sociology, business, management, information technology, information systems and is thus a bit more flexible than positivism.

Critical Research

The third assumption under epistemological studies is critical research, which is concerned with the social issues regarding human interaction. At the base of it is critique, which looks at opposing issues of freedom, power and social control. It is a method that interrogates the social norms and seeks to challenge diverse assumptions. It allows researchers to critically evaluate phenomena under investigation, as well as the responsibilities that cause alienation of individuals with regards to social and ethical issues (Orlikowski & Baroudi 1991; Myers & K.Klein 2011). It diverts itself from the standards that govern positivism and interpretivism. However, this method lacks a theoretical basis that is agreed upon and sometime the aim becomes unclear. According to Myers (1997), Jurgen Harbemas was one of the most significant critical research philosophers to date. His studies framed the concept for researchers such as Ngwenyama and Lee (1997), and Mcgrath (2005) among many others.

4.6 EPISTEMOLOGICAL ASSUMPTIONS FOR THIS STUDY

For purposes of academic rigor and thorough exploration of the research problem, the researcher will use this section to examine the methods and practices under the chosen epistemological perspective of interpretive research. It should be noted that both critical and positivistic research epistemologies have research methods for explaining phenomena. Nevertheless, for purposes of this study, only the methods for interpretivism will be highlighted, as the researcher interprets reality and this epistemological assumption is best suited for this study.

4.6.1 INTERPRETIVE RESEARCH METHODS

This subsection evaluates the various types of interpretive research methods used in information systems research.

Case studies

According to Myers (1997), case study research is the most widely used method in information systems as can be seen in Orlikowski and Baroudi (1991), and Hughes (2003). Researchers prefer this method of study as it is perceived to be simpler to explain what happens in a single setting, presenting findings from an organisation, school or department, as opposed to doing multiple enquiries. Different authors use the method applying disparate empirical assumptions based on the depth they would like to reach.

Ethnographic studies

This method requires the researcher to spend a significant amount of time with the study group, without interfering with their daily lives and the way they live it. Early ethnographers such as Orlikowski and Baroudi (1991), as well as J.Hughes and colleagues (1992) built on the method within information systems research and since then it has been widely adopted and used to understand tacit knowledge of closed and isolated groups.

Action Research

Action research is lot like ethnographic research in the way that they both involve the researcher spending time with the study group for a length of time. However, action research requires more involvement from both groups. The researcher spends time with the population and, while inside, he/she can suggest or set up different scenarios that the population can implement to change the way they operate from day to day. It aims to solve a problem while actively doing the research as well. Action research is not a library project where the investigator aims to solve a particular

problem in isolation, but it is a quest to improve on already known knowledge, as Braa et al. (2004) did by analysing the conditions for developing a sustainable and scalable Health Information Systems Plan (HISP) in developing countries.

Grounded Theory

Grounded theory is known as the method that builds theories rather than testing them. Due to the inductive direction of its reasoning, it calls for constant interaction between empirically collected data and the analysis and synthesis thereof in the development of theories. This method is an important component of information systems research as it is very context based. The iterative process has produced significant findings in information systems research in the years gone by and will prove important for further research (Orlikwoski 1993).

4.7 PHILOSOPHICAL CONSIDERATIONS TOWARDS THIS STUDY

Having introduced several of the methods of enquiry in the social sciences and more particularly in information systems, the chosen methods will be applied to the research question identified earlier: "What skills do IT graduates need to learn in order to fit into the competitive IT environment?" The research aim revolves around the interaction of the three main stakeholders within this study, namely, the triple helix.

4.8 RESEARCH METHOD IN REGARDS TO THIS STUDY

The research method used in this study is the case study method. The method is appropriate for the framework used in the study. The term "case study", is a strategy for explaining the functionality of a group in a single setting (Eisenhardt 1989), fundamentally describing the entity under investigation (Flyvbjerg 2006). The group consists of post graduate students studying towards a diploma in application and infrastructure management, who were socialised into a real life working environment. The conceptual framework guides the study and is tested using the case study (Eisenhardt 1989). A blend of three data collection methods were used: seven face to

face IT industry and governmental interviews (semi and structured), online web logs (better known as blogs) from graduates, and sixty online job adverts in junior level infrastructure and application management, were analysed.

4.9 SAMPLE POPULATION

In an effort to alleviate the shortage of graduate-level IT skills, the Cape IT initiative (capaciti1000), a Non-governmental Organisation (NGO), set up two programs at the University of the Western Cape (UWC) with graduates from the Economic and Management Sciences (EMS) department in the Information Systems faculty. These were the post graduate diplomas in application and infrastructure management (PGD ICT AIM) and software development (PGD SWD) which were initiated in early 2012, each occupying 15 graduates. The programs are run in conjunction with the IT industry and governmental agencies in an attempt to fast track non-IT graduates to enter the IT field and bridge the skills gap. Programs are managed by Capaciti1000.

4.10 TARGET POPULATION

The contextual study was conducted with only one group, the PGD ICT AIM. The researcher was able to interact with academia, industry and governmental agencies, and had to choose who to interview within these organisations. This employer interview group had to be directly responsible for the graduates and had to have the knowledge. It was of utmost importance that the right person be chosen for the interview. The interviewee had to be dealing with new employees constantly in order to qualify for the interview.

From the total 30 graduates involved in the courses in 2012, only the 15 from the PGD ICT AIM were part of the sample size. All of the graduates have one thing in common; after graduating from their original degrees, they could not get employment and have thus joined the PGD ICT AIM program. The graduates all came from different academic backgrounds; Finance, management, marketing, education, geology, psychology and accounting. In addition, besides the graduates, 4 IT Companies and 2 Governmental agencies were simultaneously part of the sample

size. 2 governmental agencies, 3 IT industries and 60 online job adverts added to the data collection.

4.11 CAPACITI1000

Capaciti1000 is a non-governmental organization (NGO) which aims to up-skill graduates within Information Technology and Information Systems. It targets graduates who are unable to get a job after one year of graduation. Since this type of unemployment is regarded as a universal problem and not just centred in South Africa, the NGO sets out to enhance graduates' technical and interpersonal skills in order to make them more marketable and employable. Initiated in 1998, the program provides training, internships and support, acting as a buffer/bridge between industry and academia locally. It initiates communication between the two spheres. Moreover, the initiative was established to understand the challenges that limit the supply of knowledgeable, creative and employable "industry ready" graduates. Capaciti1000 is run in three tertiary institutions in the Western Cape, with an additional four more programs besides the PGD ICT AIM and PGDSWD.

The program at UWC was funded by UWC for twelve months, runningfrom January to December 2012 at UWC. The program started with six months of theoretical and practical work at the University, and thereafter, six months of internship at host companies followed, with one week block periods back at the University.

Lectures and theory around the program involved principles of IT in business, IT Infrastructure Management, Application Management, IT Service Management, Business Specific Systems & Application, IT Governance & Risk Management, IT Project and a final mini-thesis. The practical part of the program was at the company's own discretion, based on the type of technology they use and the demand for such technology at the time.

4.12 PRELIMINARY ANALYSIS FOR MOTIVATION OF COURSE DESIGN

The motivation for the course design and partly for this study was initiated by the author's interaction with the capacti1000 program and UWC. Before the launch of the two courses, PGD ICT AIM and PGDSWD, the stakeholders had a multi-stakeholder engagement. The IT industry, academia, the governmental agencies and the NGO (Capaciti1000) were all part of the initial engagement in October 2011.

The purpose of the engagement was to have all the parties involved at the inception of the program. It aimed to express all the opinions and concerns, content, structure and the state of the IT skills and expectations gap in South Africa presently. It paved the way for collaboration, interaction and slowly bridging the skills-expectations gap.

During the term of the program in 2012, pre-scheduled steering committee meetings for update and requirements management were planned every 3-4 weeks. As mentioned in chapter 2 the skills gap is a concern all over the world and companies require skills and competent professionals to stay competitive. With regards to this one stakeholder stated:

> *"By far, skills is probably the most important thing when a foreign company, whether it's a company based in Johannesburg or an International company, decide to set up a capability" BM_1.*

Academia complains that industry is not transparent with their requirements and therefore they cannot sufficiently train "industry ready" graduates. The creation of the PDGAIM program was not just the initiative of academia but industry played a big part. As one participant stated:

> *"A really important point is success depends on industry driving structure and content." Direc_1. The participant went on to say:*
>
> *"I think it's testimony to the fact that Industry really can influence the creation of new programs and work with competitors to develop them." Direc_1.*

The industry and government agencies acknowledged the fact that collaboration and transparency was lacking.

They expressed the need for more IT programs to be set up, build and share their ICT knowledge base in South Africa, not just now but for the long term. As a stakeholder stated:

> *"We need to see it as our portion of the investment because this is a long program; it's absolutely important that we all see ourselves as doing our bit towards ploughing back the education and the experience that we have, and one of the most important reasons why the initiative is hosted at an academic institution is because it is ultimately altruistic; it is philanthropic; it is multi stakeholders ploughing back into the local communities" Corpor_6.*

The creation of the program, combined with the theoretical knowledge that the graduates gain, will not be the major factors that potential employers will hire graduates on. The degree might capture the top two per cent of the graduates, based on their academic performance, but will not address the issue of employing graduates in their numbers. One stakeholder stated:

> *"I felt that this diploma, within itself, won't address the things that we all do, employing a lot of people" Indus_3.* The stakeholder goes on to say:
>
> *"I'm not saying I'm anti this program; the program is brilliant;it's good, but it's only for the top guys, and it's not addressing the issue when we talk about creating jobs and getting the people" Indus_3.*

The participant mentioned important concerns at the engagement in order to panel-beat the course curriculum so the graduates that need the skills the most are trained, and not just trained, but trained on the right skills set that industry demands. The participant continues their comment by saying:

> *"It's fundamental that we start training people with the right skills […] is a first start service management, understanding how, what is 'services'? And starting to teach people IT is about services"… "All we are asking is that you start to teach them the things that's relevant for us" Indus_3.*

It is not just IT skills that graduates need these days. Due to the dynamic ever changing environment of IT, graduates need to have more depth about certain hard and soft skills in other disciples that can complement IT. As a participant states:

> *"I'm looking for breadth, I'm looking for depth, I'm looking for service orientation, I'm looking for organizational awareness, I'm looking for risk, governance, audit and I'm looking for it all." Corpor_6.*

Based on the concerns from academia and the requirements from the IT industry, the PGD ICT AIM course was initiated accordingly. The course was set up for 6 months of theoretical and 6 months of practical exposure.

Graduates were exposed to a series of interviews, where the industry or government would choose the best candidates they felt would fit into their organisational environment. All 15 students received placement and the interview data was collected from these host companies.

4.13 INTERVIEW PARTICIPANTS

Table 2 shows the participants involved in this study. There were 5 groups' involved, governmental agencies, an NGO, the IT Industry, academia and the graduates. From the groups, the NGO, ABSA capital, and UWC were involved in the multi-stakeholder engagement which took place before the post graduate programs were set up.

The engagement gave the study a deeper perspective on the demand and supply of IT skills currently in the infrastructure and applications field. Based on this engagement, communication between the participants became much clearer.

Relevant theories were assimilated and then applied when graduates joined the industry after the 6 months of theory. The researcher used this multi-stakeholder engagement to compare what the interview participants require from graduates. The #sources column indicates the number of interviews/Multi-stakeholder engagement and the number of Blog posts analysed.

Table 2: Study Participants table

Division	Participants /Code	# Sources
Governmental Agencies		
Governmental Agency 1	Senior Manager: Infrastructure/Gov_1	1
Governmental Agency 2	Director/Gov_2	1
Non-Governmental organisation (NGO)		
Capaciti 1000	Director/Direc_1 Programme manager/ man_1 Board members/BM-1	Multi-Stakeholder engagement
IT Industry		
Industry 1	Service Development Manager/Indus_1 Enterprise Systems Analyst/Indus_2 Managing director/Owner/Indus_3	2 interviews and Multi-Stakeholder engagement
Industry 2	Director : Application Development/Indus_4	1
Industry 3	Director/Indus_5	1
Corporate 4	IT director/Corpor_6	Multi-Stakeholder engagement
Academia		
UWC: Economic and Management Sciences Department (EMS);Information Systems faculty	Head of Department/HOD_1, Senior Lecturer/SL_1 and department Lecturer/L_1	Multi-Stakeholder engagement
Graduates		
Graduate 1	Grad_1	8
Graduate 2	Grad_2	13
Graduate 3	Grad_3	6
Graduate 4	Grad_4	10
Graduate 5	Grad_5	8
Graduate 6	Grad_6	30
Graduate 7	Grad_7	1
Graduate 8	Grad_8	4
Graduate 9	Grad_9	4
Graduate 10	Grad_10	5
Graduate 11	Grad_11	10
Graduate 12	Grad_12	6
Graduate 13	Grad_13	16
Graduate 14	Grad_14	3
Graduate 15	Grad_15	7

4.14 DATA COLLECTION

Data were collected using three methods: online blog, structured and semi structured interviews and online job advertisements.

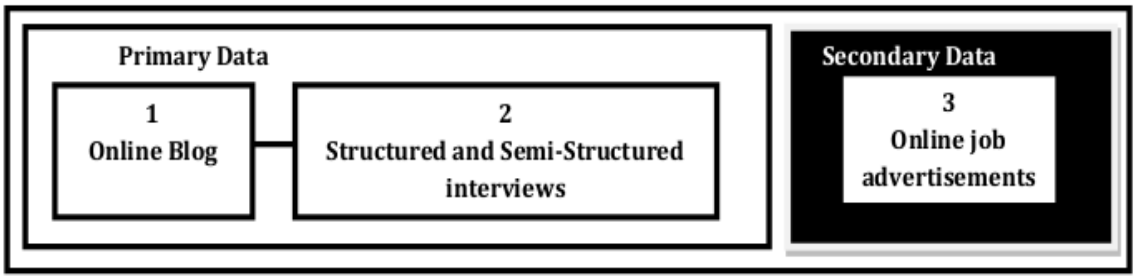


Figure 12. Data collection process

The first method of data collection was from an online blog. The blog was created by the author on Edublogs, which is hosted by a popular blog WordPress. WordPress is one of the free blogging sites for education and teaching. The blog was set up two weeks prior to the socialisation period. Zawilinski (2009) says that a blog is an "easily editable webpage with posts or entries organized in reverse chronological order". The author used the blog as an online journal or diary (Williams et al. 2005; Zawilinski 2009).

Blog data were collected from a two week exposure to the real life working environment at an IT refurbishment company. The students wrote about the events that occurred every day during their time at the company.

The second method was the interviews. The researcher had to set up a questionnaire related to the framework. Once the interview questions were set up, the researcher applied for and received ethics clearance from UWC to conduct the study. A week or two prior to the interview process, the interviewee was made aware of the interview by Capaciti1000. The interview was set up on the basis that the interviewee knew the reason behind it. However, the researcher did refresh the interviewee of the main reasons on the day of the interview. On the day of the interview participants were handed a confidentiality agreement form to sign (Appendix IV), stating that the study is genuine and approved by the University.

Open ended interview questions were asked to discern the thoughts of the interviewee as clearly as possible. The researcher prompted open-ended feeding questions so as to have solid data reliability. In response, interviewees were free in terms of their answers. This allowed the researcher to gain added data validity after the interview when necessary. However, the researcher did have a set of questions that were used a guiding questions to answer the research question.

Interviews were firstly set up with directors and top management and thereafter, if time allowed, with the line managers. The researcher wanted to get a brief introduction about the inner workings of the company from the top managers before he moved onto the line management in order to get the most out of the type of open ended questions asked. After the interviews with the directors, senior managers and line managers, a casual semi-structured interview was conducted with a recent staff member for more validity.

All the companies interviewed were operating in applications and infrastructure management, accounting, government services, software design and development, testing as well as IT and laptop refurbishment.

The third method was collecting secondary data from the internet. Online job advertisement companies were targeted, namely, Pnet and Career Web. Adverts were collected on jobs advertised nationwide in South Africa from 2012-2013. These two online job advertisement companies were used becausePNet is South Africa's leading e-Recruitment company (PNet pty 2013), and Career Web has a credible track record over the past 12 years as the only e-Recruitment company that purely advertises ICT jobs (IT Web Limited 2013).

Todd, Mckeen, and Gallupe (1995) say that job advertisements are used to find the type of skills demanded in the marketplace and, with regards to this study, to identify whether the IT industry and government agencies truly hire on these skills.

Adverts were limited to the (1) IT Infrastructure and application management sector and (2) entry level or graduate level jobs. Table 3 shows all the jobs that were targeted.

Table 3: IT infrastructure and application management jobs

Support and installation engineer	Help desk desktop support
Client support engineer	Hosted applications engineer
Desktop engineer	IT Administrator
Desktop support engineer	IT client support
Desktop support technician	IT field technician
Network engineer	IT graduate program
Desktop support technician	IT help desk agent
IT help desk consultant	IT service desk agent
IT support technician	IT technician
Network technician	Support engineer
Network administrator	Junior project manager
Security engineer	Service delivery technician

The job advertisements add validity to the requirements from the interviews from the IT industry and governmental agencies. Furthermore, the advertisements were used as supplements to see if the competencies, skills (Hard and soft), qualifications, expectations etcetera are similar to the requirements from the interviews.

The following diagram represents the phases undertaken in this research study. Thereafter, Phase I will be discussed.

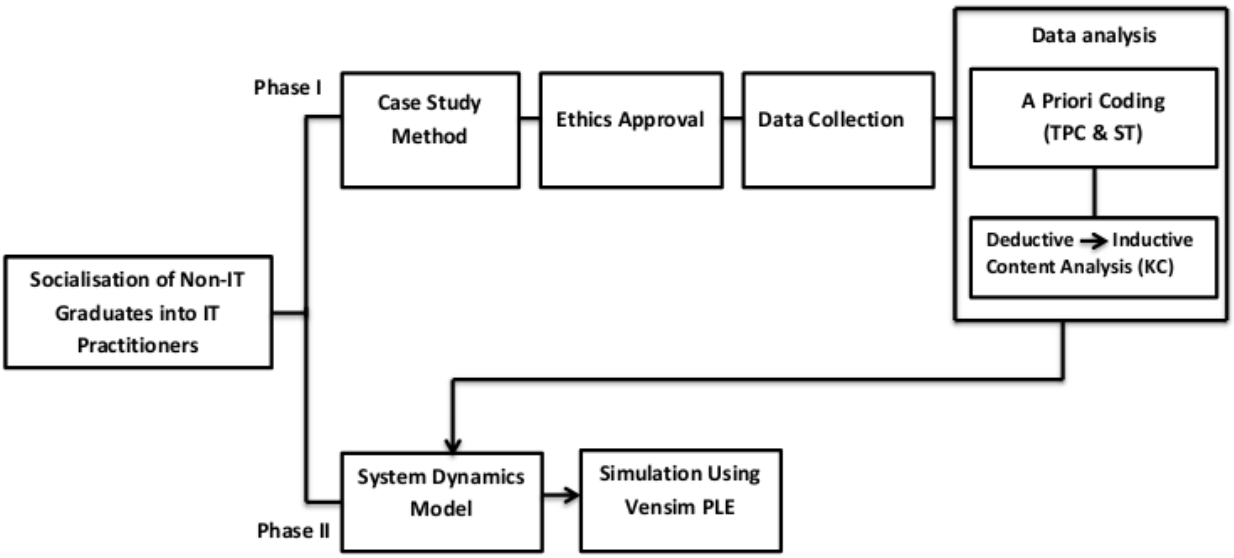


Figure 13. Phases of Research

4.15 PHASE I – A CASE STUDY APPROACH

The case study focuses on the graduates involved in the PGD ICT AIM program at UWC, managed by capatici1000. Phase I is the collected qualitative data for phase II (System dynamics model and simulation using Vensim).

The first step was to load the qualitative data analysis tool on the laptop; thereafter a project was created to load the data. The software used is called Nvivo 10. As mentioned in section 4.15, the qualitative data were collected using 3 methods – blogs, structured and semi structured interviews and online job advertisements. The data were cleaned, prepared, organised and reported simultaneously.

The first source of data, blogs, were exported from the internet, converted to RTF (rich text format) in Microsoft Word, and then altered to PDF (Portable Document Format) in order to keep the font size stable and data safe. The procedures for analysing the blog data were to copy the concepts from the framework and paste them on a Microsoft word spread sheet.

The second source of data, interview, utilised voice recordings copied from the voice recorder onto the laptop and emailed to a credible transcriber. The recordings were transcribed verbatim. Transcriptions were received from the transcriber 3 days later. RTF documents were converted to PDF and were imported to Nvivo along with the blog data. Finally, the last sources of data, the online job adverts, were captured directly from the internet (PNet and Career Web) websites into Nvivo.

After all the data were imported into Nvivo, it was approached in two stages. Firstly, the blog data were scrutinized through a priori coding template approach by using certain aspects outlined by Crabtree & Miller (1999). A priori coding is a process where the codes are defined before investigating any data; it involves deductive reasoning, and codes are gathered from the theory (Jacoby & Siminoff 2008). The method is appropriate for this study as it can be based not only on the codes from the framework but also the data collection categories, literature, research questions, relevant empirical work or the hypothesis (Fereday & Muir-Conchrane 2006).

Blog data were used to test the first two theories in the conceptual framework, PC (Psychological Contract) and ST (Systems Thinking). PC represents the individual graduates' transactional PC

development based on their own thoughts about the PDG ICT AIM course and the socialisation experience. The blog data were further examined in ST as it contained deep insight on the experiences graduates encountered as well as the interactions they were a part of during their exposure to the company.

Concepts were coded a priori based on (1) the definitions based on the literature (2) the researcher's definition of the concept as seen in the empirical setting (3) an example of the concept based on literature (4) relationship between the concepts and how this action helps graduates socialise. The concepts were copied to the far left of the spread sheet and the four steps mentioned above were placed on the top row of the spread sheet which allowed data to be coded inside the cells.

It should be noted that step (2) should not be viewed as inductive in this stage of the analysis. It simply explains the codes based on the framework, and whether actions of this framework are/not viewed in the setting.

In addition, the third theory, KC (Knowledge Content) was analysed using both deductive and inductive content analysis, using the deductive content analysis approach from Elo & Kyngas (2008). A structured categorisation matrix was developed and data were coded according to categories. This type of coding allowed the researcher to test the categories from the KC framework (Elo & Kyngas 2008).

This approach is well suited for the framework because it is a qualitative data analysis technique used to make replicable and valid instances from data to the context in which the population operates (Krippendorff 1989). The approach was chosen because the interview data from the IT industry and governmental agencies highlight the hard and soft skills, competencies, requirements, etcetera, that they require. Furthermore, it was used to test the research questions stated in section 1.6.

Secondly, the researcher moved to the inductive content analysis approach based on Elo & Kyngas (2007) to show additional categories that emerged which were not mentioned in the literature and theoretical framework. After the interviews were analysed, the online job adverts were investigated to add validity and substance to the requirements from interviews.

Content analysis is used to demonstrate the approach of textual data which can be described through levels and units of analysis, for example "words or terms, themes, characters, paragraphs, items and concepts that occur in the texts" (Berg 1989 p.246). It aims to understand the text as is (Hsieh & Shannon 2005; Elo & Kyngas 2008). Content analysis is a great starting point for quantitative data which will be used, in phase II of the data analysis, for the system dynamics modelling and simulation. Elo & Kyngas (2007) present three stages of analysis for both deductive and inductive content analysis: (1) preparation (2) organisation and (3) reporting.

4.16 PHASE II - SYSTEM DYNAMICS

This subsection introduces the concepts of systems, system dynamics (SD) and systems thinking (ST) to the reader. As for ST, the chapter will only mention its relation to SD and will not go into much detail about the methods and components of the concept, as it is beyond the scope of this research study. The words "much detail" have been specifically used as the systems field is enormous and consists of many aspects. Section 5.3 shows a definitions table created from the theoretical backgrounds of the two concepts.

The main objective of the chapter is to discuss systems in terms of theory, methodology and practice. In order to use SD modelling and simulation in socialisation of IT graduates, as has been the case throughout the thesis, it is important to understand the underlying philosophical and methodological practices of system dynamics. The socialisation processes were modelled in a causal loop diagram and further simulated in Vensim PLE to represent the stock-flow diagram. Section 5.6 expands on the different types of simulation tools available.

For purposes of clarification and avoiding misinterpretation the terms methodology and method need to be clearly defined. Systems work is extremely subjective and constantly looks to improve methodologies used to identify and interpret problems. For the last 40 years, SD practitioners have attempted to extend on SD methodologies to show the complex nature of systems (Jackson 2003). The term "methodology" in this thesis is the iterative stepwise process of problem investigation. The processes followed can be represented independently, separate from any problem. Methodology encompasses methods and rules used to study a subject in a disciple (Wolstenholme 1983). A methodology should not be misinterpreted with the term

"method" which follows a specific list of steps and specific procedure; for instance, a chemistry experiment. Methodology pays attention to theoretical underpinnings of which a method is more subject related.

4.17 DEFINITION OF A SYSTEM

Firstly, before comparing the definitions of both systems thinking and system dynamics, a system has to be defined. A German biologist by the name of Ludwig Von Bertalanffy was one of the first to define a system in the mid 1920's, under the term 'general systems theory' (Bertalanffy 1972). He stipulates that a system is greater than the sum of its separate parts; depending on its boundary, a system can be simple or complex; for example, a country, an ecological-system, an information system, a human system or even a mechanical system.

The study of systems is called reductionism. Reductionism seeks to understand the parts included in the system, know how they work and relate these to the whole system (Jackson 2003; Sterman 2000). All systems consist of certain elements or components of which when understood separately, can improve the performance of the whole system, namely:

- Open or closed – A system can be either open or closed. An open system shares resources, materials, thoughts and information with its environment; for example, a student population or any social system. Mountains or rocks represent a closed system and do not share any information with the outside environment.

- Inputs – Raw materials that the system transforms; for instance, university students enrolling into a class and transformed into graduates.
- Boundary – The barrier between the system and its environment. For example, classroom walls acting as a barrier between the students in the class and the university population.
- Process/transformation – A course of action taken to reach a specific target that the system wishes to accomplish. For instance, in the case of learning theory and writing tests.
- Output – The result of the inputs being transformed to a required specification, such as recent graduates.

- Feedback – The positive or negative knowledge gained from the previous steps of the system, which are used to improve on mistakes. For example, module evaluations form.
- Control – A checks and balances measure set out to stabilise and direct or regulate a specific action. An example given may be a subject course outline.
- Environment – The surrounding conditions in which the (inputs) population live/occur, this may be the University grounds, where students study.
- Goal – Industry competent graduates represent the end result that is calculated and desired. Once achieved, it justifies the process followed, (Bertalanffy 1972; Kast & Rosenzweig 1972) .

Though there are a plethora of definitions for a system, the common thread remains that a system is defined as a collection of elements that continually interact to form a whole (Kauffman 1980; Minarik et al. 2012). The dynamic is that a system changes constantly and thinking is the process of using the mind to generate ideas (Richardson 2011). In a dynamic environment such as information systems, it is extremely important to define the system in which the interactions occur. Some studies view systems thinking as an abstract and immanent field while a separate class of authors view it differently. This class sees systems thinking as a particular methodology; a case in point is system dynamics. A host of studies see it as a separate field all together. Below is a table that shows the link between systems thinking and systems dynamics.

4.18 SYSTEMS THINKING VERSUS SYSTEM DYNAMICS

As can be seen from table 4, the two fields are clearly related. Both systems thinking and system dynamics are aspects of the general systems theory and therefore they are closely related. However, for the purposes of this research, system dynamics fits the scheme due to its ability to build dynamic computerized models and describe the behaviour of the population over a period of time by testing the research questions (Harris & Williams 2005). This is important as can be seen in chapter 7 where the researcher builds a model from the qualitative data analysis (phase I).

Table 4: Systems Thinking and System Dynamics Comparison

Authors	Systems Thinking	System dynamics
Caulfield & Maj (2011)	Systems Thinking is a direction of comprehending that aims to understand the interactions between the parts forming a purposeful whole.	System dynamics is modelling a complex problem though computer generated software to test the behaviour of the models over time.
Cabrera et al. (2008)	A cross-sectional idea that can gain traction in any field where there is a system. Not the same as system dynamics, but much more holistic, conceptual and patterned.	A methodology of Systems Thinking. A practice under systems Thinking.
Czarnecki (2012); Richardson (2011)	How a group of interrelated elements interact with each other non-exclusive from their environment. A thinking that encompasses everything that is interdependent as a part of a whole and how they relate to and influence each other.	Knowledge based interactive, informative information feedback systems.
Yurtseven & Buchanan (2012)	The main concern of Systems thinking is how to best use the number of systems methodologies available.	A methodology that can be traced as synthesizing both hard and soft systems thinking elements.

For the longest time most system dynamics models and their information came from quantitative data; however, qualitative data play a great role in systems modelling. System Dynamics modelling has a way of capturing the complex real-world non-linear aspects over time and the methodology is interdisciplinary (Forrester 1992) and has been used in business process modelling, health care modelling, project management, water resource management, etcetera (Rodrigues & Bowers 1996; Dangerfield 1999; An & Jeng 2005; Winz et al. 2009).

More recently, and from a technological point of view, system dynamics has been used in selecting sustainability indicators for Bio-diesel production in South Africa (Musango et al. 2012). However, the problem with only using quantitative data to model the IT expectations gap, graduate employability, and so forth, is that these models exclude the independent richness of values, culture and the story telling thought process.

Nuthman (1994) doubts the credibility of the qualitative system dynamics models. They are seen as less accurate, and more subjective rather than using numbers and figures. Conversely, System dynamics has the ability to use both quantitative and qualitative approaches (Luna-Reyes & Andersen 2003). Sterman (2000 p.845) underlines the importance of qualitative data in model designing, stating that by overlooking subjective data from the model because there is no ordinal phenomena available is "less accurate and is less scientific than guess work". The use of qualitative data has always been important and has been used widely over the years (Luna-Reyes & Andersen 2003).

In the unpublished works of Olivia (1996), the author collected qualitative data from participant observation, interviews and archival data to test the operations of a banking system in the UK. Hirsch et al. (2007) introduced system dynamics into a psychological educational setting in order to study the systems change of complex systems.

Perhaps the richest set of resources that deal with qualitative and subjective data is Rouwette et al. (2004) who encompass 51 studies on system dynamics from complex decision making. The vastness of this literature review speaks about both qualitative and quantitative data collection. The only major problem with qualitative data in system dynamics is that it takes a long time to gather and code the themes before building the model (Luna-Reyes & Andersen 2003). However, this can be seen as a way to bring rigor and depth into the methodology.

4.19 Brief history of System Dynamics

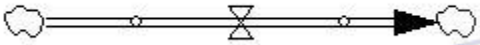
System dynamics was initially known as industrial dynamics (ID). ID as a field was initiated by Professor Jay Forrester at the Massachusetts Institute of Technology (MIT) in 1956. The first SD simulation was written on paper with a pen rather than using modern computer software. Forrester prompted a process of thinking that made it possible to tackle persistent, deep attention seeking complex problems over time (Forrester 1989). The use of system dynamics modelling is evident in this study as both approaches of data collection were used for modelling and simulation. Coyle (1996 p.10) provides a complete description of using the approaches together. The study highlights system dynamics as dealing "with the time-dependent behaviour of managed systems with the aim of describing the system and understanding, through qualitative

and quantitative models, how information feedback governs its behaviour, and designing robust information feedback structures and control policies through simulation and optimization".

4.20 STRUCTURE AND ELEMENTS OF A SYSTEM DYNAMICS MODEL

As a modelling and simulation tool, system dynamics software contains certain variables that make up the model.

Stock/Level variable

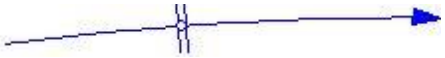


Rate/Flow

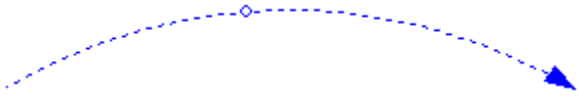
System Boundary

Converter: (Converters can change information from other variables into output).

Connector: Shows dependencies amongst variables



Connector with a delay to variable "B"



Dotted connector: shows dependencies amongst variables

Positive polarity is represented by a (+) connector to variable 'B' from variable 'A' and a negative polarity is represented by a (–) connector. In order to fully utilize System Dynamic Modelling (SDM) four key aspects have to be understood. Firstly, the boundary has to be

defined to show the interactions between the components inside the system. Second, feedback loops inside this identified boundary need to be identified. For example, positive (+‘ve) and negative (-‘ve) feedback loops representing the cause and effect between elements ‘A’ and ‘B’. A positive relationship is where an increase to element ‘A’ causes a positive increase to element ‘B’. A negative relationship is where a decrease to element ‘B’ is caused by an increase on element ‘A’. These two feedback loops are called reinforcing and balancing loops (Jackson 2003; Yim et al. 2004).

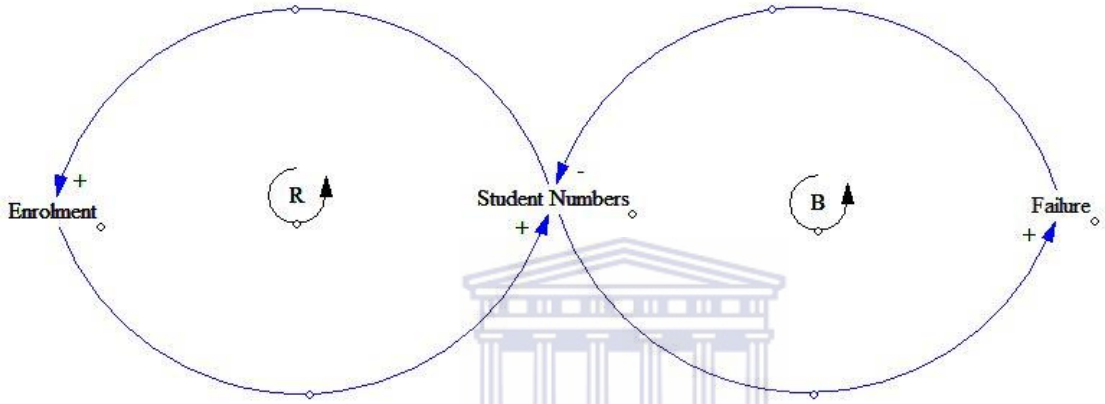


Figure 14. Balancing and reinforcing loops

Figure 14 shows an example of the reinforcing and balancing loops of student numbers. The increase in ‘enrolment’ causes an increase in ‘student numbers’ thus causing a reinforcing increase in ‘enrolment’. The balancing loop is caused by an increase of ‘student numbers’ which causes an increase in ‘failure’ rate, which causes a decrease in ‘student numbers’. This means that once it begins, the loop will continue to circulate itself.

The Third key aspect is defining the substructure of the loops which are known as ‘level’ or ‘stock’ and ‘rate’ or ‘flow’ variables. Rates lead to changes in levels and ‘level’ refers to a quantity of an element that has accrued in the system, usually at the end of a cycle. A rate is the relationship between the elements and it reveals the behaviour of the system (Jackson 2003).

The level and rate variables are used to draw up the simulation though stock and flow. The stock can be represented through a level and a flow is in-flowed or out-flowed by a rate. Basically a rate is a variable which builds up to a flow (Yim et al. 2004).

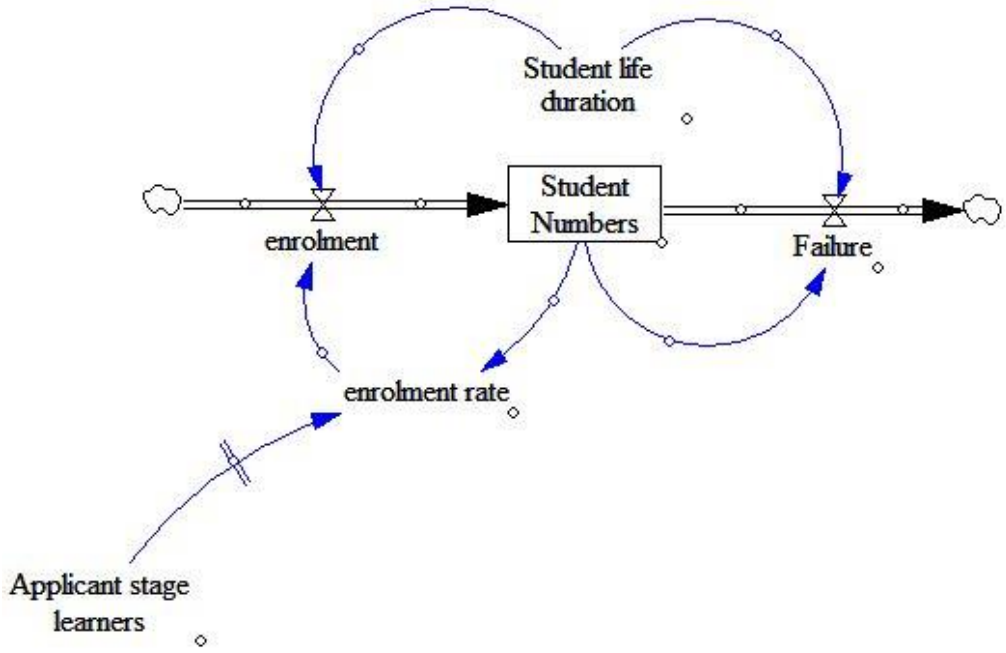


Figure 15. Stock and flow student enrolment map

Figure 15 shows an example of the stock and flow for student enrolment. The process starts at the 'application stage' and leads to the yearly 'enrolment rate'. Yearly 'Enrolment rate' is influenced by 'student numbers' and 'application stage learners'. For instance, if the numbers of graduates are 10000, the enrolment rate will be more or less depending on the actual numbers and level of accommodation. The equation will be ('enrolment rate' = 'application stage learners' × 'Student numbers').Yearly 'enrolment' can be calculated by enrolment rate/student life duration. Similarly to yearly 'enrolment' the equation for 'failure' is 'student numbers'/'student life duration'. 'Enrolment' has an inflow into student numbers, and this stock has an outflow to failure at the end of the boundary. This means that student numbers are increased by enrolment and decreased by student failure.

The final point to understand in a SD structure is looking for 'leverage points'. Because it is a dynamic system, time delays and interventions may take place. The job of the modeller is to achieve the maximum gain out of the model, even if it means restructuring the model to achieve such criteria (Jackson 2003).

4.21 PROCESS FOR SYSTEM DYNAMICS MODELLING

Across classic literature, several authors have expanded on the methodology presented by Forrester in 1961. Figure 16 shows the development of the model from Randers in 1980 to Sterman in 2000.

Randers (1980)	Richardson and Pugh (1981)	Roberts *et al.* (1983)	Wolstenholme (1990)	Sterman (2000)
Conceptualization	Problem definition	Problem definition	Diagram construction and analysis	Problem articulation
	System conceptualization	System conceptualization		Dynamic hypothesis
Formulation	Model formulation	Model representation	Simulation phase (stage 1)	Formulation
Testing	Analysis of model behavior	Model behavior		Testing
	Model evaluation	Model evaluation		
Implementation	Policy analysis	Policy analysis and model use	Simulation phase (stage 2)	Policy formulation and evaluation
	Model use			

Figure 16. Table of System dynamics modelling across classic literature (Luna-Reyes & Andersen 2003 p.275)

The authors visualise the process in stages. Wolstenholme (1990) visualises the process in three stages, and Richardson & Pugh III (1981) envisage it in seven. John Sterman took parts of all the steps and formed his own in 2000. For the purposes of this study, the feedback non-linear processes of (Sterman (2000) will be used. The process is iterative and can be repeated over and over again. The modeller broke up the modelling process into two, namely; casual loop diagram (CLD), stock and flow map and finally the simulation phase.

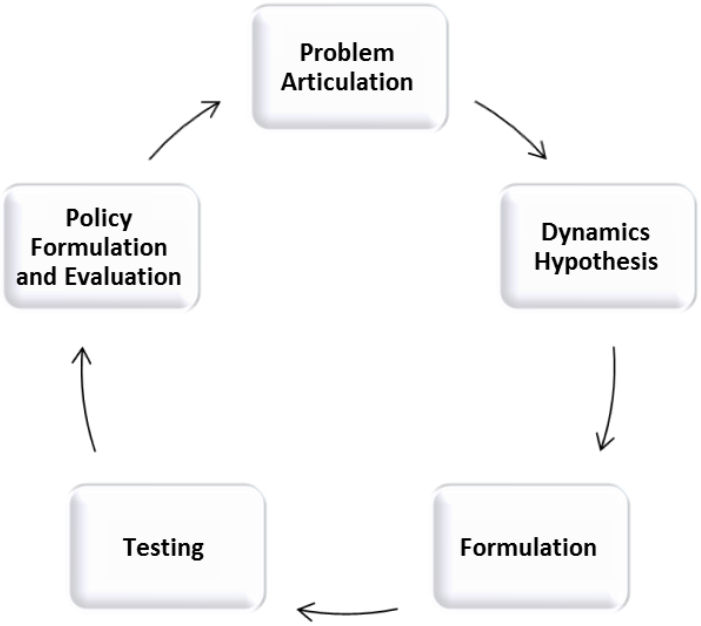


Figure 17. System Dynamics modelling process adapted from (Sterman 2000 pp. 89-104)

4.22.1 CLD'S AND STOCK AND FLOW MAPS

This subsection discusses the system dynamic modelling process displayed above in figure 17.

Problem Articulation

Problem articulation includes identifying the specific problem under investigation and not the general problem. The symptoms and time horizon should be highlighted, as well as the factors, through to the entire purpose of the model. The model should have a clear purpose as this is the most important step in the process (Sterman 2000). Data collection should include resources not only from written databases but the mental databases as well. For instance, researchers can collect data from conducting interviews as well as doing field studies for participant observations.

Dynamic Hypothesis

The hypothesis is dynamic due to the ever changing nature of the problem. It represents the problem in terms of the feedback structure using the system variables. For example, stock, flow, levels and rates (Sterman 2000). It is an educated guess and aids the modeller as he/she learns from the real-world while building the model. It guides the modeller when quantifying the model for the simulation phase. This is where endogenous (variables that are members of at least one feedback loop) and exogenous (variables that are not part of a feedback loop) factors are determined in the system. The most important part in this step is to understand the model structure which will cause the system behaviour (Jackson 2003).

Simulation phase

Simulation is a powerful tool that closely represents the real word. Using a computer simulation program unlike the olden days, increases reliability tests in simulation. The closest way of representing a system without representing it physically is through simulation. Modelling a social system with numerous subsystems can in itself be a challenge and simulation is one way of doing this. Maria (1997 p.7), in a study, states that simulation is "a tool to evaluate the performance of a system, existing or proposed, under different configurations of interest and over long periods of real time". It is a flexible and cross sectional tool for investigating problems, for continuous testing and building interactive assumptions (Winz et al. 2009). Simulations aid modellers and are a helpful tool for modellers and policy makers to experiment with a problem without the large costs associated with social systems.

Formulating model

This stage of the process tests the CLDs and stock and flow diagrams to get rid of any errors. Once errors are taken care of, the model is quantified. Sterman (2000 p. 103) points out that experimenting must be conducted virtually, moving from the conceptual models to a more

quantified, equation based formal condition. After the model is quantified, simulation can take place.

Testing

For purposes of improved quality the model has to be validated once the equations are written. The model must be a true representation of the real world. If not, the test will reveal flaws, and the modeller then has to go back to the previous step and re-test the model to reconfirm validity (Sterman 2000).

Policy Formulation and Evaluation

The last step of the process is implementation and use. Once the model has passed the validation tests, the modeller has to present the findings to the clients/population. This process takes both the qualitative and quantitative aspects of the model and describes it to individuals who are interested in, or particularly affected by the problem. The results are then tested in real life; they are tested in the short, medium and long term to see if the model would hold up through time (Sterman 2000).

4.22 SYSTEM DYNAMIC MODELLING AND SIMULATION SOFTWARE COMPARISON

Appendix 1 shows the list of system dynamic software. This list is by no means exhaustive. The list displays the variety of SD modelling and simulation tools available on the market, be it commercial, free or open source software. The list only shows SD simulation tools and not simulation tools in general.

For this research, the Vensim PLE software environment was chosen as it deals with modelling complex managerial decisions, which are relevant towards this study. Created by VENTANA software, Vensim PLE is available commercially and freely.

4.23 CHAPTER SUMARY

As demonstrated in this chapter, this research has too many aspects to simply present straightforwardly. The study holds a unique place within social research and these steps needed to be highlighted. The chapter discussed the phases of the research: Phase I, the case study and Phase II, system dynamics. The chapter further discusses systems thinking (ST) and simulation to the reader. It presented the elements that make up a system and discussed the difference between SD and ST by comparing several studies. A brief history and system variables were mentioned. Furthermore, the structure and SD modelling process was highlighted. The chapter introduced the SD methodology to be used in the second phase of the research. Finally, the varieties of simulation tools were tabulated: open source, commercial, online and offline.

CHAPTER 5 ANALYSIS AND FINDINGS

5.1 INTRODUCTION

This chapter presents the findings and discussions from phase I & II of the data analysis. It discusses the results from both methods of the data analysis - a priori coding and the deductive to inductive content analysis approach, for the blog data, interviews and online job adverts. The blog data were used to test the TPC (transactional psychological contract) and ST (systems thinking).

The interview data were analysed through a categorisation matrix and specific questions are stated for each KC (knowledge content) segment. In addition, it presents the system dynamics model as well as the model simulation and its results and discussions.

5.2 TESTING THE PSYCHOLOGICAL CONTRACT

All the graduates that were part of the PGD ICT AIM programme; upon registration, they signed up to be take part in both the course and the two week socialisation at the IT refurbishment company.

5.2.1 INTERACTION

Before being exposed to the organisation, the graduates had an initial interaction with the University and industry. Based on the definition of interaction, the employee needs to accept the terms and conditions of the offer letter presented by the employer before employment. Graduates were asked to complete a consent form, stating that they agreed to all the policies of the company and would not disrespect the company or the staff.

My example of the definition based on the empirical setting showed that graduates agreed to these terms and were excited to join the program. Graduates stated:

"When I heard about PGDAIM programme from CAPACITI 1000, it was an opportunity I could not miss. I am keen to learn new things in this programme," Grad_5.

"I applied for the IT AIM programe because I want to further broaden my understanding of the IT industry from the ground up before I specialise in one field. I believe that the program will meet my expectations with regards to covering the technical aspects and managerial sides of IT," Grad_13.

"I mean I am very excited with what this program has to offer according to the curriculum that has been set for us learners. More exiting is the fact that we will be concentrating more in what is relevant in the market place in ICT," Grad_10.

The majority of the graduates involved in the program were excited about the programme and the prospect of the course curriculum. They gained theoretical and practical exposure while the knowledge was still fresh in their minds. The practical work was something they did not have in their previous degrees. Therefore, they expected this type of socialisation to integrate their knowledge much easier. As presented by a graduate:

"At varsity we were not given the opportunity to put into practice what we were learning and I felt that the knowledge which one was acquiring was meaningless, because it couldn't be applied in practice. So this programme at least provides that avenue to put into practice what one learns," Grad_14.

5.2.2 RECIPROCAL EXPECTATIONS

Organisations reward hard work and increase tenure based on level of competency, passion, innovation, etcetera. At the IT refurbishment company, some graduates were lost and did not have a clue about what it takes to refurbish a computer or laptop. Initially, some graduates were caught up and still tried to understand the complexities of moving into a new disciple. The expectations they had about the company were severely weakened. As stated by one of the graduates:

> *"At first, I was a sceptic. The type of work I would like to do in IT is more of a strategic role. This was more technical, the work environment was more of a warehouse type. This was challenging as I never experienced this type of environment before," Grad_4.*

However, due to the belief that their hard work will pay off, some of the graduates linked theory and practice to make the socialisation process much easier and more worthwhile. As indicated by one of the graduate trainees:

> *"I believe that the program will meet my expectations with regards to covering the technical aspects and managerial sides of IT," Grad_13.*

> *"When practicals are in place, theory starts making a great deal of sense holistically," Grad_8.*

5.2.3 CONSTANT PATTERNS OF INDUCEMENT AND CONTRIBUTION OVER TIME

Due to the nature and time allocated to exposure for IT refurbishment, the 2 weeks were not nearly enough for the employee to notice the patterns that would secure employment of any graduate over time. The time frame was too narrow for such patterns to occur. Graduate could therefore not to make the necessary impact on the organisation. Consequently, data did not show this concept and it was not coded. However, it did equip the graduates with the necessary skills to open their own IT refurbishment company in the future. As one graduate wrote:

> *"Personally I think we have acquired the relevant knowledge in order to successfully open and run our own PC refurbishment company. Some of the skills we have acquired during our time at [the organisation] were, refurbishment cleaning; this entailed us cleaning the PC's and monitors with a special cleaning solution" Grad_6.*

Because of the timeframe, the company did not just socialise the graduates for possible employment purposes but trained them to be self-sufficient and bridge the skills gap by hiring or up-skilling other individuals that may be interested in IT refurbishment. It motivated some graduates to give back to less privileged school kids. As one graduate mentioned:

> *"I was also exposed to different computer forensic techniques which helped me today to start a computer refurbishment project to help schools in a less privileged area to be equipped with refurbished computers" Grad_10.*

5.2.4 TRUST: EXPERIENCED RELATIONSHIP

Although there was no intention of possible retention from the company there was mutual trust from both parties. Graduates were curious enough to ask the founder and owner of the company about the values, challenges and responsibilities he has to face daily, in order to make the company a success. These are the values that they were missing when they were unable to get a job after their respective degrees. The graduate said:

> *"I also had a meeting with the founder and CEO [name] to know more of the responsibilities and challenges he faces in running the business and also how he keeps the standards of the company. I also asked him of the growth plan he has for the company and also found out the steps he had taken in making it possible to achieve this", Grad_1.*

The graduate used the socialisation process to increase his entrepreneurial skills, with the possibility of opening a company in the future. The nature of the whole two-week socialisation was to expose the graduates to real-life work, so they can merge their theoretical knowledge into practice. It was highly demanding for some and really interesting for others, as can be seen from the quotes above.

5.3 PSYCHOLOGICAL CONTRACT DEVELOPED

As mentioned earlier, the company did not aim to retain the graduate, and as theory suggests the graduates built a transactional PC (Neill & Adya 2007). The process they went through was very short term and required high performance.

It was simply to expose rather than to hire graduates permanently, but became enlightening nonetheless. The graduates learnt the full cycle of IT refurbishment, company policies and how to conduct themselves in organisations. They learnt how to conduct themselves by arriving on

time and respecting fellow staff members. One graduate noted:

> *"we learnt new things, like pc check where you can test your hardware, like processor, ram, hard drive, destructive write, stress and also imaging…when you do a normal installation (full installation) of an operating system using a cd, it normally takes about +_30 minutes… imaging it only takes +_2minutes by just connecting your two hard drive transfer information operating system, (other software), at the same in 2 minutes using a boot hiren boot cd that is the just pc's software" Grad_11.*

> *"I was introduced to different company policies and procedures in the various stages of PC refurbishment at [the company]" Grad_2.*

5.4 TESTING THE SOCIALISATION TACTICS

In this section the socialisation dataset imported from the ST into Nvivo 10 was analysed. Now that the transactional contract has been established as the contract for new graduates entering an organisation, the methods the IT refurbishment company used for integration are mentioned and investigated.

According to literature, institutional tactics enable organisations to structure and organise the newcomer's adjustment into the organisation. Individualised tactics are under less organisational control and can be either very good in terms of giving the graduate space to learn and thrive, by being innovative, or it can demotivate the graduate as there are no set program dates and he/she cannot share information with others. In the case study there was data that showed that the organisation used both individualised and institutionalised tactics in order to socialise the group.

5.4.1 COLLECTIVE VERSUS INDIVIDUAL TACTICS

The definition of collective socialisation based on literature is that organisations socialise newcomers in groups so as to share common learning experiences together. My definition for the collective tactic based on the empirical setting is stated by one of the graduates:

> *"We were exposed to how the PCs come into the warehouse and the process that takes place up to when they are taken out to clients," Grad_3.*

Graduates were introduced to the IT refurbishment processes, work area, history and staff, and were briefed about the two week deliverables as a group. At the beginning they were all introduced to the same process of IT refurbishment in the same context. This type of onboarding allows for group learning and knowledge sharing. After the exposure, graduates were split up into different sectors and learned more about the context.

In the individual tactic each newcomer was exposed and learned new knowledge independently. Some graduates were left to their own devices and had a tough time understanding their individual responsibilities, as one graduate stated:

> *"the half of the first day of being at [the company] was OK as I did not seem to not know what we were precisely supposed to do, but as the day's events were unveiled, the day was extremely horrible as we did more cleaning duties than anything. I understand that we are supposed to understand the basic processes but we did more than that," Grad_7.*

Graduates were exposed to the not so glamorous side of IT, but this taught them about the importance of keeping a clean and tidy work area as well as wearing the right protective gear when working in IT refurbishment to avoid injury (this goes back to understanding company policy).

5.4.2 FORMAL VERSUS INFORMAL TACTICS

The formal tactic investigates whether newcomers are exposed to structured learning experiences with other organisation insiders. The PGD ICT AIM graduates were exposed to insiders during their time at the company. However, this process was not planned. There was interaction with the insiders and graduates could ask for advice but there was no set structure for the graduates to follow. Two graduates noted:

> *"I spoke to one of the guys who work at [the company] and told him I needed to be moved to another department," Grad_7.*

> *"After consultation and engagement with management, we were allocated tasks in different departments," Grad_3.*

The data does not show a clear representation of the formal tactic in this case. This tactic is more reactive than anything else. The formal tactic socialises students so that they can follow the same method of induction. This however, was only evident after the graduate requested it.

In the informal tactic, new employees are segregated from other members. Through this method individuals learn tacit and explicit knowledge that is not defined, as opposed to the formal tactic. The PDG ICT AIM graduates were introduced to this tactic as early as the first day. Graduates had to learn on the go, at any time, without any warning and formal structure. One graduate stated:

> "*The first few days when we got there were a bit tough as there was no clear communication between us and management," Grad_3.*

The lack of coordination was a major problem for the graduates. Although the experience in itself was very informative, some felt that organisation would benefit them more it there was cohesion.

> *"There should be more cohesion though for the next group, upon the duties the interns are to be assigned upon,"Grad_8.*

Graduates were seen as part of the company since day one. This may be good if the candidate is strong and capable; however, if the candidate is still finding their feet in the organisation, it is very challenging to expose them to informal tactics from the first day. The data shows that the absence of a formal engagement slowed the learning experience and frustrated some of the graduates.

5.4.3 SEQUENTIAL AND RANDOM TACTICS

The sequential tactic reflects the parts of socialisation where newcomers receive guidelines on the learning process they will be taken through. In this tactic, recruits are given dates and times

for training sessions based on how long their socialisation period lasts. The 2 weeks were planned in advance, and graduates had an idea of the type of work they would be doing in the organisation. Graduates expressed having learned about the whole cycle of desktop and laptop refurbishment. As expressed by one graduate:

> *"PC check and specs check, this is where I had to grade the monitors and computers according to the quality and functionality of the stock that is brought in for refurbishment…. Blowing is necessary where we clean up the computers….. Imaging – this is where we had to deploy software and other required programs to the computer according to the client's needs," Grad_1.*

> *"Refurbishment cleaning; this entailed us to clean the PC's and monitors… pc-check system, this was required in order to check the hardware of the pc in order… Quality check entailed us to check the specs of the pc's, if they were up to standard for the clients requirements… image hard drives. This process basically clones the clients hard drive … Monitor checking entailed us to use a special testing program to check the monitor… Sanitation is the procedure taken in order to clear the hard drives of any confidential information,"Grad_6.*

This tactic helps graduates socialise in a way that provides a sequence of activities and processes.

Random socialisation happens ambiguously. The learning curve is ad hoc, inexplicit and unplanned. Random socialisation was not noticed in the blog data and therefore was not coded. The 2 week exposure was planned and a sequence was followed daily. In random socialisation, newcomers are not given dates and a timetable for the processes they are going to follow during their socialisation. This tends to cause an imbalance and stunts the integration process.

5.4.4 FIXED VERSUS VARIABLE TACTICS

The fixed socialisation tactics resemble sequential tactics as both require newcomers to complete a specific task in a given timeframe. Both tactics are mainly concerned with the content that the individual learns.

A graduate mentioned having completed the whole refurbishment rotation in two weeks.

> *"As the period that we were supposed to be there seemed to come to an end I had rotated all departments and had learnt a lot - even the mice and keyboard packing," Grad_7.*

This type of tactic reduces the uncertainty of the graduate. It teaches them that even the smallest of tasks mean a great deal and are important in the bigger picture. By understanding the small tasks, graduates gain confidence to control and make sense of bigger tasks. For example, graduates dealing with anxiety in the workplace.

The variable tactic has no set timetable for task completion. Individuals do not know when a certain stage of the socialisation process has been reached. The graduates involved in the PGD ICT AIM program did not reflect about the variable tactic and therefore the tactic was not coded in the spread sheet.

5.4.5 SERIAL VERSUS DISJUNCTIVE TACTICS

The serial and disjunctive tactics are mainly concerned with social aspects of the socialisation process. In the serial tactic, newcomers are paired with senior organisational members or role models. This process eases the socialisation process, as mentioned by one graduate:

> *"I was then left to wander, but I found someone to shadow, and the experience of the second day was better than that of the first day," Grad_7.*

The serial tactic makes the learning process much more cultured as experienced employees reduce graduate uncertainty and their possibility of making mistakes. It increases the learning curve and in turn increases task mastery.

The disjunctive tactic does not pair the graduates with senior members. They are simply left to understand the integration process by themselves. However, this tactic may or may not be harmful to the development of the graduate depending on the graduate's abilities. In this instance no data were observed in the blog data that exhibited this tactic.

5.4.6 INVESTITURE VERSUS DIVESTITURE TACTICS

The investiture and divestiture tactics are both mainly concerned with the social characteristics of the socialisation process similar to the serial and disjunctive tactics. Investiture tactics happen when organisational members provide newcomers with positive reinforcing comments to boost employee morale. The divestiture tactics are the exact opposite, and newcomers are blown away with negative unsupportive comments. After breaking down the newcomer, the organisation builds the employee back up with its own requirements.

No evidence of either investiture or divestiture tactics were expressed by any graduate in the blog data. Therefore these tactics were not coded in the spread sheet.

So far, the data analysis has completed testing the first two stages of the framework as shown in figure 18. The next stage analysed the interview and online job advert data to test the knowledge creation section of the framework.

Figure 18. TPC and ST Stages of conceptual framework analysed

5.5 TESTING KNOWLEDGE CREATION

In this subsection, the interview data and online job adverts are analysed. The aim of the interview and online job adverts analysis was to see if industry and government practice what they require. The IT refurbishing 2 week exposure was used as a test to see if the requirements from interviews conducted correlate with the blog data reflections. The data were used to test the KC stage of the conceptual framework as figure 19 shows with grey shading.

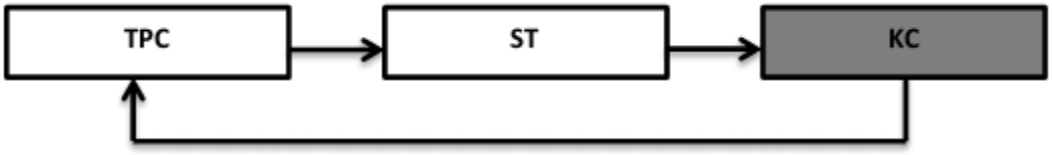


Figure 19. KC stage of the analysis competed

As mentioned in section 4.16, the researcher used the content analysis approach from Elo & Kyngas (2007), appendix II, to analyse interviews and test the KC. The first part of the analysis was deductive and verified or refuted all the concepts in the KC. The KC shows the interactions of the individuals in the organisation from an individualised to social stage. "Ba" in this study is the IT industry or governmental agency. Practitioners reveal their tacit knowledge and suggest what type of graduate would fit into the working environment.

5.5.1 PHASE I PREPARATION

The units of analysis are based on a words, themes, paragraphs and concepts from the interview transcripts. As graduates gain knowledge through interaction with experienced organisation staff, knowledge is transferred to the graduate.

SOCIALISATION

Table 5: Categorisation matrix for IT Industry and government socialisation segment

	Division	Face to face	Individual to iIndividual	Tacit to tacit
How do you integrate Graduates?	**IT Industry**	Graduates are introduced into environment through training in 3 levels, from basic to tertiary level.	Graduates recieve mentors.	• Graduates are fast tracked to bring out natural ability to teach themselves. • Autodidect
	Governmental agencies	We map graduates according to their interests.	Graduates shadow senior staff.	Understand government culture

Table 5 shows the categorisation matrix for the IT industry and government socialisation segment of the knowledge creation theory in the conceptual framework. The matrix groups the main categories of the concepts. Data revealed that the integration process for graduates in both industry and government are quite similar.

5.5.2 ORGANISING AND REPORTING PHASE

Data were organised and reported as follows. Interview questions were posted on the left side of the categorisation matrix, main categories were listed on top of the matrix and concepts were coded inside the cells based on IT industry and governmental agency quotes.

On the one hand, industry data showed the presence of all the concepts from the socialisation segment. Data showed face to face, individual to individual and tacit to tacit socialisation. One IT expert stated when asked the question:

> *"Our competencies are basically more at the services… and how we introduce from what we call infrastructure, the interns into that environment, is that they shadow", Indus_1.*

Graduates are assisted by senior staff members and not left to their own devices. Besides the roles and duties, newcomers get to learn, share and create tacit knowledge through direct interaction with these senior members. Companies stated that graduates are introduced to the environment through stages and are placed inside the organisation based on the spaces available and the need for resources at a specific time. The expert continued his statement:

> *"Ja, they start at a basic layer in that we obtain access and we separate the task level one, two and three, so they only do level one tasks… So they get familiar with the environment and start understanding the environment, what are the pains and the groans in the environment and start learning to escalate", Indus_1.*

As IT operates in a service based environment, it is important that graduates learn tacit knowledge as quickly as possible. In service based organisations, calls for maintenance can come in at any time of the day. Companies stated that graduates are fast tracked to be able to be

resourceful and handle such instances by learning to teach themselves. Employers promote graduates to become autodidacts, as one practitioner mentioned:

> *"Okay I am on autodidact... I'm doing that with [intern y] at the moment but there is a requirement for a bit of everything and the primary one is learning yourself, self-taught," Indus_4.*

On the other hand, most graduate in government are introduced to the organisation as interns. Government integrates these graduates in a similar way as industry, at least for the first two categories; however, they are slightly different in that they create a space for graduates to fit themselves in. Due to the sheer size of government institutions, graduates can, to an extent, determine where they would like to add value. One government expert said:

> *"We looked at what is their focus in terms of the innovative project that they are doing and map them to their interests… So we will be doing an orientation that will entail a two-week training of our environment", Gov_2.*

Government are partly different from privately owned IT organisations in that they require the graduate to understand the organisational culture, not only for the graduate to be able to fit in, but also for senior members to understand the graduate's background in order for the graduate to flourish.

> *"Part of the induction process is key to us. It is important that someone coming from the outside understands the culture. Because we are a government organisation, things are very different to your normal run of the mill private companies,"Gov_1.*

EXTERNALISATION

At this stage the graduates articulate the tacit knowledge they gained in the socialisation stage into explicit knowledge. Table 6 shows the categories coded from the interviews in the externalisation stage.

Table 6: Categorisation matix for IT Industry and government externalisation segment

	Division	Peer to peer	Tacit to explicit
How do you manage knowledge within the organisation?	IT Industry	• Graduates start forming a project team or on site team with senior members. • Work on projects that are stimulating and interesting	Evaluation and give feedback for graduates.
	Governmental agencies		Doesn't happen quickly; however, measures are put inplace to shorten process.

Both IT industry and government graduates are externalised. The industry showed both peer to peer and tacit to explicit externalisation. However, the data for the government did not clearly show any peer to peer externalisation, although there were aspects of peer to peer engagement.

Therefore, in order for data not to be misquoted, only tacit to explicit externalisation data were coded for government. Data were not coded for peer to peer government externalisation. Industry experts say that graduates express their knowledge better, through forming and collaborating in teams. Besides being exposed to their mentors, exposure to team dynamics allows for exchanging ideas while working on stimulating and exciting projects. Industry participants say:

> *"The next level is that they will actually start forming part of a project team, or an on-site team" Indus_1.*
>
> *"I will take care of them when they're here, ensure that they get the mentoring that they require, that they get an opportunity to work on projects that are interesting and stimulating",Indus_5.*

While in the groups, graduates receive feedback on their performance. By this stage, their knowledge is being transferred from tacit to explicit. Mentors take the time to provide positive reinforcing feedback to graduates through one on one meeting or through team evaluation guides. The question asked, one expert responded:

> *"We will do evaluation, go to the client, spent time there, get the feedback; they come back and they come back for more training in the office", Indus_2.*

Government too have their own way of monitoring the graduate's learning curve from tacit to explicit. Government monitor graduate progress and give feedback through deeper and more insightful means. Due to the nature and security of government material, one participant stated where asked:

> *"It doesn't happen overnight. So, we normally have diversity workshops, etcetera in teams if we detect problems. So we monitor this closely all the time. We have what we call an employee-wellness programme" Gov_2.*

Similar to industry, government sit with graduates for feedback and if they require further training, mechanisms are set in place to handle this.

COMBINATION

After the evaluation and feedback from their superiors, both industry and government newcomers have at this stage gained some sort of explicit knowledge. Having been exposed through socialisation as well as externalisation, graduates are now able to combine and collectively use the knowledge they have learnt within the environment. Table 8 shows the externalisation segment in KC.

Table 7: Categorisation matrix for IT Industry and government combination segment

	Division	**Collaborative**
Do you allow group collaboration for a newcomer or do you do this individually?	IT Industry	• Collective • Group collaboration
	Governmental agencies	• Gradautes work with mentors

Similarly to the externalisation segment, newcomers are exposed and introduced to the company collectively. Government data for this segment was not expressed in the same way as the theory suggested, although experts did mention that every graduate is always paired with a mentor. The expert said:

> *"Every individual obviously has his/her own strengths when they come into the environment and we have also allocated a mentor for each of them. We have to, as it is part of our process that we have to identify a mentor for each intern and provide them with a job description, and this has to be negotiated",Gov_2.*

The graduate is given a particular role and works closely with the expert, until such a time the graduate is internalised. Conversely, industry clearly state that any newcomer is exposed to collaboration, as well as mentorship. Newcomers are exposed on company grounds or by a client. Two participants stated:

> *"So I would be interested in their experience and in their portfolio. How do you acquire that knowledge, where does that knowledge come? I mean, I'm a great believer in mentoring and learning from a team, not even necessarily from a superior, even just from a team, from the engagement that happens within a team", Indust_5.*

> *"It was bound to happen to collaborate with those guys to achieve the process goals at the end of the day", Indus_2.*

The industries expect graduates to not only know the tasks within the group but as well to understand group dynamics, in order to share and synthesise that knowledge. Group collaboration is emphasised by all the industries that were interviewed. This will be the first step to becoming an internalised employee.

INTERNALISATION

The previous segment (combination) showed how newcomers use their explicit knowledge on a collaborative group to group and group to individual basis. The internalisation segment is the final stage of the knowledge creation process. In this segment newcomers are supposed to incorporate all the knowledge they have learnt from the other 3 segments into practice. In theory, only after this stage is a newcomer a fully internalised employee.

Table 8: Categorisation matix for IT Industry and government Internalisation segment

	Division	Excercising
Can anyone become an IT practitioner?	IT Industry	Applied theory
	Governmental agencies	Graduates gain competitve edge after internship

In the internalisation phase, participants were asked whether they thought anyone could become an IT practitioner. At the end of it all, will interns, graduates/newcomers, that were part of the PGD ICT AIM course be successful in the company or government? Would they become a value adding employee within these organisations? Participants had different responses to this question. Firstly, the IT industry says that these actions from training to feedback and excercising cause apply theory that is supposed to be used in real world practices. One professional said:

> *"So they see applied theory; okay, they experience that applied theory; you know, so that's what we do with them… real world scenario, yes we understand the problems, but there is still the deliverable, and when we keep it, holding each one accountable at the same level, they have to perform", Indus_1.*

Even during this stage, graduates still receive constant feedback from mentors and internal staff. It is so important for graduates to use what they learn in practice. This experience is vital for any newcomer within the organisation. Through practice and repetition comes a structured routine. This experience allows graduates to gain a competitive edge in the market, as one government practitioner mentioned:

> *"They just have the competitive edge because they have had the foot in the door for six months" Gov_2.*

The term of employment may differ. However, the processes followed are still the same regardless.

Now that the knowledge creation theory has been tested with interview data, the next step is to test the hypotheses stated in section 1.6. From these responses the inductive method of content analysis is followed and skills that literature does not mention were extracted.

5.6 RESEARCH QUESTIONS EXPLAINED

RESEARCH QUESTION 1: Can causal relationships be used to advise on successful IT graduate socialisation?

The views of IT industry and governmental agencies are different to some extent. On the one hand, the majority of the IT industry interview participants indicate that anyone can become an IT practitioner. Others say that IT needs a specific type of person. Two participants stated, based on their own experiences:

> *"In my view, anyone can do IT. When I started out, I was asked three things by a particular [practitioner] he asked me can you think logically, can you think for yourself; that's what he asked me, can you write and can you read?" Indust_2.*

> *"No, it's a special breed of people. You've got to have that analyst thing in you and there has to be a test for that" Indus_4.*

Governmental agencies do not have the same outlook on adaptability as the industry. Government say it is all about passion for the discipline. In their opinion anyone can become an IT expert, if they are passionate. One government agent stated:

> *"You know, IT is a passion. It's a passion. And you can pick up whether it is a passion in a person"Gov_2.*

RESEARCH QUESTION 2: Are graduates adequately prepared by academia for the working world?

Both industry and government agree that graduates suffer more when they are spoon fed. They state that in the real world, time is of the essence and graduates need to learn quickly if they want to make it. As one industry expert mentioned:

> *"We are of the opinion that once you are on site at the client, and there are problems, you need to be resourceful" Indus_1.*

RESEARCH QUESTION 3: Does the industry hire graduates based on their requirements from academia?

Once again there were mixed emotions when this hypothesis was raised. Most of the respondents thought of this questions as a stepping stone for the previous hypothesis. However, it had its own merits. From the data, seldom is it the case that graduates get into industry and apply their knowledge without further training. Government say that graduates need more training once they enter the organisation due to the nature of IT. One expert stated:

> *"We basically have to take them as though they are starting from scratch… send them for retraining… It then takes us two years to get them onto a training level, where they are actually supposed to be starting" Gov_1.*

The industries echo these statements from government by saying that a newcomer with experience is more valuable to the organisation, as they can add and create immediate value. Graduates are not the same as experienced newcomers, as stated by the expert:

> *"it depends on where they come in, you know, IT and officially ICT is a very kind amorphous, it's not as if it's neat and tidy and you got, you know, clear job roles and clear types of companies" Indus-5.*

RESEARCH QUESTION 4: Can system dynamics be used as a methodology to model these dynamic aspects?

The final hypothesis was applied after the simulation as modelling and simulation are capable of representing the real world practices over time. This question is answered in subsection 5.11.

5.7 CONCEPTS THAT EMERGED FROM THE DATA

Table 9 reveals the concepts that emerged from the interview data. Seeing that respondents were asked open-ended questions, there were a few new themes and skills demands that emerged, some of which were not seen in the literature. Candidates mostly revealed new material when asked directly about two questions, namely: What do you think graduates need to learn in order to fit into an IT environment?" and "Based on what features do you hire graduates"?

Table 9: Emergent themes and concepts

Concepts that emerged from the data	
Understand IT as Service driven	Think logically
Understand research and development	Critical acumen
Business Knowledge: debits and credits	Understand business processes to solve problem
Demonstrate abilities, show results or something tangible	Know how to write a business letter, reports and emails
Show work ethic	Resourcefulness
Understand organisational value system and culture	Have the potential to develop

5.8 ONLINE JOB ADVERTISEMENTS

Findings from the online job adverts revealed similar concepts to those in the literature; however, there were several new ones. The online job adverts had already categorised concepts into: qualifications, experience, expectations as well as skills (hard and soft). Table 10 depicts a skill-expectation code table. The main nodes, also known as the 'root,' have sub nodes called children.

Table 10: Skill-Expectation code table

No	Root Code	Children
1	Qualifications	Level of qualification
2	Experience	Degree of experience
3	Expectations	Required expectations
4	Skills	• Soft Skills Communication skills (verbal and written), problem solving or critical thinking, goal driven, adaptability and competency, teamwork and collaboration, team work and collaboration, critical observation, legal, conflict resolution and negotiation. • Hard Skills Technical skills (software and Hardware), Administration and financial skills

In the qualifications code, organisations in the IT infrastructure hire newcomers straight out of high school purely based on ability and potential. In terms of graduates, the lowest level of qualification needed is a certificate, and supplements would be a diploma or degree in any IT field relevant for the jobs being applied for. Despite the degree, organisations still require some degree of experience, even in entry level jobs. The required expectations for each company differ, but they all require the newcomer to cope in a high pressured environment and have a sound understanding of the IT field. Finally, different organisations require a varied skills set. All the 60 adverts that were analysed require the full set of skills, soft and hard. Table 11 details the nodes by number items coded. The figure signifies how many times the items were mentioned in the online adverts.

Table 11: Node compared by number of items code

Number of instances	Root Code	Children
47	**Qualifications**	**Level of qualification**
36	**Experience**	**Degree of experience**
18	**Expectations**	**Required expectations**
23	**Skills**	**Soft Skills** **Communication skills** • Verbal
23		• Written
21		Problem solving or critical thinking
16		Goal driven
17		Adaptability and competency
15		Teamwork and collaboration
15		Critical observation
8		Legal
2		Conflict resolution and negotiation
38		**Hard Skills** **Technical Skills** • Hardware
42		• Software
7		Administrative
1		Financial

For further elaboration, the attributes for the dominant codes are depicted in table 12. The root code for qualification indicated that graduates would stand a better chance if they had; A+, N+,

Linux+, MCSE, MCTS, MCITP etcetera. In the experience root code it can be seen that organisations want experience in any of the chosen IT fields the newcomer may apply for. The code expectation has the end result, as well as the process driven approach, in mind. Graduates are tasked to keep deadlines and milestones in mind. Working overtime is to be expected when requested. The skills root code shows both soft and hard skills. In the soft skills, industry shows a need for fluent English, verbal and writing skills. When meeting clients, the newcomer has to represent not only him/her-self but the organisation as well. They have to show the organisational culture, similar to the other employees. When faced with conflict in the workplace, graduates are expected to be flexible enough to foster and promote good working relationships. They should do this without legally infringing the rights of their colleagues or their own.

Graduates are expected to collaborate and share ideas in teams. Organisations value critical thinkers that are able to solve problems thorough using different means. For example, they should be able to think out of the box in troubleshooting hardware and software client issues, in order to add value. More interesting are the hard skills, as these are more administrative, financial, and the hands on tasks that define the type of job. For example, junior network engineers who work with cabling and understand the length and breadth of wiring a building. As can be seen in the table, the graduate who has an understanding of mathematics and financial background will have an added advantage. In the process of fulfilling their role, newcomers should be capable of being client liaisons and be able to cope in high pressured environments. Nothing can prepare newcomers for these roles if they do not have the passion for IT. These dominant codes are shown in table 12.

Table 12: Dominant Root codes and attributes

No	Root Code	Attributes
1	Qualifications	Matric , MCSE, MCTS, MCITP, A+ and N+,VOIP, CCNA, MS SQL server, IIS, Active directory, Microsoft SharePoint, Small Business Server 2003/2011.
2	Experience	Knowledge of accounting practices/systems, customer service experience, strong experience in network fundamentals, have a basic understanding of MSSQL and other SQL variants, extensive experience in Windows Server operating systems, effective problem resolution and troubleshooting /root cause analyses skills and experience.
3	Expectations	Client liaison, working overtime, pedantic and confident individual to fill this client interfacing role, be able to work in a pressured environment.
4	**Skills** **Soft Skills** • Problem solving and critical thinking	Guide users on ICT related issues, configuration and trouble shooting, problem resolution skills, problem solving skills
	Goal Driven	Passionate about IT and customer service, self-starter who can perform duties without constant supervision, planning skills, demonstrate sound work ethics.
	Adaptability and competency	Have flexibility and excellent business ethics, to learn and know company products by heart, ability to work in a multi-cultural environment.
	Teamwork and collaboration	Excellent written and verbal communication skills, team player, able to communicate at all levels, enable successful knowledge transfer between team members.
	Legal	Clear criminal and credit record, adherence to standard operating procedures.
	Critical observation	Pay attention to detail, high attention to detail, show accuracy, methodical, process driven.
	Conflict resolution and negotiation	Foster good working relationships with direct team, root cause analysis skills and experience
	Hard Skills • Administrative	Perform daily administrative tasks and provide feedback to management, record keeping and recording of relevant activities, administering Email & Web access.
	Financial	Understanding of the financial services industry.
	Hardware	Network configuration, networking and internetworking, troubleshooting, diagnose hardware faults and arrange repairs with the service providers.
	Software	Linux and experience with VOIP and IP technologies, troubleshooting, system maintenance and anti-virus software maintenance, testing and piloting of new IS products with team.

5.9 DISCUSSION OF PHASE I FINDINGS

The findings support the literature to an extent, yet also introduce some new underlying perspectives on graduate socialisation from the PGD ICT AIM programme. Over their two week exposure, the graduates were equipped with necessary practitioner skills, which are different

from the skills they use as students at a university level. This would concur with the sentiments of Taylor (2012), for industry and academic collaboration not only teaches graduates the necessary skills but enlightens them about career long competencies and attributes that they will make use of inside and out of their work place.

The PGD ICT AIM graduates had to present themselves professionally even in a warehouse type environment. For all the graduates this was the first time they had signed a contract and interacted with the IT industry. This meant that they had to come in early, conduct themselves professionally and respect company policies. After rotating through the sectors of the refurbishing company, they claimed to have the skills and ability to open up their own IT desktop and laptop refurbishing company.

Findings show that the requirements from industry and government are partly different. Their induction processes also have slight differences. One the one hand, industry organizations are revenue driven, meaning that they want the individuals coming in to have prior experience and add value immediately, even if it is for a graduate position. Because of the revenue driven approach, the refurbishing company introduced the graduates through more individualised tactics, in order to maximise their value.

There were instances of institutionalised integration in the early stages of exposure. Graduates collaborated when needed. This is similar to the study by Handzic & Chaimungkalanont (2004) who found that informal means of socialisation can have a powerful effect if done properly. The researcher found that the process the refurbishing company took was more of a structured chaos and worked for this particular group of graduates. In addition, the study of Saks et al. (2007) underlines the importance of role orientation for graduates. If the graduate knows and understands their role within the organisation, their PC would become solidified. Whether the structured chaos was planned or not is to be further examined.

On the other hand, government do not necessarily have the same problem as industry because of the sheer size of the ICT sector in South Africa. Government are the biggest ICT spend in the country and, based on the data, can afford (or are able) to train graduates until such time as they are ready to add value, since while they are gaining the relevant skills, other people are there to do the work.

5.10 PHASE II FINDINGS AND DISCUSSIONS

The dynamic modelling process from Sterman (2000) was used to develop the system dynamics model. In this subsection, the CLD's are modelled from the qualitative data from phase I. The CLD's were modelled using two major questions; "what influences this part?" and "which other parts of the system does this part influence?". In order to keep the model simple, the variables that were expressed frequently in phase I were modelled. This was in an effort to visualise and represent the complex, in-depth, yet easy to understand model, while showing the interactions in the socialisation system, in order to represent an in depth, but simple illustration of the socialisation process including all the stakeholders.

It is important to mention here that some interesting connections were being developed from both the literature and phase I of the data analysis. For instance, graduates are incorporated into the organisation and socialised through learning processes until such a point that they become internal employees. Through this exposure, they learn the various competencies to bridge the skill-expectations gap, and, in the bigger picture, increase the labour market. The variables inside the system are drawn in the CLD diagrams and then migrated into stock and flow diagrams, finally quantified and simulated.

5.11 THE SOCIALISATION HIGH LEVEL VIEW

The problem definition in this study already hints at 4 variables for constructing the CLD's, namely, IT is service driven, academic graduate supply, IT industry and government skills demand plus graduate socialisation. Graduate socialisation is placed inside the system as this is not only the goal of the system, but as well the only hint that is part of at least one casual loop.

The variable IT is service driven, and is the only variable from the qualitative analysis in phase I that has a dotted connector. However, the CLD's that were formed used both literature and data from the analysis. In this case, the causal link is assumed to have both a positive and negative polarity towards industry expectations as the field of IT is seen as an enabler to other disciplines. For example, economists and accountants would not be unable to do their job if their

infrastructure is offline or the computer hardware or software is corrupted. For instance, the example could equate to industry increasing expectations, and forcing graduates into working in a pressured environment.

This leads them to (a) understanding business processes, (b) understanding the financial services industry and (c) increasing their resourcefulness. Being resourceful leads graduates into becoming client liaisons and increases chances of them working less overtime, ultimately decreasing their chances of working in a pressured environment. This process describes the balancing loop B1 in figure *20*. Working overtime could, however, have a positive effect on the potential to develop if graduates put the socialisation process to good use. Adversely, industry expectations also have a positive influence on (I) goal driven graduates, (II) skills but may have a positive or negative influence on (III) graduate's potential to develop. As graduates may tend to apply themselves more when industry requires high deliverables from them, or sometimes, they may not handle the pressure and end up folding. Industry expectations could directly increase their chances of becoming client liaisons and decrease their chances of working overtime.

The second balancing loop B2 is created between these variables as well. There is cause and effect to resourcefulness, client liaison, industry expectations, goal driven graduates, working overtime and working in pressured environment. Eventually, after becoming a client liaison, the graduate feels responsible for upholding these high standards. In turn, upcoming graduates go through the same process, causing the first reinforcing loop R1. The 2nd reinforcing loop R2 is also formed from the relationship between industry expectations, working in pressured environment and resourcefulness. Although academic graduate supply, IT industry and government skills demand also have dotted connectors, they are mapped from literature and not from the qualitative analysis. Similarly to the CLD's formed from the IT as service driven hint, both literature and the analysis data were used to form the CLD's for these two hints.

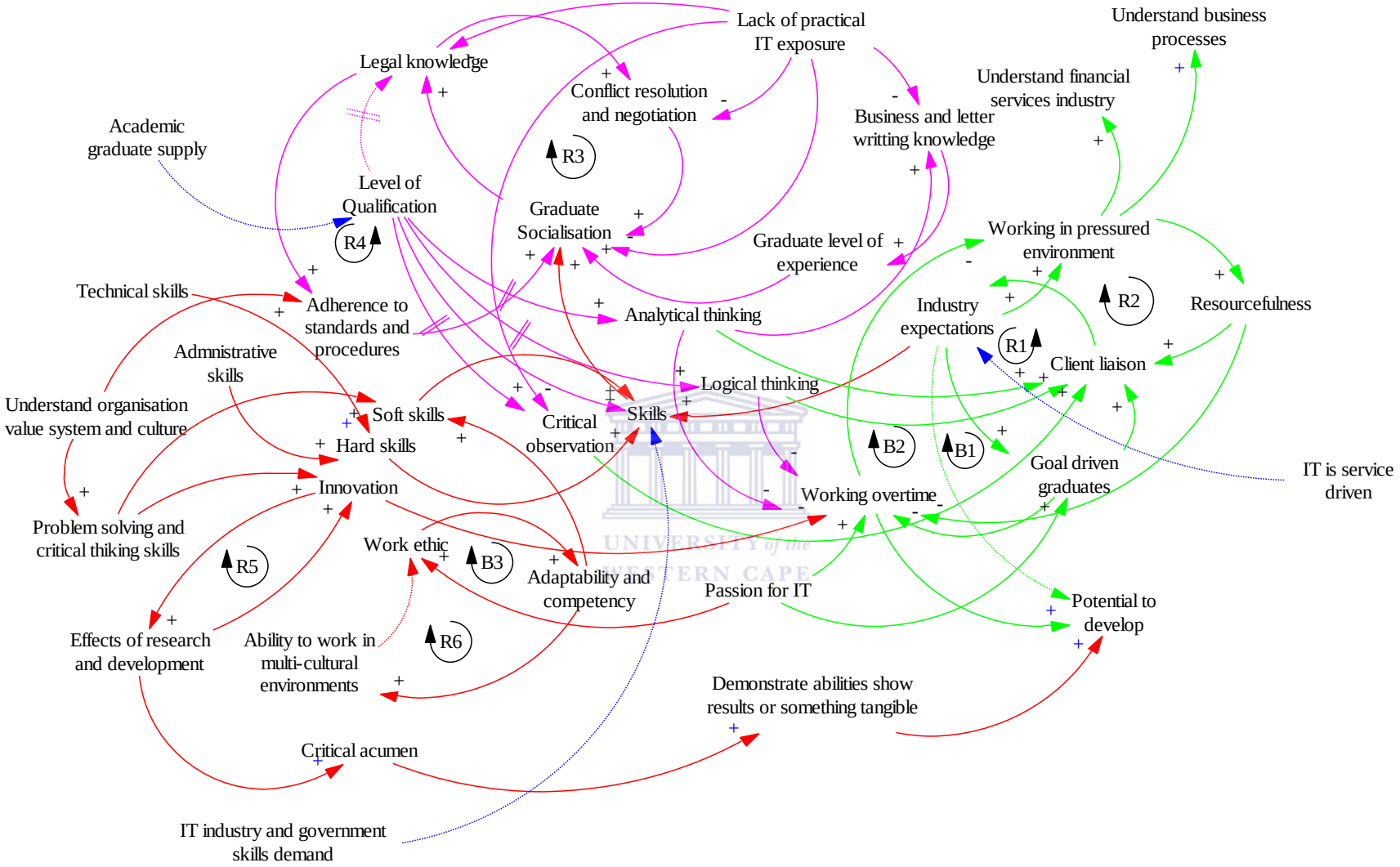


Figure 20: The Socialisation high level view

It is well known that academia draw up the curriculum, generate assessments and create a learning environment. This should be an environment that is suited to provide students with the tools and techniques to develop the necessary skills in order to become graduates (Wells et al. 2009). Therefore, academic graduate supply is assumed to have a positive or negative polarity towards level of qualification. For example, an introduction to 6 variables at a student level would equip graduates in the future. [The variables are stated from (I-VI) below.] These need only be at an introductory level, as moving to the working world is in a different context and requirements would slightly change.

The high level figure 20 shows that (I) the level of qualification have delayed positive or negative polarity on legal knowledge, as IT graduates may study legal practices in their own spare time out of pure interest, or due to what they read and hear about demand from the labour market in South Africa. Conversely, graduates may not favour a legal subject as an elective, simply because they are not interested. However, legal knowledge has a positive influence on conflict resolution and negotiation, which consequently increases graduate socialisation and leads back again to an increased level of legal knowledge. This causes the 3nd reinforcing loop R3 in the model.

Additionally, legal knowledge increases the graduate's (II) adherence to standards and procedures and this eventually leads to graduate socialisation. As mentioned before, graduate socialisation had a positive influence on legal knowledge and the relationship between these variables points to the 4th reinforcing loop R4 in the figure. For the graduates to adhere to the standards and procedures, it is important for them to understand the organisations value system and culture. This culture in turn shows graduates how an organisation (1) tackles problem solving and (2) applies its critical thinking skills.

The role of academia is to provide a sustained level of qualified ICT graduates that can add to the labour market in an attempt to decrease the ICT skills gap (Breytenbach & de Villiers 2012). Through the years of theoretical training at university, academia should include aspects that focus on building (III) analytical and (IV) logical thinking to the under-graduate's diet.

These two attributes, although delayed, require repetition and consistency to master, but are capable of having a direct impact on decreasing working overtime. Applying these two attributes

to practice may separate and increase the chances of completing work much quicker as graduates learn how to use different techniques. This might eventually lead graduates into becoming client liaisons.

In part, analytical skills influence business and letter writing knowledge as graduates break whole tasks into separate manageable tasks. Once the graduates start to understand the business and letter writing knowledge in industry, it increases their chances of gaining experience and ultimately increasing graduate socialisation. However, a lack of practical IT exposure adversely leads a decrease in business and letter writing knowledge, conflict resolution and negotiation, critical observation, legal knowledge and decreases graduate socialisation. The (V) variable that is positively influenced by the level of qualification is a delayed level of critical observation. Similarly to analytical and logical thinking, gaining these attributes takes practice, consistency and patience. The more observant graduates are, the better their chances are of becoming client liaisons. The (VI) variable that is positively influenced by level of qualification is skills. However, skills will be discussed as a variable under the IT industry and government skills demand hint.

Due the volatile nature of the economic environment (Daud et al. 2011), IT industry and government skills demand is given the premise of having a positive or negative polarity to industry expectations. For example, total skills often include hard and soft skills. There are two variables in figure 20 that positively influence soft skills. These are (1) problem solving and critical thinking skills and (2) adaptability and competency.

Problem solving and critical thinking skills also have a positive influence on innovation, and this leads to an increased effect of R&D which ultimately leads back to increasing innovation. This back and forth casual loop is the basis for the 5th reinforcing loop R5. The increase in innovation has now prepared the graduate, and he/she will likely decrease overtime. Effects of R&D cause a positive influence on the graduate's critical acumen, which can be used when dealing with reasoning and understanding. Critical acumen increases the graduate's ability to demonstrate abilities, show results, or something tangible, which then leads to positively influencing potential to develop. Potential to develop is not part of any CLD because potential was not seen as having a direct influence to any result in the model. Potential remains potential until it is put to use.

Adaptability and competency may have a positive influence on ability to work in multi-cultural environments. Without this, graduates will struggle to communicate and will not impact and add value as they would like to. Ability to work in multi-cultural environments may have a positive or negative influence on work ethic. If positive, the relationship will create the 6th reinforcing loop R6. If negative, the effect will create the 3nd balancing loop of the figure B3. In addition, the work ethic that was produced from these loops is caused by the passion for IT. Passionate IT graduates would in turn not mind putting in the overtime hours; passion also increases the numbers of goal driven graduates available.

Lastly, hard skills are influenced by a combination of technical and administrative skills. Eventually both soft and hard skills influence total skills positively, and this finally increases graduate ability to socialise in the work place. If graduates have these coming out of the university, it may help reduce the expectations from industry.

5.12 SYSTEM DYNAMICS - DRILLING DEEPER

Subsection 5.9 discussed the full socialisation high level view. In this subsection the endogenous and exogenous variable for the stock and flow figures were extracted. In order to focus on the research question, only key variables were included. Parts of the 6 reinforcing and 3 balancing loops were also included; see appendix III for simple presentation of loops.

5.12.1 SOCIALISATION KEY VARIABLES

As stated in the objectives, the purpose of this study was to not solve the problem, but rather to give an in-depth understanding of the environment that graduates will face when entering the working environment. The structure of this model includes the four hints in the socialisation system: service driven IT , academic graduate supply, IT industry and government skills demand and graduate socialisation.

Table 13: Key variables from the socialisation model

Endogenous	Exogenous	Excluded
Ability to work in multi-cultured environments	Administrative skills	Analytical thinking
Adaptablity and competency	Demonstrate abilities, show results or something tangible	Business and letter writing knowledge
Adherence to standards and procedures	Passion for IT	Conflict resolution and negotiation
Effects of research and development	Potential to develop	Critical acumen
Goal driven graduates	Technical skills	Critical observation
Graduate level of experience	Understand business processes	Critical thinking
Graduate Socialisation	Understand financial services industry	Hard skills
Industry expectations	Understand organisation values system and culture	Soft skills
Innovation		Client liaison
Legal knowledge		
Level of qualification		
Problem solving and critical thinking		
Resourcefulness		
Skills		
Work ethic		
Work in pressured environment		
Working overtime		

5.12.2 STOCK AND FLOW MODELS WITH SIMULATION

This subsection uses stock and flow modelling techniques to draw up the socialisation simulation. Writing a stock and flow model goes a step further from the CLDs in figure 20. It allows the modeller to display more than just the important parts of the system and how they relate. It empowers the modeller to precisely quantify all parts of the key variables in the system and the connections between them using data and simple mathematical equations (Sterman 2000). The figures can be translated directly into mathematical equations because the stocks and flows have precisely defined semantics. These figures can be solved numerically using simulation software. Ceteris paribus thesis figures show an in-depth simulation of how the system might behave overtime (Jackson 2003).

5.13 FORMULATING THE MODEL

For more detailed elaboration, figure 20 is turned into a stock and flow model. The model consists of 16 endogenous variables: ability to work in multi-cultured environment (dmnl), adaptablity and competency (dmnl), Adherence to standards and procedures (dmnl), Client liaison (dmnl), Effects of research and development (dmnl), Working overtime (dmnl), Work in pressured environment (dmnl) , Work ethic (dmnl) , Skills (dmnl) , Resourcefulness (dmnl) , Problem solving and critical thinking (dmnl), Level of qualification (dmnl), Legal knowledge innovation (dmnl), Graduate Socialisation Industry expectations (dmnl), Graduate level of experience (dmnl), Goal driven graduates (dmnl). The variables are placed at dmnl because they are subject to change at any time.

The model starts with the two most important parts, viz. graduate level of experience and graduate socialisation. In this case the graduate level of experience will be 0, as only graduates coming straight out of a university setting were chosen. Both of these variables accumulate and/or deplete over time, therefore stocks are used to model them. The 15 students from the PGD ICT AIM course are used as an illustration; as a result the maximum number of graduate socialisation will amount to 15. The initial number will be 0, this simply means that no graduate was socialised at the beginning of the course.

There is a flow between these two stocks when graduates with no experience enter the IT industry or government exposure rate. Through exposure they move into the graduate socialisation stock. The flow rate is controlled by a valve attached to the flow pipe, named IT industry and government exposure rate.

In continuation, now that the major parts of the stock and flow model are discussed, the factors that influence the IT industry and government exposure rate are discussed. The first such factor is goal driven graduates. To make the model neat and easy to understand, it is assumed that the number of goal driven graduates is a constant at 15. This is because organisational socialisation is not possible without some sort of effort from graduates. Graduates need to be able to gauge what they would like out of the IT exposure. The second factor is industry expectations. As mentioned before in phase I, there are reciprocal expectations between industry and graduates. Both enter into the psychological contract for different reasons (Silverthorne 2004).

Industry expectations are factors that would make it worthwhile when hiring the graduate. These factors include working overtime, work ethic, resourcefulness, working in pressured environment, adaptability and competency, the ability to work in multi-cultured environments and adherence to standards and procedures. These variables were part of the endogenous variables included under the key variables for the socialisation model. The third factor that influences IT industry and government exposure rate is skills. The level of skills influences the rate of exposure. The skills factor itself is directly influenced by 4 other variables, namely, legal knowledge, effects of research and development, innovation and level of qualification. Other skills sets are generic and would simply be seen as a duplicate to other literature. These 3 factors may be different for other disciples, but for IT these are the assumptions that are made for this study.

Table 14: Variable, stock value, unit of measurement, min value and maximum value variables

Variables	Stock value	Unit of measurement	Min Value	Maximum
Graduate Socialisation	0	Dimensionless	1	15
Graduate level of experience	0	Dimensionless	0	0
goal driven graduates	15	Dimensionless	1	Endless
working overtime	0.25	Dimensionless	0	100
Working in pressured environment	0.25	Dimensionless	0	100
work ethic	0.30	Dimensionless	0	100
Adaptability and competency	0.25	Dimensionless	0	100
The ability to work in multi-cultured environments	0.15	Dimensionless	0	100
resourcefulness	0.30	Dimensionless	0	100
Adherence to standards and procedures	0.25	Dimensionless	0	100
Legal knowledge	0.60	Dimensionless	0	100
effects of research and development	0.50	Dimensionless	0	100
Innovation	0.50	Dimensionless	0	100
level of qualification	0.45	Dimensionless	0	100

The simulation figures are based on literature and phase I. This is because when modelling the simulation system, it needs to be consistent with the mental model at all times. Figures that can be easily calculated by any reader were chosen. The numbers in table 14 are changeable in the simulation based on the rate of the variable. Initial simulation is run to show the behaviour of graduate simulation over time.

5.14 RESULTS OF SIMULATION

The first rounds of simulation were done with a reference mode which displays the present circumstances, the Synthesim simulation attribute in Vensim, in order to simulate the interactivity between the variables in the model. The information in this first simulation may seem like a best guess, but experience and research shows that the graph matches reality very well.

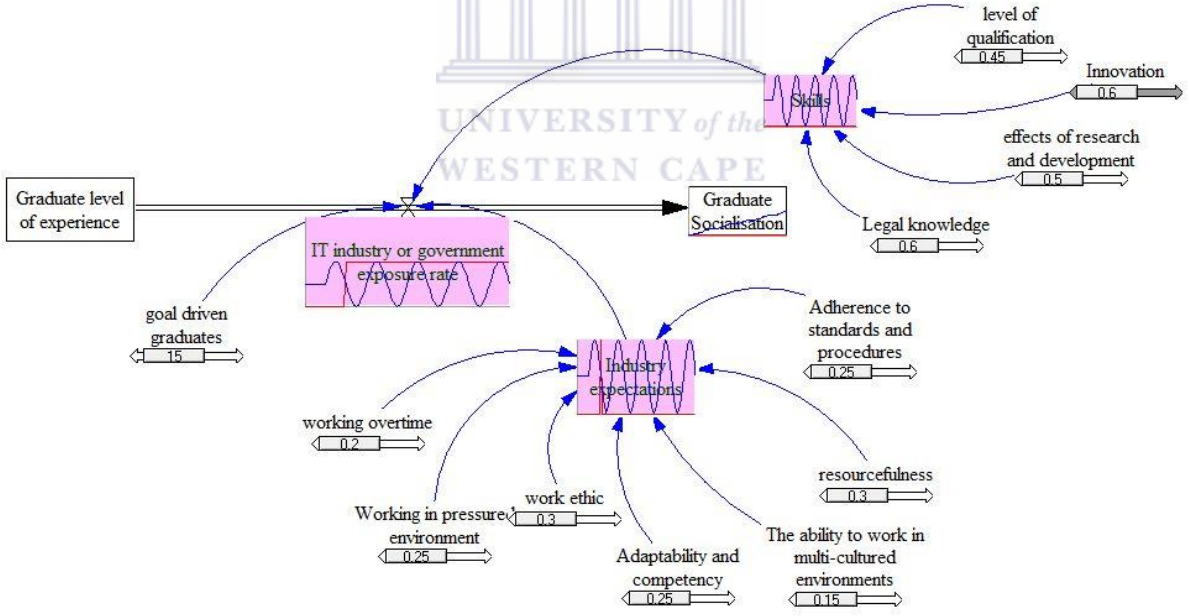


Figure 21. First round of simulation

The round shows a positive influence on all the effects from the auxiliary variables to the levels and then to the stocks. The 3 highlighted levels 'IT industry or government exposure rate', 'industry expectations' and 'skills' display a sine wave that represents the smooth repetitive

oscillation. The wave goes up as the auxiliary variables influencing them to increase. In turn this leads to graduate socialisation increasing incrementally over time. If the auxiliary variables cause a decreasing effect on the 3 levels, then graduate socialisation decreases.

Universities test memory and industry tests problem solving and decision making; knowledge is created by individuals interacting, but organisations play a major role in this process. The skills shortage in the IT sector means that graduates are open to a world of opportunity. By using the tactics, the organisation exposes the newcomer to an environment of knowledge sharing.

Graduates are exposed to group work, peer mentoring, positive feedback, time controlled tasks etcetera. This is all for the purpose of encouraging knowledge sharing in and amongst the organisation in order for the organisation to become competitive in industry. However, Graduates need to want to work at the organisation. The nature of reciprocity should not be taken lightly. This simulation only shows the first round. Corrections and more causal links need to be included adjusted to prepare for the second round.

Equations for socialisation simulation model
Initial:
Graduate level of experience=INITIAL(IT industry or government exposure rate)
Goal driven graduates = 15
Constants:
working overtime = 0.2
Working in pressured environment = 0.25
work ethic = 0.3
Adaptability and competency = 0.25
"The ability to work in multi-cultured environments" = 0.15
Resourcefulness = 0.15
Adherence to standards and procedures = 0.25
Legal knowledge = 0.6
effects of research and development = 0.5
Innovation = 0.2
level of qualification 0.45
LEVELS:
IT industry or government exposure rate = INTEG (IT industry or government exposure rate) + Initial value (goal driven graduates + Industry expectations + Skills)

Equations for socialisation simulation model
Graduate Socialisation = INTEG (IT industry or government exposure rate) initial value = 0 **Normal Auxiliary:** Skills= effects of research and development + Innovation + Legal knowledge + level of qualification Industry expectations = Adaptability and competency + Adherence to standards and procedures+ resourcefulness +"The ability to work in multi-cultured environments" + work ethic + Working in pressured environment + working overtime

Figure 22. Equation for socialisation model

5.15 MODEL VALIDATION

This subsection presents a test for model validation and validity. The main purpose of this subsection is to show the confidence through certain steps to create a sound and useful model. It employs three sets of tests, namely:

- Tests for model structure
- Test of model behaviour
- Tests of policy implementation

Table 15: Tests for model validation and validity (Forrester & Senge 1979)

Tests for model structure	
Structure verification	Is the model structure comparable to the structure of reality?
Parameter verification	Do the parameters (constants) apply to the observations in the real system?
Extreme conditions	Are the extreme conditions appropriate to the model and does it permit extreme levels (state variable in the model)?
Boundary adequacy	Does the model include all structural relationships to please the model?
Dimensional consistency	Can the model be scalable to be dimensionally consistent; does the model include parameters that have little or no real life meaning?
Tests of model behaviour	
Behaviour reproduction	How well does the model behave to predict the future behaviour of the real system
Tests of policy implications	
Changed behaviour prediction	How well will the system behave to a change if a governing policy is altered?

By testing, validating and verifying the model, authors mean to compare the model with empirical reality for purposes of refuting or correcting the model (Forrester & Senge 1979).

Model validation involves external participants that were not part of the initial model building. Externals need to have the same mental image towards the model as the modeller had for the structure, behaviour and implications in order to be a success.

The models figure 20 and 21 were put through several tests to confirm the validity of the model.

a) Is the model structure comparable to the structure of reality?
   The structure witnessed in this figure 20 and 21 represents reality as closely as possible from a case study perspective. The model was developed in a way that could leave opportunity for additional variables.

b) Do the parameters (constants) apply to the observations in the real system?
   The parameters of the system do apply to the constants in the system but the synthesim was developed to change the inputs of the system at any time. For example, if goal driven graduates increased from 15 to 30.

c) Are the extreme conditions appropriate to the model and does it permit extreme levels (state variable in the model)?
   The likely chance that extreme conditions will be seen in the socialisation model is highly likely. Therefore the model catered for these changes in the all the stock, levels and auxiliary variables.

d) Does the model include all structural relationships to satisfy the model?
   At a closer inspection the boundary of the model could have been expanded to include other disciplines, however, this was not the aim of the study, and the boundary showed the structural relationships displayed in the figure.

e) Can the model be scalable to be dimensionally consistent; does the model include parameters that have little or no real life meaning?

Along with the behaviour reproduction, this was perhaps the most important test for the model as the nature of IT is forever changing dimensions, and the equations for the dimensions had to consistent, with or without parameters that have meaning or no meaning in real life.

f) How well does the model behave to predict the future behaviour of the real system?
This is the most important step in the validation and verification of the model. This was the purpose of the model, to show the behaviour onetime and show the hidden factors that graduates will need in industry. The behaviour would have been more stable if the number of graduates had been more; however, it displays the behaviour as best even when graduates are few.

g) How well will the system respond to a change if a governing policy is altered?
The model was generated based on the current behaviour of the system. The first run showed that even if policies change around the model, the model itself will rewrap and change accordingly.

5.16 PROPOSITIONS

With regard to the research questions, propositions were compiled for each.

PROPOSITION 1

This study has shown the causal relationship that Non-IT graduates can become IT graduates. However, only some of these graduates become successful IT practitioners. Future studies should look at passion, work-ethic, adaptability, logic, and written and verbal skills.

PROPOSITION 2

The study tested the second research question and come to a promising assumption. It demonstrated that IT graduates are genuinely interested in the working world, because of their

enthusiasm and eagerness to put theory into practice. However, this is not reflected in the initial interactions with the industry. Early difficulties stunt confidence and give the impression that there is a disinterest from the graduates. Future studies should look at making the initial interaction much friendlier.

PROPOSITION 3

Graduates coming into industry are seldom able to add value immediately. This study shown that industry does hire based on their requirements but it is not always consistent. Industry and governmental agencies have different requirements ranging from personal to technical. However, from the single case in this study there were graduates that displayed these abilities but then still remained jobless. Future studies should look at the consistency of industry and government requirements overtime.

PROPOSITION 4

This study developed a model for advising what graduates need to learn in order to fit into the competitive IT environment. The model was able to incorporate the concepts from table 9 and 12 to develop the CLD and Stock and flow model.

However, some elements were excluded from this research in order to show simplicity and not confuse the reader. Future research should use these excluded variables to show more causal links that could bridge the IT skill-expectations gap.

In addition, the study revealed the first round of simulations. For the second round exogenous and excluded variables should be included for the second round of simulations, in order to compare results.

5.17 CHAPTER SUMMARY

This chapter discussed the findings and discussions from phase I and phase II of the data analysis. It discussed the psychological contract, organisational socialisation tactics and the knowledge creation in the qualitative analysis part I. Thereafter, part II was the system dynamics CLD model, highlighting the major interaction between the variables and then quantifying and simulation the endogenous variables in a stock and flow model to show the behaviour of socialisation overtime. Validation and verification tests to build confidence were listed in order to reproduce the model in future. Finally, propositions for the research questions were presented.

CHAPTER 6 CONCLUSION

6.1 INTRODUCTION

This chapter summarises the major findings and theoretical implications of graduate exposure to the IT industry. It provides the, design contribution, research contributions, limitations of study, direction for future research and the final parting advice the study.

6.2 DESIGN CONTRIBUTION

This thesis was designed to study the major factors that graduates are lacking to get a job in the working world. The study used an novel mix of methods and a stringent system dynamics methodology. The methodology was used to set out a representation of the real world as closely as possible.

6.3 RESEARCH CONTRIBUTIONS

This study was the first to explicitly express socialisation tactics and system dynamics as well as psychological contract and system dynamics methodology. The element that made the most contribution to the thesis is that graduates are willing and excited about the prospect of the real working world.

Graduates develop a strong psychological contract even for a few weeks of working exposure. They would like to turn the theory from academia into practice. IT is an inviting field, and graduates were inspired to start up their own refurbishing companies from the skills that they learnt.

However, graduates need to learn that organisations reward hard work and increase tenure based on passion, innovation, work ethic, problem solving, critical thinking abilities, adaptability,

competency, critical observation, legal knowledge, teamwork, collaboration, conflict resolution and negotiation.

The IT refurbishing company examined in this study used both institutional and individual organisational tactics to integrate the graduates. For example, collective, individual, formal, informal, sequential, fixed, and serial tactics were noticed. The negative, character crushing route from random, variable, disjunctive and divestiture was not seen in this study, as well as investiture. In terms of knowledge creation, both the IT industry and governmental agencies use similar types of socialisation and integration methods to manage knowledge in the organisation.

This study combined three theories together, namely: the psychological contract, organisational socialisation tactics and the knowledge creation theory. The psychological contract and organisational socialisation tactics theories are mainly from a human resources background but when used together with the knowledge creation theory in the information technology context they provide great contribution to the skill-expectations gap.

Each of these theories have successfully been used to test newcomer adjustment and integration in industry (Silverthorne 2004) tacit knowledge has been transferred successfully from graduates to seasoned employees. Literature has not shown the combination of these three theories before. This is the first time they have been used together.

6.4 LIMITATIONS OF THE STUDY

This study only looked at the IT skills-expectations gap to an extent. The study was limited to one case, specifically concentrating on the needs for Infrastructure and Application Management. Further limitations were the target population. The original number of graduates was 25. However, priorities and personal requirements decreased the size to 15 graduates. An increased number of interviews would have been convenient as well; nevertheless, most organisations were too busy or were simply not interested.

In addition, data from the online job adverts were introduced; however, not all the variables could be modelled as the model would become too complex and would dilute the main research question in the study. These excluded variables may have generated additional links that the

system dynamics modelling may have related; however, this would complicate the model. These may possibly be further avenues for investigation. The study was restricted to first round results from the simulation.

6.5 DIRECTIONS FOR FUTURE RESEARCH

Due to the complex and dynamic nature of this research, the combination of the three theories and system dynamics sets an important contribution by providing a good starting point for introducing a number of new research avenues for future investigation.

Organisational socialisation and graduate integration, including the skill-expectations gap, can be greatly extended upon. In terms of the system dynamics modelling and simulation, academia and organisations should think of the causal analysis, why graduates need these skills, as opposed to functional analysis, which purely aims to state what graduates need.

Researchers should look into the behaviour from the interviews as well since graduates reach an interview and, in most cases, a potential employer gives them 30 minutes to assess fit. 30 minutes is simply not enough time for the graduate to fully display his/her skills set. Furthermore, there is also a lot of power dynamics in supply of jobs from industry and government. For example, industry advertises the job post fully knowing that they already have the post filled, or they might already have a suitable candidate in place. Modelling the corruption and transparency of supply and demand from academia to industry could be a fruitful avenue of investigation. Directions for second round simulations should include more variables to compare results overtime through the years to see how things change.

6.6 IN CONCLUSION

The research questions in this study were one part of the greater problem. The bigger problem set out to answer deeper questions such as:

1. Is it possible to convert graduates from Non-IT backgrounds into IT graduates, and then IT practitioners, within a year?
2. Is it easier to teach the graduate about tasks or is it easier to do it with the graduate?

3. Would graduates be able to go into the working environment and apply what they have learnt from academia?
4. Would the program be a success, and could it be duplicated in years to come?

No single one of the research questions, nor all of them together, can solve the IT skills-expectations gap. It takes time, effort, collaboration and constant feedback from Industry, government and academia. It requires collaboration though criticism and advice for improvement from all parties concerned. Interested parties seldom need coercion; therefore the transition to increase the skilled IT labour market by Academia converting Non-IT graduates, is a worthwhile exercise, if a story is told. This study tells such a story.

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APPENDICES

APPENDIX I : SYSTEM DYNAMICS MODELLING AND SIMULATION SOFTWARE TOOLS

Table 16: System dynamics Simulation software tools Extended from Rizolli (2005)

No	Software package	Description	Open source/ Commercial/ Free Software
1	AnyLogic	Supports managerial process visualization. It allows for strategic planning and optimisation. Developed by XJ technologies the tool proposes to support a wide range of modelling approaches.	Commercial
2	ASCEND	Developed by the ASCEND team this open source software can solve numeric linear and non-linear problems.	Open Source
3	Consideo	Advertised by the developers Consideo GmbH as a tool which makes planning and decision making easier, this software incorporates not only SD but as well other strategic decision making tools such as concept maps for seamless planning and decision making.	Commercial
4	Arena	A product of Rockwell software the package works through visual basics to allow the modelling of business process engineering in industries such as manufacturing.	Commercial
5	DYNAMO	One of the oldest SD modelling and simulation software packages. Created in 1986 the historical suite	Commercial

		is no longer distributed commercially.	
6	Forio Simulations	Forio is an online web based simulation software for system dynamics practices.	Commercial
7	Insight Maker	Insight maker is a multi-feature, multi-user tool that operates directly inside the web browser.	Open source
8	iThink	Created but IEEE Systems along with Stella, this allows for simulation and analysis from SD mapping for business rather than education (Academia).	Commercial
9	JDynSim	Is a more programming targeted simulation tool, which works in Java for System dynamics frameworks.	General Public License. (GPL)
10	Mapsim	Open source software created by Sourceforge. Mapsim is an engine for system dynamics which works across multiple Operating systems.	GNU Library or Lesser General Public License version 2.0 (LGPLv2)
11	MyStrategy	A tool for strategy dynamics, Mystrategy is used as a substitute for the conventional spread sheets. Allows users to be flexible between modelling the business environment, .in other words clients, increasing revenue, competitors and suppliers.	Commercial
12	NetLOGO	Although System dynamics is used in NetLOGO as a secondary feature the package is a multi-agent and is programmable. Programmable for different modelling environments. For instance academia, between graduates, teachers and researchers all over the world.	GPLv2

13	OptiSim	Software license is free for educational use on this web based tool educators can use traditional system dynamics software to model their setting.	Commercial
14	Powersim Studio	Powersim software provides a Software development kit (SDK), produced by Powersim Software. The kit allows for modelling a whole range of problems and executes it through simulation and modelling.	Commercial
15	Simile	Simile was created by simulistics developed and sells Simile as a commercial system dynamics and object based modelling and simulation tool. Used in life sciences and environmental affairs.	Commercial
16	Simulink	This software created by Mathworks is incorporated with MATLAB for complex modelling and simulation of which results are taken and expanded upon using block libraries, project management tools, programming tools. For instance, C and C++ languages.	Commercial
17	Sphinx SD Tools	Created by the same developers as mapsim, Sphinx SD tools are a collection of tools to create the SD environment. With features such like multi-project approach and textual system dynamics model editor amongst others is included in this free software.	Apache License, Version 2.0
19	Stella	Similar to ithink, Stella is produced by IEEE systems; however Stella is aimed at Academia and research rather than the dynamic business environment.	Commercial

20	SystemDynamics	Another product developed by Sourceforge, this web-based tool provides the fewest features as compared to its competition. It's used to execute SD models through java application, visualization and execution.	GPL
21	TRUE (Temporal Reasoning Universal Elaboration)	Possibly the most advanced SD simulation package available with features like 3D modelling, 4D virtual prototyping, TRUE sets itself apart. Using advanced intelligence functions and feedback algorithms in Robotics and Multi-body Dynamics Simulation.	Free version (need Internet checking) & commercial version (using usb dongle)
22	Vensim	Created by VENTANA systems Vensim is aims to solve real life complex systems by integrating managerial and technical aspects to show how useful spread sheets can be when created through a rich dynamic simulation environment.	Commercial/PLE free

APPENDIX II: CAUSAL LINK TABLE OF VARIABLES

Table 17: Variable causal link of variables and source

No	Variable 1	Causality	Variable 2	Source
1	Ability to work in multi-cultural environment	+/-	Work ethic	(Pnet pty 2013) & (IT Web Limited 2013)
2	Adaptability and competency	+	Soft Skills	(Pnet pty 2013)
3	Adaptability and competency	+	Ability to work in multi-cultural environment	(IT Web Limited 2013)
5	Adherence to standards and procedures	+	Graduate socialisation	(Pnet pty 2013) & (Austin 2002)
6	Administrative skills	+	Hard skills	(IT Web Limited 2013)
7	Analytical thinking	+	Business and letter writing knowledge	(Pnet pty 2013) &Data analysis
8	Analytical thinking	+	Client liaison	(Pnet pty 2013)
	Analytical thinking	-	Working overtime	(IT Web Limited 2013)
9	Business and letter writing knowledge	+	Graduate level of experience	Data analysis & (IT Web Limited 2013)
10	Client liaison	+	Industry expectations	(Pnet pty 2013) & (Weligamage & Siengthai 2003)
	Conflict resolution and negotiation	+	Graduate socialisation	(Pnet pty 2013) & (Cooper-Thomas et al. 2012)
	Critical acumen	+	Demonstrate abilities show results or something tangible	(Pnet pty 2013) & data analysis
	Critical observation	+	Client liaison	(Pnet pty 2013)
	Demonstrate abilities show results or something tangible	+	Potential to develop	Data analysis
	Effects of research and development	+	Innovation	Data analysis & (Harker 2007)
	Effects of research and development	+	Critical acumen	Data analysis & (Pnet pty 2013)
	Goal driven graduates	+	Working overtime	(Pnet pty 2013)
	Goal driven graduates	+	Client liaison	(Pnet pty 2013)
	Graduate level of experience	+	Graduate socialisation	(Cooper-Thomas et al. 2012)
	Graduate Socialisation	+	Legal Knowledge	(Cooper-Thomas et al. 2012)

	Hard skills	+	Skills	(Villiers et al. 2012)
	Industry expectations	+	Skills	(Fajar & Hidajat 2012)
	Industry expectations	+	Goal driven graduates	(Daud et al. 2011)
	Industry expectations	+/-	Potential to develop	(Daud et al. 2011) & Data analysis
	Industry expectations	+	Working in pressured environment	(Fajar & Hidajat 2012) & (IT Web Limited 2013)
	Innovation	-	Working Overtime	(Trow 2012)
	Lack of practical IT exposure	-	Business and letter writing knowledge	(Hagan 2004) & Data analysis
	Lack of practical IT exposure	-	Legal knowledge	(Mutula & Brakel 2007) & (Pnet pty 2013)
	Lack of practical IT exposure	-	Graduate socialisation	(Fortenberry 2011) &
	Lack of practical IT exposure	-	Conflict resolution and negotiation	(Aasheim et al. 2009) & (Pnet pty 2013)
	Lack of practical IT exposure	-	Critical observation	(Aasheim et al. 2009) & (Pnet pty 2013)
	Legal knowledge	+	Conflict resolution and negotiation	(Pnet pty 2013)
	Legal knowledge	+	Adherence to standards and procedures	(Pnet pty 2013)
	Level of qualification	+	Analytical Thinking	(IT Web Limited 2013)
	Level of qualification	+/-	Legal Knowledge	(Pnet pty 2013)
	Level of qualification	+	Skills	(Pnet pty 2013) & (Villiers et al. 2012)
	Level of qualification	+	Logical Thinking	(IT Web Limited 2013) & Data analysis
	Level of qualification	+	Critical observation	(IT Web Limited 2013)
	Logical thinking	-	Working overtime	Data analysis &
	Logical thinking	+	Client liaison	Data analysis & (Pnet pty 2013)
	Passion for IT	+	Goal driven graduates	(IT Web Limited 2013)
	Passion for IT	+	Working overtime	(Pnet pty 2013)
	Passion for IT	+	Work ethic	(IT Web Limited

				2013)
	Problem solving and critical thinking skills	+	Soft Skills	(IT Web Limited 2013) & (Joseph et al. 2010) & data analysis
	Problem solving and critical thinking skills	+	Innovation	(IT Web Limited 2013) & (Harker 2007)
	Resourcefulness	-	Working overtime	Data analysis & (IT Web Limited 2013)
	Resourcefulness	+	Client liaison	Data analysis & (Pnet pty 2013)
	Skills	+	Graduate socialisation	(Fortenberry 2011) & (Cooper-Thomas et al. 2012)
	Soft skills	+	Skills	(Cooper-Thomas et al. 2012)
	Technical skills	+	Hard skills	(IT Web Limited 2013) & (Barber et al. 2012)
	Understanding organisation value system and culture	+	Problem solving and critical thinking skills	Data analysis & (Pnet pty 2013)
	Understanding organisation value system and culture	+	Adherence to standards and procedures	Data analysis & (IT Web Limited 2013)
	Work in pressured environment	+	Understand business processes	(IT Web Limited 2013) & Data analysis
	Working in pressured environment	+	Understand financial services industry	(IT Web Limited 2013) & Data analysis
	Working in pressured environment	+	Resourcefulness	(IT Web Limited 2013) & Data analysis
	Work ethic	+	Adaptability and competency	(Pnet pty 2013)
	Working overtime	-	Work in pressured environment	(IT Web Limited 2013)
	Working overtime	+	Potential to develop	(IT Web Limited 2013) & data analysis

APPENDIX III: BALANCING AND REINFORCING LOOPS

Balancing loop number 1 of length 2
- Resourcefulness
  - Working overtime
  - Working in pressured environment

Balancing loop number 2 of length 5
- Resourcefulness
  - Client liaison
  - Industry expectations
  - Goal driven graduates
  - Working overtime
  - Working in pressured environment

Balancing loop number 3 of length 2
- Ability to work in multi-cultural environments
  - Work ethic
  - Adaptability and competency

Reinforcing loop number 1 of length 2
- Industry expectations
  - Goal driven graduates
  - Client liaison

Reinforcing loop number 2 of length 3
- Resourcefulness
  - Client liaison
  - Industry expectations
  - Working in pressured environment

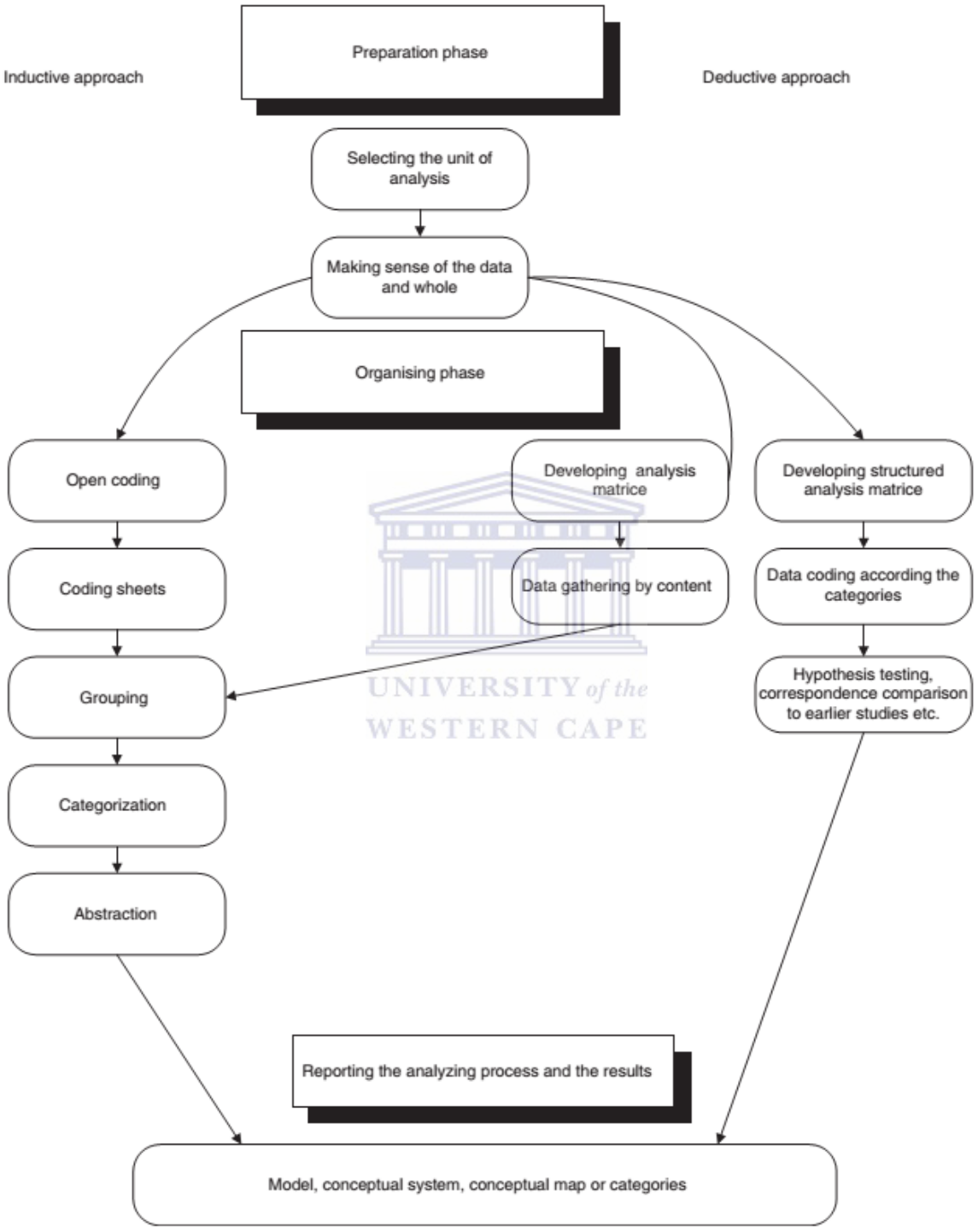
Reinforcing loop number 3 of length 2
- Conflict resolution and negotiation
  - Graduate Socialisation
  - Legal knowledge

Reinforcing loop number 4 of length 2
- Adherence to standards and procedures
  - Graduate Socialisation
  - Legal knowledge

Reinforcing loop number 5 of length 1
- Effects of research and development
  - Innovation

Reinforcing loop number 6 of length 2
- Ability to work in multi-cultural environments
  - Work ethic
  - Adaptability and competency

Appendix IV: content analysis approach from Elo & Kyngas (2007)



APPENDIX V: ETHICS CLEARANCE

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

12 April 2013

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and ethics of the following research project by:
Mr R Tjikongo (Information Sciences)

Research Project:	Understanding what students need to learn in order to fit into the competitive IT environment.
Registration no:	13/2/32

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Private Bag X17, Bellville 7535, South Africa
T: +27 21 959 2988/2948 . F: +27 21 959 3170
E: pjosias@uwc.ac.za
www.uwc.ac.za

APPENDIX VI: INTERVIEW QUESTIONS

University of the Western Cape
Faculty of Economic and Management Science
P/Bag X17, Bellville 7535, South Africa Tel.: +27 21 9593183
Fax: +27 21 9592598 E-mail: wuys@uwc.ac.za
Department of Information Systems
23 May 2012

Interview questions

1. Seeing that IT changes all the time:
2. What do you think graduates need to learn in order to fit into an IT environment?
3. How do you manage knowledge within the organisation?
4. How many people are in your IT Application and Infrastructure group, and what do they do?
5. How will the people in your company influence the graduates?
6. How do you manage graduates
7. How do you manage big groups?
8. Have you ever had a (graduate) internship and how did you onboard them?
9. Do you allow group collaboration for a newcomer or do you do this individually?
10. What has been the most difficult way to induct one of these interns to the culture?

10. Based on what features do you hire graduates? E.g. skills, knowledge, and competencies etcetera?

11. How do you motivate a depressed Graduate?
12. Can anyone become an IT practitioner?

APPENDIX VII: LETTER OF CONSENT

University of the Western Cape
Faculty of Economic and Management Science
P/Bag X17, Bellville 7535, South Africa Tel.: +27 21 9593183
Fax: +27 21 9592598 E-mail: wuys@uwc.ac.za

Department of Information Systems
23 May 2012

To whom it may concern

Re: INFORMATION SYSTEMS RESEARCH
STUDENT: Ricardo Tjikongo

Dear Sir/Madam

At the department of information systems we place strong emphasis on individual growth and encourage students to further their studies beyond undergrad level. The department supports this growth with regards to research and development 100 percent. Therefore, at a master's level we require that our students to be initiative and adapt to change which will make it easier for them to move onto PhD or join the workforce.

In the masters program students are required to choose a relevant and persisting topic within the IT/IS environment which will contribute to the body of knowledge and be of benefit to the field. Ricardo Tjikongo, has chosen, to investigate the asymmetrical pattern of industry demand and academia supply with regards to IT graduates in South Africa. His main question is, "**What do students need to learn to fit into a competitive IT environment?"** Furthermore, the relationship between industry and academia is extremely dynamic, especially in the IT disciple. Ricardo will aim to understand the problem in an endogenous manner from both sides of the coin. In an attempt to find the hidden relationships that determine a behavior of the complex system.

In addition, this research will only not benefit students in understanding the hidden factors that their potential employers require, but as well, it will be greatly beneficial to curriculum development and lowering the unemployment rate of IT graduates in the long run.

I therefore respectfully request your kind assistance in this regard. All the gathered information will be kept anonymous, and company names will not be mentioned for ethical reasons. All information will be treated in the strictest confidence.

Kind regards

.....	.....	.....
Ricardo Tjikongo Masters Student (B.Com Hon)	Interviewee Signature	Date:

Appendix VII: Turnitin Receipt

Turnitin Originality Report

First draft review by RICARDO TJIKONGO

From First draft review (Masters in Information Management)

- Processed on 02-Dec-2013 07:36 PST
- ID: 379078770
- Word Count: 30901

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E-mail	2827978@uwc.ac.za
Submission time	02-Dec-2013 07:29AM
Total words	30901

First 100 words of your submission

Chapter 2: Literature Review CHAPTER 1 INTRODUCTION 1.1 MOTIVATION FOR THE STUDY Organisational socialization (OS) is known as "the process through which a new organisational employee adapts from outsider to integrated and effective insider" (Cooper-Thomas & Anderson 2006 p.492). For this to take place graduates need to be introduced to work in an interactive way inside an organisational setting. In the last 5-10 years however, the numbers of qualified and knowledge competent graduates (from here on graduates and newcomers are interchangeable) were and still are not supplied by academia in the numbers required from the IT industry and government. Filling the unemployment gap with competent...