



JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL  
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# **IS Project Implementation**

An approach using the Theory of Constraints

Master Thesis within Business Informatics

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### **Abstract**

Nowadays companies face continuous changes. Every change a firm face has to be carefully addressed by everyone in the organization but especially by leaders and the managerial team. However these changes not always produce monetary benefits. A change on the IS might increase productivity in one business area but it might not represent profit to the whole company.

There are several change studies which can be used as guide by leaders when implementing a change. However none of these theories consider the possibility to improve efficiency as a result of the change. Neither to assure that after the IS change implementation the company's profitability increases. The theory of constraints (TOC) is a useful tool which covers both of the issues mentioned before.

This paper will combine several change theories with the theory of constraints. With this mixture of ideas we want to show leaders a new procedure on which they can relay on when dealing with the process of an IS change. This procedure should assure an increment on the productivity produce after the change. But also consider an addition to the company profitability.

We studied three change related theories. We then revised the TOC and we compared all this recollected information with the way six leaders handled IS changes in their companies. These five companies were Dell, Cisco Systems, Desca, Ericsson, and Nortel.

At the end we were able to identify critical success factors which any leader should consider when facing an IS change. These factors cover from the beginning of the IS change, the implementation of it and finally the way to make this change maximize the business performance.

# Table of Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Background	1
1.2	Problem discussion	4
1.3	Selected research questions	6
1.4	Purpose	7
1.5	Delimitation	7
1.6	Definitions	8
<b>2</b>	<b>Method</b>	<b>9</b>
2.1	Philosophy of science	9
2.2	Research orientation: Multi-Grounded Theory (MGT)	11
2.3	Choice of research method	12
2.4	Data collection	13
2.4.1	Secondary data	14
2.4.2	Primary data - Interviews	14
2.4.3	Pilot study	15
2.4.4	Selection of the respondents	15
2.4.5	The interview process	17
2.4.6	The interview questionnaire	18
2.4.7	Interpretation and analysis of data	19
2.5	Trustworthiness: Validity and Reliability	20
2.5.1	Internal validity	20
2.5.2	External validity	20
2.5.3	Reliability	21
<b>3</b>	<b>Theoretical Framework</b>	<b>22</b>
3.1	Information System Project Management	22
3.1.1	Unique features of IS projects	23
3.1.2	Project Management context	24
3.1.3	Implications for the thesis	24
3.2	Major notions of IS failures	25
3.2.1	Dimensions of failure	25
3.2.2	Categories of IS failures	26
3.2.3	Implications for the thesis	27
3.3	Theories of Change	28
3.3.1	Implication for the thesis	31
3.4	Theory of Constraints	32
3.4.1	The concept of system constraints	32
3.4.2	Change and the Theory of Constraints	33
3.4.3	Theory of Constraints principles	34
3.4.4	TOC measurements	35
3.4.5	The 5 steps of TOC	36
3.4.6	Implication for the thesis	37
<b>4</b>	<b>Empirical findings</b>	<b>38</b>
4.1	Dell Services	38
4.1.1	Critical success factors	39

4.1.2	Performance enhancement .....	40
4.2	Nortel .....	41
4.2.1	Critical success factors .....	41
4.2.2	Performance enhancement .....	42
4.3	Ericsson.....	43
4.3.1	Critical success factors .....	43
4.3.2	Performance enhancement .....	44
4.4	Cisco Systems .....	44
4.4.1	Critical success factors .....	44
4.4.2	Performance enhancement .....	45
4.5	Desca.....	46
4.5.1	Critical success factors .....	46
4.5.2	Performance enhancement .....	46
<b>5</b>	<b>Analysis.....</b>	<b>48</b>
5.1	Critical success factors .....	48
5.2	Performance enhancement .....	53
<b>6</b>	<b>Conclusions.....</b>	<b>57</b>
<b>7</b>	<b>Concluding discussion.....</b>	<b>60</b>
7.1	Method Criticism .....	60
7.2	Reflections .....	61
7.3	Further Research.....	62
<b>8</b>	<b>References.....</b>	<b>63</b>

## Figures

Figure 1-1.	Project results history (2006-2009) .....	3
Figure 2-1.	Multi-Grounded Theory (MGT) as incorporation between inductivism and deductivism.....	12
Figure 3-1.	Dimensions of failure model .....	25
Figure 3-2.	The chain (system) concept.....	32
Figure 3-3.	The 5 steps of TOC .....	37

## Tables

Table 1.	Abstract of selected respondents.....	38
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## Appendices

Appendix 1.	Interview questions .....	66
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## **Abbreviations**

IS – Information System(s)

IT – Information Technology

TOC – Theory of Constraints

OpEx – Operational Expenses

GT – Grounded Theory

MGT – Multi-Grounded Theory

PMI – Project Management Institute

# 1 Introduction

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*In this chapter, the reader will find the background of the topic we are dealing with in order to get an overview of the problem and the relevance of this research. This chapter will present the discussion of the problems associated with IS changes in business processes and the main research questions that will conduct the entire thesis. Furthermore this chapter will provide the specific aspects such as purpose, perspective and delimitation that will narrow the investigation. In addition the chapter will provide some definitions to clarify and bound terms which will be used throughout this thesis.*

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## 1.1 Background

“We live in times of great and constant change. Because the world is turbulent and the competition is *hyperturbulent*, managers must take seriously the job of continually initiating and adjusting to change” (Nguyen Huy & Mintzberg, 2003, p. 79) Nowadays, companies are in a race for improving their business structure in order to compete in the 21st century global market. This market is electronically connected and dynamic in nature. Therefore, companies are trying to improve their agility level with the objective of being flexible and responsive to meet the changing market requirements (Gunasekaran & Ngai, 2004). In the pursuit of this adaptation and improvement, companies are investing in information systems (IS) projects that allow them to reach efficiencies and become more productive.

Within this demanding business world, organizations are modifying their operational and business structures with the support of IS. They perceive IS as a tool to improve business process, attain goals and improve efficiencies and productivity. IS serves to coordinate the work of many different organizational functions and in many industries it is part of the operating core of the organization. The IS uses information technology (IT), manual procedures, models, and knowledge bases and databases. IS applications may improve operational efficiency, improve and innovate functions, or restructure business processes (Yeo, 2002).

IS projects permeate all forms of business organizations and therefore companies are implementing IS changes to renovate their business processes. According to Goldratt Institute (2009), taking into consideration today’s market difficulties and constant shifting environment, to not change is to give advantage to competitors. Thus, it is understandable that to improve means to change. However, to change does not necessarily mean to improve and in this turning point many companies fail in their IS change implementation since they do not consider all the factors involved in a change and in many cases the result is not the expected but worse. “Change, by definition, is good. Resistance to change is bad” (Nguyen Huy & Mintzberg, 2003, p. 79); therefore every change should bring benefits and companies must work to assure it by avoiding resistance and working on the limitations.

From the systems thinking view, information systems exist to serve, help or support people taking “action” in the real world (Checkland & Scholes, 1990). The “action” of the real world could mean anything from increasing the efficiency of the workforce to consolidating the resources under the power and control of one person (Yeo, 2002).

Organizations worldwide spent an estimated \$3.2 trillion on IT during 2009 (Gartner Inc., 2009). Nevertheless many organizations do not see real benefits from these huge investments. The evidence presented in the Information Age Research Report (Information Age, 2008) conducted in partnership with KPMG, suggests that there is a whole series of barriers that stand in the way of organizations reaping the full benefits of modern IT. Some are technical, but many of the most critical ones centre on business culture and the management of the IT functions within the business.

These barriers are constraints that limit and block the successful implementation of the IS project. These limitations can hit directly or indirectly the IS project that might result in a failure of the project since it does not fulfill all the expectations planned previously. According to Lyytinen and Hirschheim (1987), there are four major notions or categories of IS failures as follows: (1) correspondence failure, (2) process failure, (3) interaction failure and (4) expectation failure.

The number of IS projects that fail has increased in the last 5 years. Researches continually show that companies have difficulties with IS projects. According to a report made by The Standish Group (2009), the number of IS projects that failed has increased considerably in the last year (Figure 1-1).

The category definitions for The Standish Group research (2009) are as follows:

- Successful projects were completed on time and on budget, with all the features and functions that initially specified.
- Failed projects were cancelled before completion or never implemented.
- Challenged projects were completed and operational, but over-budget, over the time estimate, and with fewer features.

As we can notice, challenged and failed projects represent 68% of total projects which illustrates the need to study the factors and limitations involved in the failures in order to conduct them in a way in which companies can elevate the number of success projects and reduce risky IS investments. The project team, the suppliers, the customers and other stakeholders can all provide a source of failure, but the most common reasons for project failure are rooted in the project management process itself and the aligning of IT with organizational cultures (Tilman & Weinberger, 2004).

Project management is essential when implementing an IS project so we consider this issue as key in this thesis. Therefore this thesis considers as meaningful in the IS project management those factors that create a critical barrier or limitation (constraint) to attain the goals of the IS project. Hence we consider the Theory of Constraints (TOC) as a powerful tool to analyze constraints and come up with a potential guideline when implementing IS changes using TOC principles.

Theory of Constraints is a system improvement management theory which gets its name from the fact that all enterprises are constrained by something. If they weren't, they could grow as large and as fast as they wanted. As Ricketts (2007) states, one has to monitor Wall Street or Main Street for only a moment to know that for the vast majority of enterprises growth is really hard. Constraints are why. A constraint is anything that prevents the system from achieving more of its goal (Goldratt & Cox, 1993).

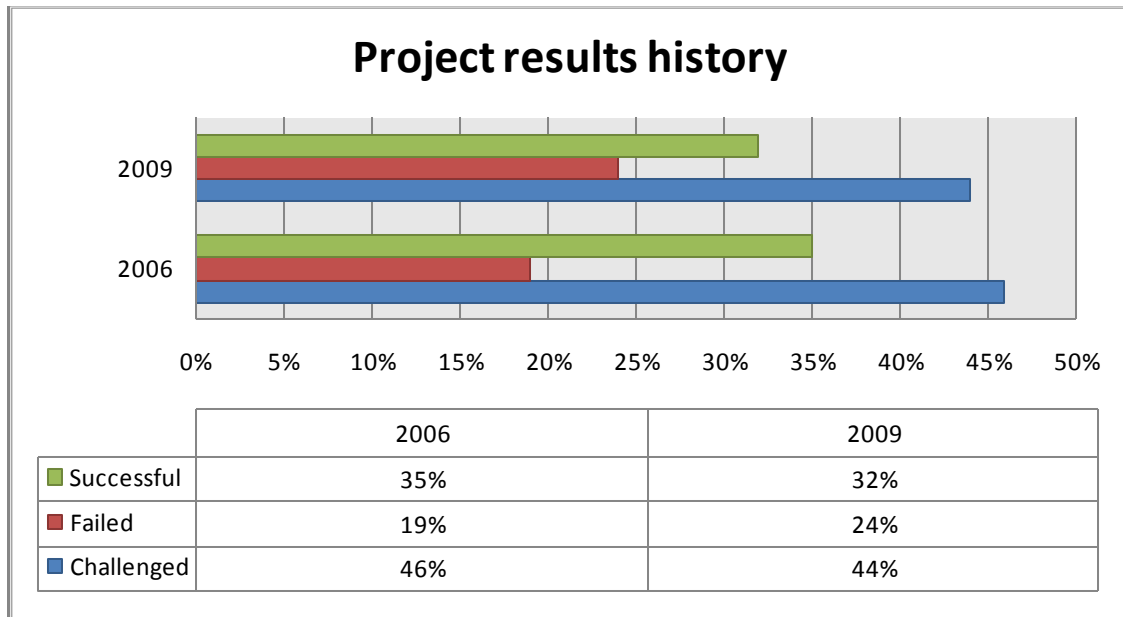


Figure 1-1. Project results history (2006-2009)

A constraint is usually considered to be something negative, something to be eliminated if possible. Blackstone (2001) argues that what makes TOC different from traditional approaches to management is that TOC considers a constraint to be a focusing point around which an organization can be organized or improved. TOC's thinking processes exist for the purpose of managing change, starting with identifying what was preventing an organization from achieving its goal (Davies, Mabin, & Balderstone, 2005).

How does TOC differ from more commonly known continuous improvement theories? According to Nave (2002), nearly all the improvement theories focus primarily on improvement of "individual processes"; TOC, on the other hand, is systems focused looking for any system element that reduces the throughput of the whole system. It is less concerned with an individual process.

Every change generates constraints. In TOC, the constraints are used as a focusing mechanism for management of the system so following this principle we can say that the more organizations can reduce the constraints to their performance, the closer they can come to realize their full potential. According to Nave (2002), TOC is a management philosophy that can offer that desired general path. There are other management theories such as Lean or Six Sigma principles. Nevertheless TOC suits our needs of considering IS projects for the global system, according to Nave (2002) by concentrating on constraints, productive results on the flow time of the product or service within the business system are attained. A decrease on waste in the constraint enhances throughput and amends throughput time. Therefore when the constraint is managed and improved, deviation is diminished and quality is enhanced.

TOC takes concepts of Lean thinking to another level of systems thinking. There are some similarities between TOC and Lean. Both are focused on reducing waste and increasing process flow. However, TOC goes beyond Lean with its focus on throughput. Reducing waste is nice but the emphasis should be on making more money by selling more product (enhance productivity) not just by cutting costs and this is where the two diverge (Bizmanualz Inc., 2005).



The goal of any company is to make money by increasing throughput and that is why companies are investing in IS. An overall comparison among Six Sigma, Lean and TOC shows that focusing in constraints, more benefits are carried to support the objective to increase sells and therefore more money for the company. According to Nave (2002), if companies center their attention on decreasing variation, through Six Sigma, then they will achieve standardized procedures. If in the other hand they center their attention on taking away wasting, following Leans ideas, then flow time enhancement will be reach. However if firms center their attention on constraints, by following TOC, then throughput rate and volume will pick up.

Davies et al. (2005) state that TOC has been used all around the world by companies of all sizes, pointing that a wide range of managers who habitually apply TOC consider they comprehend their business from the beginning. From this understanding managers attain a feeling of control and they are motivated to behave proactively. Hrisak (1995) argues that this is because TOC empowers managers by offering a reliable structure for assessing problems.

TOC had been applied only to production. Today it has been applied to a wide range of things including operations, finance and measures, projects management, distribution and supply chains, marketing, sales, managing people and strategy (Blackstone, 2001).

Hence TOC techniques have been applied at a number of Fortune 500 companies such as 3M, Amazon, Boeing, Delta Airlines, Ford Motor Company, General Electric, General Motors, and Lucent Technologies who have publicly disclosed significant improvements achieved through deployment of TOC solutions. There are also government agencies and non-profit organizations who have applied TOC principles such as United Nations, Pretoria, British National Health Service, NASA, United States Department of Defense (Air Force, Marine Corps, and Navy), and the Israeli Air Force (Davies, Mabin, & Balderstone, 2005).

## 1.2 Problem discussion

Companies are involved in a business environment characterized by complexity in which small differentiators can be the key to success in the market. We already know that IS has almost endless applications in the service of business and companies are searching in IS projects a way to improve their business processes. We have realized that an IS project might be this differentiator which reaches the productivity goal; nevertheless in the way to reach this goal, many companies struggle with limitations and constraints when implementing their IS projects. We wonder how companies can assure the successful of their IS projects by applying some principles in terms of the Theory of Constraints; therefore we came up with several research questions which will conduct our further research and these are:

*Which are the major notions of IS failures?*

Recent studies show that many of these projects have failed in the combination of many factors that bring down the IS project. It is important that the information technology community together with other stakeholders have a better understanding of the nature of

software or information system projects and the special problems of the widespread systems failures (Yeo, 2002).

The reasons of why many IS projects fail does not due to technical faults only but because of resistance or rejection by the users or corporate management. According to Lyytinen & Hirschheim (1987) there are four major categories of failure factors; however there are some other factors that endanger the IS project which must be considered by organizations when applying IS projects in order to avoid failures. The resulting under-performance or the entire abandonment of the system is catalogued as a major problem for IS project managers and a waste of resources for the entire organization.

*Which are the factors to consider when conducting an IS change to be successful and productive based on the Theory of Constraints (TOC)?*

The Theory of Constraints applies the cause and effect thinking processes used in the hard sciences to understand and improve all systems (Goldratt Institute, 2009). Companies must take care into consideration this process thinking in order to identify the factors that might be involved before and after applying an IS project within their business processes.

According to studies made by other authors (Lyytinen and Hirschheim, 1987, Beynon-Davies, 2002) there are many potential factors that contribute to the failure of an IS project; hence avoiding or minimizing these factors, companies can guarantee or maximize the probability that IS projects run according to the expected.

TOC has a methodology that is suitable to identify and understand risk factors or constraints in critical areas where the constraints threaten dramatically the success of the implementation. Furthermore this theory has principles that will help us to recognize constraints to analyze the possible track a company has to take in order to increase the likelihood of success. A common weakness of many IS projects is their failure to recognize and effectively manage the constraints of the entire system.

In addition to bring an IS project to success, the term productivity is determinant in the expectations. The aim is to run an IS change successfully and productive at the same time within the whole process. TOC refers that any new implementation in a business chain must support and augment productivity. Goldratt & Cox (1993) affirm that the future of any business depends upon its ability to increase productivity.

*How to maximize performance (productivity) of an IS change in the business chain according to TOC?*

IS projects are implemented to create efficiencies and to make activities within the business process easier and more productive. It is not enough to only run the IS project but to run it a way that enlarge productivity for the whole business. There are cases in which companies do not see ahead before implementing the IS project so they do not notice that one change can trigger a chain of changes in order to attain real productivity.

Organizations invest a considerable amount of money in IS projects and they want to see real benefits on it. The problem is that productivity is not measured accordingly to the IS project and other intangible benefits. TOC collaborates with measurements to set productivity goals according to the change and possible limitations.

There is a gap in terms of productivity, some IS project managers invest in IS projects to cut costs and they do not consider the other side: maximize business performance to excel productivity and make money. Theory of Constraints lies on heightening the performance of business chain to its highest.

*In which extent do IS changes really help to enhance productivity?*

Organizations in general invest in IS to make their processes easier and more productive. The latter invests resources to amend processes and induce productivity but the aim is to allocate resources in IS where it really supports the productivity goal. Using more capital or other resources does not necessarily increase productivity. Productivity growth comes from working smarter (Brynjolfsson & Hitt, 1998).

Companies have spent vast sums on IT with little benefit, while others have spent similar amounts with tremendous success (Brynjolfsson & Hitt, 1998). If the IS project is not allocated consciously, it might be useless and unproductive for the business system. Organizations are spending too much time, money and effort on IS that simply keeps the business ticking over and not enough on exploiting the potential for IS to deliver much greater business value. IT has the potential to change the business – to establish competitive edge, to generate huge efficiencies, to drive innovation (Information Age, 2009).

Technology is only one component of an IS investment; there are usually large expenditures on training, process redesign and other organizational changes accompanying a systems investment. The benefits are not just the returns from IT but returns from a system of technology and organizational changes; for every dollar of IT there are several dollars of organizational investments that, when combined, generate the large rise in measured firm productivity and value (Brynjolfsson & Hitt, 1998).

### 1.3 Selected research questions

Our thesis will be focused on the following research questions which will conduct the entire research.

- *Which are the critical factors to consider when conducting an IS change to be successful and productive based on the Theory of Constraints (TOC)?*
- *How to maximize performance (productivity) of an IS change in the business chain according to TOC?*

After analyzing the problem of our research, we have decided to focus our attention in these two main research questions. These questions constitute the foundation of the issues that have been considered in the problem discussion. The other two questions are related to our main research questions but they required a different research approach and a deeper knowledge that exceed the scope of our thesis. However, in order to conduct answers for our main research questions, we will need to go through all four research questions in a certain way considering the scope and core of the thesis.

## 1.4 Purpose

The purpose of this thesis is to adapt the principles of the Theory of Constraints into an IS implementation process in order to assure success and productivity of the entire business process. The aim of this research is to identify critical factors based on TOC principles that are tightly related to the final result when IS are implemented.

Furthermore we would like to provide recommendations that companies can follow in order to implement a successful IS change that maximize companies' productivity and performance. This paper should be used as a guide for companies so that they can consider all aspects involved on their particular needs and therefore have a more structured IS change plan.

## 1.5 Delimitation

Both theories of change and TOC can be applied to different industries and sectors; however it should be clear that this research will focus only on IT industry. We will focus on IS changes processes on different companies within the same IT industry. In order to make this inquiry more homogeneous, we will focus our research on worldwide companies located in Mexico which have fairly the same cultural approach. Hence we avoid cross-cultural issues and the study will be more pure and consistent.

It is important to mention that this research will analyze IS changes as a whole which includes the interaction between people, processes and technology. We put emphasis on IS as the relationship of these three factors in organizations. IT investments are a considerable subject for companies due to the big amount of money they represent, but it is not until the IS makes to work the IT investment. It is not the IT investment per se who delivers improvements and payback, but the entire IS working as a unique system.

In spite of the existence of other improvement and change theories, we will base our research and thesis in the previously mentioned Theory of Constraints. Regarding the latter, we will conduct our inquiry based on the major principles this theory proposes.

This thesis considers as failed IS projects both those that were cancelled before completion or never implemented and those that were completed, but over-budget, over the time estimate, and/or with fewer features. We have bounded in this way since we believe that IS projects that were not implemented as previously expected, failed sometime during its management implementation in a certain way and consequently these "unexpected" modifications alter and limit the way to implement a successful and productive IS project.

## 1.6 Definitions

This thesis refers to some terms that must be clarified in advance in order to have a better understanding of the research. We have created a list of terms that will be useful to delimit and conduct our research. Defining terms will restrict the reader to focus only in the definitions we refer so we avoid misunderstandings or possible concepts that might exceed the scope of our thesis. It is vital to make terms clear since some of them are very different from the traditional definitions.

**Information System:** Information system (IS) refers to the interaction between people, processes and technology. This interaction can occur within or across organizational boundaries. An IS has an information technology (IT) component that interacts with the people and processes components. We refer as IS projects to those projects that contain IT components that interact with people and other processes in the business chain in order to create a change in the way of conducting the business.

**Constraint:** A constraint is anything that limits the system from achieving more of its goal. Every change generates constraints. The constraint is the thing that is preventing organizations from getting more productivity. A constraint is a bottleneck, delay or a barrier to companies' full potential.

**Bottleneck:** A bottleneck is any resource whose capacity is equal to or less than the demand placed upon it (Goldratt & Cox, 1993). It might be a source of constraints and restrictions during the IS implementation process. A bottleneck is a potential barrier for throughput that can jeopardize the whole business process. Bottlenecks are not necessarily bad; they are simply a reality in many systems.

**Throughput:** Throughput is the rate at which the system generates money through sales (Goldratt & Cox, 1993). If companies produce something, but do not sell it, it is NOT throughput. Throughput is the final stage of any system in which the goal is to sell and generate profits by the production or implementation of something. Throughput is to sell what a company produces.

**Productivity:** Productivity is the ratio of what is produced to what is required to produce it. "Any action that moves companies toward making money is productive" (Goldratt & Cox, 1993, p. 41) Productivity is measured in the entire business process.

## 2 Method

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*The research method constitutes the process and plan for data collection and its analysis. In this chapter, the overall strategy to get the information wanted to solve our research questions is presented and justified. Furthermore this chapter will clarify our position regarding the philosophy of science, research level and choice of method. A discussion of the techniques used to gather and validate information will be held as well in this chapter.*

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### 2.1 Philosophy of science

There are two major schools of thought in the philosophy of science that are useful to allocate this research in order to have a guideline while gathering and analyzing information; these school of thoughts are known as “positivism” and “hermeneutics”. These philosophies have different approaches and procedures regarding the way a research should be conducted to find out answers and conclusions for the research questions.

Despite the timeliness of the issues it addresses and its practical relevance, the IS field has not attained a particularly prominent position within academia yet, even in the regions where it is widely studied (Avgerou, 2000). IS studies are difficult to reach a specific category in the conventional scientific disciplines, due to the fact that IS cover a wide area of study, researchers cannot place their inquiries in only one school in the philosophy of science. Although IS are related with new technology, it conducts issues of organizational action and social change.

In past times, IS studies adopted a merely positivist epistemological stance. According to Avgerou (1999) quantitative modeling, empirical surveys and laboratory experiments were almost exclusively considered to be the trustworthy methods of investigation of the field. Keys (1997) defines “positivism” when knowledge refers to explanations about regular behavior and cause-effect relationships in the world. Such knowledge is seen to be cumulative and the value of understanding may be assessed against criteria of truthfulness in certain ways. Knowledge, in this perspective, is able to be expressed unambiguously and transmitted in precise terms in the form of statements and hypotheses about behavior. Due to its empirical approach, the idea that observation and measurement are the core of scientific endeavor, positivism is based on quantitative methods to gather and analyze information.

On the other hand, “hermeneutics” is the classical discipline concerned with the art of interpreting (Gadamer, 1984). Hermeneutics generally refers to the theory of interpretation which has no metaphysical or epistemological guarantee of success. A hermeneutic approach proposes that all understanding is based on an interpretation of situations but that this understanding is conditioned by an individual’s prior understanding or pre-judgments that are not usually brought to critical awareness (Westrup, 1994). A hermeneutic perspective lies on the view that understanding a context is more than just an analytical process and it is closely related to interpretation. Consequently, the latter bases its research approach in qualitative methods to conduct the gather and analysis of information.

The aim of this research is to identify and manage those critical factors that are key to implement a successful and productive IS change within an organization. The intention of this inquiry is to study the variety of limitations that companies face when implementing IS changes and how to overcome these limitations in order to attain maximum performance of their new IS implementations. As it is already known, IS are based on the relation and interaction of different actors that make IS a wide area of study and therefore different philosophy approaches may fit in the research.

For the aim of the research, we need to observe and measure aspects that do not need interpretation or speculation. We refer to these aspects as measurements, for instance productivity and efficiency, in the way that companies can have a monitoring of these outputs in terms of specific procedures and variables. In this specific case, the thesis adopts a positivist view since we will manage data and knowledge by merely describing the phenomena that companies experience. The purpose of positivism, according to Trochim (2006), is simply to stick to what we can observe and measure to obtain straightforward answers for future analysis related to research questions.

Nevertheless a simple approach of linear casualty between observed aspects, defined by positivism, may not be enough to solve our questions. Therefore this thesis needs to adopt a hermeneutic approach to go further in the research since the study of the implementation and use of IS in organizations inevitably raises questions about how people as individuals interpret and perceive information and use technologies. Information systems studies are expanding in scope, becoming increasingly more concerned with the wider context within which an organization is embedded (Avgerou, 2000).

Due to the complex nature of IS, this investigation will face individuals' own perceptions and interpretations of the phenomena in which they are involved; therefore hermeneutic approach suits better within the research process and information analysis. In order to come up with answers and conclusions, a prior understanding of the topic is required to elaborate interpretations and judgments of the phenomena. Therefore this thesis requires an overall prior understanding of notions of IS project failures. A deep understanding of TOC is also required since this thesis is based on TOC principles in order to avoid failures; interpretations and judgments will be based on TOC to solve research questions. In addition, due to the fact that companies apply IS to support their organizational changes, theories of change must be pre-understood to guide the information to fulfill the purpose of the thesis. The latter will gather information from different perspectives and in specific scenarios in which people behavior and thought are crucial in every decision they made and cannot be replicated equally. Issues will be examined from different perspectives, making different assumptions on the nature of the phenomena investigated.

Studies of IS and organizational change go beyond the analysis on the economic value of IS, thus they raise new social issues and adopt theoretical perspectives from the social sciences to understand and interpret the value of IS in organizations. Hence a merge of positivism and hermeneutics is required in this inquiry; however a hermeneutic approach will be the fundamental philosophy that will guide this research. The hermeneutical framework brings an openness of inquiry to the interpretive work in IS design and use. An open process of interpretive inquiry can enrich both research and practice by improving the possibilities for recovering, uncovering and discovering meaning, so central to the IS field (Boland, Newman, & Pentland, 2009).

## 2.2 Research orientation: Multi-Grounded Theory (MGT)

Due to the wide range of the IS studies, the IS field lacks of developing and positioning inquiries in a unique orientation related to their theory development. According to Ghauri & Gronhaug (2005) and Lind & Goldkuhl (2005), there are two major reasoning orientations to develop theories with the aim to test what is true or false: induction and deduction. The selection of the convenient reasoning orientation depends on what the research aims to study according to the problem definition.

IS studies have been largely issue oriented, investigating a set of questions regarding the implementation of IT in organizations, therefore IS is predominantly issue oriented rather than theory driven (Avgerou, 2000). This research aims to draw conclusions from the observations of various situations within the same approach of IS implementations which perfectly correspond to an inductive orientation. Ghauri & Gronhaug (2005) defines “inductive reasoning” as the systematic process of establishing general propositions on the basis of observations or particular facts.

Through induction reasoning, we are able to draw general conclusions form empirical observations. In this type of research, thus, theory is the outcome of research (Bryman & Bell, 2003). In this type of inquiries, qualitative type of research is often applied to gather information. This thesis focuses on studying different situations in which an IS project is implemented in order to find out which critical factors determine the success of the implementation. Hence this research deals with the observation of facts in order to generate findings that allow us to draw recommendations to conduct the IS implementation in a way to attain higher performance and increase productivity.

Nevertheless a deductive reasoning orientation is also suitable to conduct our research since this thesis aims to look the consequences of an already established theory within a specific IS setting. Ghauri & Gronhaug (2005) state that deduction reasoning involves gathering of facts to confirm or disprove hypothesized relationships among variables that have been deduces from existing knowledge. This inquiry aims to match the already known Theory of Constraints towards the identification of critical factors when implementing an IS project in organizations; in accordance with the principles of TOC, we will try to assess IS implementations with the purpose to provide recommendations to guide an IS project to attain real productivity.

However, it is important to mention that these reasoning orientations are not completely isolated from each other. According to Ghauri & Gronhaug (2005), the processes of induction and deduction are not totally exclusive of each other and induction includes elements of deduction and vice versa. Therefore, this thesis requires both approaches to propose answers to the research questions.

The use of external theories such Theory of Constraints as a theory to depart from gives to the inquiry a deductive approach. An established theory is used to categorize and classify IS phenomena. A deductive approach to theory development is not the only one. An alternative approach often taken is an inductive analysis of empirical data for creation of a theory. Hence the Grounded Theory (GT) approach proposed by Glaser & Strauss (cited in Lind & Goldkuhl, 2005) is a prominent representative of inductive approaches to theory development. During the later years GT has been used within IS research (Lind & Goldkuhl, 2005). Nonetheless this GT has received some criticism to be



too strict inductive where existing theories are left out. An alternative approach, building on Grounded Theory, has therefore been put forward – the Multi-Grounded Theory (MGT) approach. Goldkuhl & Cronholm (2003) define a Multi-Grounded Theory to be an empirically, theoretically and internally grounded theory.

Since we need to take both research orientations, MGT suits perfectly to support our methodology to solve the research questions. MGT is an attempt to combine certain aspects from inductivism and deductivism, as a kind of abductivism. It incorporates both an inductive analysis and a theory-informed analysis of data (Alvesson & Skoldberg, 2009). The combination of these approaches is shown in the Figure 2-1.

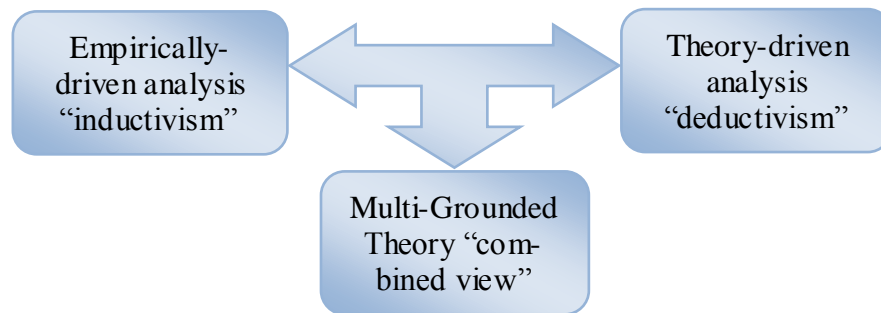


Figure 2-1. Multi-Grounded Theory (MGT) as incorporation between inductivism and deductivism (Goldkuhl & Cronholm, 2003)

This research process can be seen as an application of the MGT approach. The design of the research process intends to manage an interaction between empirical data and the existing Theory of Constraints as a basis to identify critical factors within IS implementations. Research questions are based on matching and testing TOC principles in IS implementations through empirical and theoretical analysis. The research questions for this thesis require recurrent theoretical matching as well as recurrent empirical validation.

## 2.3 Choice of research method

Which methods and techniques are most suitable for which research depends on the research problem and its purpose (Jankowicz, 1991). Research methods refer to systematic, focused and orderly collection of data for the purpose of obtaining information from them, to solve/answer a particular research problem or question (Ghauri & Gronhaug, 2005). There are two research methods that are useful for data collection and analysis: qualitative and quantitative method.

According to Ghauri & Gronhaug (2005), the main difference between qualitative and quantitative research is not of “quality” but of procedure. Trochim (2006) mentions that in some areas of social research, the qualitative-quantitative distinction has led to protracted arguments with the proponents of each arguing the superiority of their kind of data over the other.

According to Trochim (2006), the quantitative types argue that their data is “hard”, “rigorous”, “credible”, and “scientific”. The qualitative proponents counter that their data is “sensitive”, “nuanced”, “detailed” and “contextual”.

On account of the MGT reasoning orientation this thesis addresses, this inquiry will be conducted on prior understanding and interpretation which are characteristic of qualitative method. The research aims to collect data from observations and measurements in natural settings; the objective is to gather data about IS implementations directly from their environment focusing on understanding from respondent’s point of view. The purpose is to collect, analyze and understand the department or behavior of a certain phenomena through interpretation (hermeneutics) in order to validate and test the information based on the Theory of Constraints.

The purpose of this thesis is to identify critical factors (constraints) in order to implement successfully IS projects which enhance organizations’ productivity. There are constraints and benefits related to IS that are difficult to perceive or measure (intangible) and therefore we need interpretation and assumptions that guide us through data analysis. Qualitative methods enable researchers to identify intangibles and create generalizations departing from comparison of properties and context of individual organism.

Qualitative method lies on the background and previous experience of the researcher; consequently our background as IT-professionals suits perfectly to carry out a qualitative research. We have professional expertise and academic knowledge to make aware and conscious interpretations about the data gathered directly from the IS implementers. Due to the nature of the qualitative method, the data is obtained directly from the people who are involved in IS implementations and therefore we have subjective (insider view) and closeness data that will enrich our research.

Qualitative methods are flexible and unstructured; they employ a limited number of observations and try to explain different aspects of the problem area (Ghauri & Gronhaug, 2005). In this research, we focus on a limited number of organizations that implement IS changes but this “low” observations allows us to analyze several aspects of the problem area. According to Ghauri & Gronhaug (2005), low numbers are justified because we often want to do in-depth studies or provide “thick description”, which is not possible in cases of numerous observations. Qualitative method is, therefore, most suitable for our research since IS studies require an in-depth insight to generate valid and rich conclusions.

## **2.4 Data collection**

The selection of the technique to collect data and the process on how to order, gather and interpret data depends on the approach of the research. In order to solve the research questions, this thesis will use secondary data and interviews (primary data) as sources of information. Due to the nature of the research, both types of data sources are helpful in this thesis in behalf of fulfill the scope of this inquiry.

### 2.4.1 Secondary data

Secondary data are useful not only to find information to solve our research problem, but also to better understand and explain our research problem (Bryman & Bell, 2003). Secondary data sources include books, journal articles, online data sources, company's reports and studies, researches made by others and all the information gathered by others.

Since secondary data was conducted by others, it is important to evaluate if the information is useful for our specific research. It is vital to consider that a secondary data provides information that may have been collected for a different purpose and therefore its usefulness is limited.

For the specific case of this research, secondary data is used to get an overview of IS situation in companies. Due to the complexity of the topic, we will take reports and studies made by recognized and specialized companies, such as The Standish Group and KMPG, to get significant data to support and explain the selection of the research problem. Secondary data will provide determinant facts and information that present a panorama of the main problem and its reason of study.

### 2.4.2 Primary data - Interviews

Since secondary sources cover only a portion of the research questions, primary data takes part in this research as the main source of gathering information. The type of primary data used for this thesis is mainly focused on interviews. The empirical process of this research consists on interviews applied to managers from different levels within diverse organizations in the same IT industry. Interviews are often considered the best data collection methods (Ghauri & Gronhaug, 2005). By using this tool of collecting information, we attempt to attain insightful and first-hand knowledge about the process of IS projects in the real world.

An interview, according to Kumar (2009), is any person-to-person interaction between two or more individuals with a specific purpose in mind. Interviews demand real time interaction between the researcher and the respondent (Ghauri & Gronhaug, 2005).

The aim for using interviews is to have the option to discuss plainly with the respondent while at the same time to have the possibility to ask questions that were not written down in advance and they popped up in response to the topics discussed by the respondent. This way we will have a flexible discussion, making sure we will cover interesting topics deeply. Nevertheless, we believe it is important to have some questions written down already in order to make sure we cover the areas needed. Regarding the nature of the open discussion, the interviews follow a *semi-structured* pattern where topic and issues to be covered and questions to be asked have been determined beforehand. In this case there is a previous design on how the interview will be conducted but there is still a degree of freedom from the respondent. In semi-structured interviews we handle bias by careful design of the technique itself: bias arising from the sequence in which we address subject matter, from any inadvertent omission of questions, from unrepresentative sampling and from an uncontrolled over-or under-representation of subgroups among our respondents (Ghauri & Gronhaug, 2005).

### **2.4.3 Pilot study**

The tool used to collect information needs to be well developed so meaningful data can be collected and analyzed. In the qualitative method, this tool is called the interview guide which is used as foundation and basis to conduct the interviews. This interview guide has been compared with the research problem several times as suggested by Ghauri & Gronhaug (2005) in order to assess the relevance and relation of the interview's questions with the research questions. The design of this interview guide is therefore important and the content of it needs to reflect and be motivated by the purpose.

After elaborating the interview guide for the semi-structured interview, a pilot study is launched in order to have feedback about the questions and the terminology used. A pilot, or feasibility study, is a small experiment designed to test and gather information prior to a larger study, in order to improve the latter's quality and efficiency. A pilot study can reveal deficiencies in the design of a proposed procedure and these can then be addressed before time and resources are expended on large scale studies (Lancaster, Dodd, & Williamson, 2004).

A study pilot is designed and sent to a manager working in an IT company out of the group of our potential respondents. All the questions in the interview guide are held and analyzed with the "pilot manager" in order to know if there is ambiguity in the questions, difficult terminology or too wide questions; the structure of the interview is analyzed as well with the aim to plan the duration of the process for future interviews with the real respondents. Comments and feedback from the pilot study are analyzed to make the appropriate corrections.

### **2.4.4 Selection of the respondents**

Selection of respondents takes an important role in the pursuit to get valid, reliable and useful information. Since the main source of information is gathered by interview, the respondents must be carefully selected in order to have a holistic overview of the situation studied. The selection of respondents strongly affects the course of the inquiry therefore it is significant that respondents have meaningful and relevant information about the research topic and specifically about the research questions. Furthermore the research questions and purpose of this thesis shape the profile of our potential respondents.

The research questions are related to find critical factor when implementing IS projects, hence respondents must have experience in IS changes within their organizations. Accordingly we have to select respondents that we consider have expertise in IS changes and have knowledge about leading change in organizations.

Below we list some criteria for selecting the respondents:

- Managers with power of decision and leaders in their correspondence areas in their business. Leaders who are responsible to guide a team within an IS change.
- Managers with at least 5 years of experience in IS project implementations.
- Managers we knew before so we have easy access to them and we create a comfortable environment to conduct the interview.
- Large sized IT-companies with presence in other countries (international) but located in Mexico.
- Companies which are implementing or implemented IS projects.
- Companies which consider IS investment as part of their yearly budget.

The selected companies and respondents are listed below with a short business description:

1. **Dell Services** is a multinational information technology corporation that develops, sells and supports computers and related products and services, as a merchant. Based in Round Rock, Texas, United States, Dell employed more than 76,500 people worldwide as of 2009.

*Respondents:* Luis Cruz – Network Manager and Pedro Sanchez – Network Security Team Leader

2. **Nortel** is a worldwide telecommunications equipment producer with headquarters in Toronto, Canada. At the beginning of 2009, Nortel announced it would close down functions and negotiate all of its business units. Nortel employed around 32,550 as of February 2008.

*Respondent:* Juan Espinoza – Engineering Manager (ex-employee working until January 2010)

3. **Ericsson** one of the world's largest Swedish companies, is a provider of telecommunication and data communication systems, and related services, covering a range of technologies, including especially mobile networks. Directly and through subsidiaries, it also has a major role in mobile devices and cable TV and IPTV systems. Ericsson's extensive presence in Stockholm has helped transform the city into one of Europe's hubs of IT research. Ericsson has offices and operations in more than 150 countries, with more than 20,000 staff in Sweden, and also significant presences in, for example, the UK, India, Ireland, the USA, Finland, China, and Brazil. Ericsson employed more than 82,500 as of 2009.

*Respondent:* Juan Espinoza – Software Engineering Manager for Latin America

4. **Cisco Systems** is an American multinational corporation that designs and sells consumer electronics, networking and communications technology and services. Headquartered in San Jose, California, Cisco has more than 65,000 employees all around the world.

*Respondent:* Rebeca Cortés – Technical Assistance Centre (TAC) Manager

5. **Desca** is a leader solutions integrator with ample presence in Latin America. The company is based in Maracaibo, Venezuela. The company also has operations in Colombia, the United States, Mexico, Costa Rica, Ecuador, and Panama. Desca, the networking company, is a subsidiary of eLandia International, Inc. Desca has more than 1,000 employees as of 2009.

*Respondent:* Saúl Arjona - Delivery, Support and Operations Manager

#### 2.4.5 The interview process

The first step in the data collection process consists of contacting the managers of different companies. According to Ghauri & Gronhaug (2005), in order to be able to run the interview efficiently and without any disturbances, the researcher needs to know the respondent, his background, values and expectations. That is why we select managers who we previously knew due to our prior working experience and the easiness to contact them.

We first need to send e-mails to these leaders in order to check their availability. On the e-mail we explain to them what our thesis is about and if they are interested in taking part of this research; at the same time we introduce ourselves and give them an overview of our master thesis and the purpose of it. After receiving the response and confirmation from them we just schedule an interview. All the interview respondents are located in Mexico City, so the interviews must be held via phone (skype tool). Each interview is calculated to last around 30 minutes and all the interviews are held in Spanish due to the location and nationality of the respondents.

The interviews have to be recorded with the permission of the respondents and at the same time some notes must be written down for later analysis. Our goal as interviewer is to be as open as possible in order to leave the respondents to feel free and comfortable to express their thoughts and experience. All these leaders were colleagues of us in the past, so they let us interview them as a favor. Due to the fact that we knew the respondents from prior jobs, a good atmosphere will be created which will help the interviewees answer in a more open way. Furthermore they will be asked for some help later on in case we still need their assistance for further research or clarifications. In all the cases, it is necessary to invite respondents to follow the results of this interview and their comments as soon as we are done with the entire analysis.

The questions are planned accordingly on the research questions we want to answer and on the theories we previously studied. Nevertheless it is important to start the interview asking about general information such as position in the company, seniority, profession-

al background, among others. We basically conduct semi-structured interviews, we let the respondent full liberty to talk about the change he or she was part in. However we must control the interview in the cases that managers deviate to other topics (e.g. about personal information) that are not relevant for the research.

As previously discussed, the interview will be applied to different managers in a variety of companies. All these companies are IT firms. Even if the respondents are well-prepared in these topics, a must is to use simple and understandable language with the corrections done in the pilot study. However it may happen that some managers already know some theories in question so the interview could be held easier and more productive.

The interview guide for this thesis is attached in the Appendix-1. Notice that this is only a guide and it does not mean that all the questions contained there were asked in the form and sequence they are published. Due to the semi-structured interview of this research, the interview is open and susceptible to take different ways; however the interview guide serves as the main track to conduct the interview. The way to conduct questions also depends on the experience and knowledge the respondents have.

#### **2.4.6 The interview questionnaire**

For the first part of our research it was important to know what critical factors our interviewees thought were important during their IS change. For that matter we needed to identify if the following points were consider by our respondents relevant. The next essential points are the ones our reviewed literature judge as more important: Why the change was necessary, who originated the change or for the same substance who was leading the change. If they set a main goal that the IS change should accomplish and if after this goal was set; if SMART goals were set. What steps our respondents followed to achieve a successful change, in other words what the change process was. How did the interviewees handle the social interaction on their team and outside of it? If there was a motivation for the employees to achieve the goals the change needed, and if there was one what type of motivation was. Then regarding the TOC we needed to know if they were able to identify constraints on the change process, if this limitations caused other issues and if they actually dealt with this limitations or if they just focused on their activities the company already do well. It was also important to know if the change was considered successful in terms of budget, time and requirements and finally if they had a way of measure the effects of the IS change in the company.

Then for our second research question we needed to know what our respondents considered important aspects to maximize productivity. The diverse theories of change we reviewed point out the next features, which we tried to identify on the different cases the leaders we interviewed presented to us: Measurement. We need to know if the companies our respondents work for have a mechanism of measure their productivity and if this mechanism involves certain time frame. Then we focused on the role the management team played on the change, where they persistent with the change goal? Is the

leader actually motivating the change or preventing his or her subordinates to achieve the goals easily. TOC dictates that an IS change should benefit the whole business process; therefore we needed to know if the change our interviewees dealt with was to improve a certain area or if it was meant to improve the whole company and if it was also meant to increase sales. Finally it was important for us to know if they saw these changes as a continuous improvement cycle or not.

#### **2.4.7 Interpretation and analysis of data**

There are several approaches for analyzing qualitative data. According to Ghauri & Gronhaug (2005), a distinction can be made between whether the research departs from existing theory or whether the analysis departs from observations.

In our case we are conducting a MGT approach. We are first considering several change theories together with the theory of constraints and some studies already done about IS changes. Based on these previously studied theories and all the information gathered from primary data, we create a basis for elaborating conclusions in comparison with the information obtained from the interviews. The aim is to relate in a clever and objective way the theories to the research questions with the purpose to generate valid answers for the research questions.

There are some considerations stated by Ghauri & Gronhaug (2005) that must be contemplated during the interpretation and analysis of data. First, a priori assumptions and hunches should guide and direct, not dictate, the research. Secondly, even though some a priori theory may exist, it is assumed that a priori insight should not allow for complete structuring and explanation of the research problem.

Based on the latter, we will not let the previous theory direct our research. We conduct open interviews in a way that we might consider key successful factors that managers mention that helped them to implement a successful change or lead to an unexpected ending. Prior knowledge is required to conduct an enriching interview so we can take advantage of the full knowledge of the respondents; we can dig deeper in the topics and perform a better interpretation of the information given by the managers.

Even if a prior knowledge is required and semi-structured interviews are conducted, a certain degree of freedom during the interview is allowed in order to get different points of view that may empower the results. By doing this, we allow respondents to go further in their thoughts and we gather unbounded information. According to Glaser and Strauss (1967) an effective strategy, at first, literally to ignore the literature of theory and fact on the area under study, in order to assure that the emergence of information will not be contaminated by concepts more suited to different areas (cited in Alvesson & Sköldböck, 2009). Similarities and convergences with the literature can be established afterwards.



## 2.5 Trustworthiness: Validity and Reliability

All research aims to provide valid and approved results in an acceptable ethical way. The difficulties to validate the research depends on the research orientation taken, it is well known that qualitative researches are more complex due to its nature so the process of validation becomes more difficult to overcome. It is a proposition, inference or conclusion that can “have” validity (Trochim, 2006).

In qualitative research the following types of validity are often emphasized: descriptive, interpretative, theoretical and generalizable (Ghauri & Gronhaug, 2005). Descriptive validity refers to the degree to which the actual description holds true. Interpretative validity refers to how good the interpretation is. Theoretical validity refers to the adequacy of our suggested “theory” on explanation and generalizable means to what extent the findings from a study can be generalized to other settings.

This research aims, as previously stated, to find out critical factor when implementing an IS project and therefore generate a recommendations that companies can follow in order to apply a successful IS change. Hence we apply *interpretative* to test the concluding interpretations made through interviews and the result in the final recommendations, *theoretical* by validating our findings related to previous theories and explanations and finally *generalizable* validity to test into which extent our recommendations and findings can be set into a different scenario out of IT industries and IS projects.

### 2.5.1 Internal validity

Internal validity refers to the extent to which we can infer that a causal relationship exists between two or more variables (Ghauri & Gronhaug, 2005). The aim is to verify whether the theory of constraints, or any theory of change we have previously considered makes any effect in the IS change implementation, according to the managers interviewed. We want to test whether an effect is done in the implementation when managers apply theories of change or previous recommendations to conduct their IS project changes; a cause-effect relationship between theories applied and the result of the IS project.

We pay specific attention on validity threats like maturation in a way that we do not see a successful change as a result of a correct use of the theories we previously studied, when what it really occurred was just a change that happened because of the passage of time per se.

### 2.5.2 External validity

External validity can be defined as to which extent the result from a certain study is applicable to other similar situations (Ghauri & Gronhaug, 2005). This is very similar to generalization which we already cover previously in this paper. According to Yin (2009), the aim is to test the problem knowing whether our study’s findings are generalizable beyond the immediate interviews. Our objective in this thesis is to find out criti-

cal factors and come up with a set of recommendations that can be generalized to any firm pretending to implement an IS change.

We aim to make analytical generalization in which a previously developed theory is used as a template with which to compare empirical results of the interviews. The main point is that we should try to aim toward analytical generalization in doing case studies or interviews. In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory (Yin, 2009). The aim of this thesis is to make analytical generalization from a group of respondents that can be replicated in other group of respondent by following the same procedures and theories.

### 2.5.3 Reliability

Although the term “reliability” is a concept used for testing or evaluating quantitative research, the idea is most often used in all kinds of research (Golafshani, 2003). According to Stenbacka (2001), the concept of reliability is even misleading in qualitative research. If a qualitative study is discussed with reliability as a criterion, the consequence is rather that the study is no good. Nevertheless, the objective of reliability is to be sure that, if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions. The goal of reliability is to minimize the errors and biases of the study (Yin, 2009).

Instead, Patton (2001) states that validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analyzing results and judging the quality of the study. According to Lincoln & Guba, (1985) in qualitative paradigms the terms credibility, consistency and applicability or transferability are to be the essential criteria for quality.

The Theory of Constraints and some concepts we are using as a base for this research has been already used by several companies and has been proven to be effective in specific cases and scenarios. This will give us *credibility*. The people we interview have been in managerial positions for at least five years, and have been involved in different changes throughout their organizations which will provide *applicability*. There is a chance the interviewees do not give us accurate data, but we try to minimize this effect by comparing several interviews related to similar IS changes in order to have *consistency*.

### 3 Theoretical Framework

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*The focus of this part is to give the reader a prior knowledge of the topic. In order to have a better understanding, this theoretical framework presents the concepts that will help to conceive a guide of working based on stated theories and previous studies related to the matter. Moreover, this frame of reference operates as the basis for the analysis in which theories and empirical data will be compared; likewise this theoretical framework is aligned to the delimitation and scope of our research questions.*

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The theoretical framework is divided in four main sections:

- A first approach to Information system project management and its context.
- A description of already identified dimensions and categories of IS failures.
- Theories concerning change within organizations.
- An understanding of Theories of Constraints (TOC) and its major principles.

After every section, there is a summary that presents condensed information about the implications to the thesis. In this, it presents substantial information that implies directly for the aim of the research questions.

#### 3.1 Information System Project Management

Since this thesis is mainly focused in information systems (IS) projects and the way of conducting these, it is important to clarify and understand what a project is and the foundations of information systems project management. In practically all organizations there are projects comprising information systems which are frequently a key determinant of an organization's competitiveness. The way how organizations are able to manage these projects is thus a crucial skill that can help drive organizational success.

Depending upon the source, the definition of the term *project* may vary. The Project Management Institute (PMI) defines a *project* as a unique, temporary endeavors designed to meet the specific needs of the project's stakeholders (cited in Fuller, Valacich, & George, 2008). According to Fuller, Valacich & George (2008), a *project* is a planned undertaking of related activities to reach an objective that has a beginning and an end.

Business projects frequently have an assigned project manager. In information systems project the project manager needs a diverse set of skills – general management, leadership, technical, conflict management and customer relationship management – and is responsible for initiating, planning, executing and closing a project. A project manager's environment is one of continual change and problem solving (Fuller, Valacich, & George, 2008). The role that the project manager plays in the project management is essential for the success of the project and the organization in general; thus the project manager is influential to the successful completion of any project.

Information systems projects are designed to reach two main targets: to take advantage of business opportunities and to solve business problems. Taking advantage of an opportunity might mean, for instance, providing an innovative service to customers

through the creation of a new system. On the other hand, solving a business problem might involve modifying how an existing system processes data to provide users more precise or opportune information. Once a potential project has been identified, a feasibility study may need to be conducted. This study determines the necessary resources, the scope and the probability of successful completion is determined. With this information, organizations can assess whether the project is feasible within time and resources constraints in order to either taking advantage of an opportunity or solving a particular problem.

### **3.1.1 Unique features of IS projects**

This thesis refers to information systems project management. It is, thus, important for the aim of the thesis to clarify which characteristics differentiate IS projects from non-IS projects. There are many unique aspects, but Fuller, Valacich & George (2008) sum up as follow.

First, the technological context in which companies operate today is in constant flux. As new technologies are introduced, firms must quickly decide whether to invest in them or risk losing a potential competitive advantage or simply whether to match the capabilities of competitors who already have adopted a new technology.

A second unique aspect of IT projects is the difficulty of hiring and retaining experience IT project employees. In other words, not only may technologies change during projects, but a project team may also experience turnover as valued employees seek new opportunities.

A third aspect is the need to manage the extensive user involvement necessary in IT projects. It concerns of involving end users during the requirements-analysis phase of system development. A project development team must be aware that people with widely varied levels of technical proficiency are likely to use the IS. As a result, many different types of users need to be involved in the development process to ensure system success.

A fourth aspect is the need to understand established systems development methodologies and how these can be integrated into a project management framework. A fifth aspect is that the IS project must address solutions never tried before. Hence the project may focus on building a system that has an entirely new functionality; the project team may have few guidelines or past lesson learned to rely on.

A sixth unique aspect of IT projects that creates a level of complexity beyond non-IT projects is related to managing project scope. Project scope, which involves the planned definition and size of a project, is likely to change in many projects; however, progressive, uncontrolled increases in project scope are commonplace in IT projects.

Finally, the last unique aspect of IT projects is that the technologies involved in projects may change during the course of the project, presenting a moving target for the project team. Such changes in technology are commonplace, adding complexity of managing projects of this nature. In some cases, the technology might become obsolete before the project even finished.

### 3.1.2 Project Management context

The way how organizations and managers conduct projects is crucial for the success of the information system project. Projects can run in many circumstances and affected by many factors that might create unexpected issues that organizations must respond and adapt to. The Project Management Institute (PMI) defines *project management* as the application of knowledge, skills, tools and technologies to project activities in order to meet project requirements (cited in Fuller, Valacich & George, 2008). The PMI states that in order to guide a project, there are stages called *project management process groups* which are major project phases such as initiating, planning, executing, controlling and closing a project. All of these process groups together are known as the *project management life cycle*, thus, a project's life cycle illustrates all the phases a project goes through from concept to completion.

Information systems projects exist within a wider organizational context, they also exist out of organizations' boundaries. Elements of this still broader extra organizational context can and will affect any given individual project. Businesses are increasingly dynamic and global, and these aspects of the larger business environment also affect projects. Although there are many ways to think about larger environment in which projects exist; Fuller, Valacich & George (2008) present four areas of social economic and environmental influences as follow:

1. Standards and regulations
2. Internationalization
3. Cultural
4. Social-economic-environmental sustainability

Organizations are becoming more and more global, with projects and team members spread across many countries. Work that is global means projects that are global, too. Furthermore cultural issues obviously exist that potentially can affect the project. However, even when a project exists entirely within national boundaries, culture can still be an issue. In heterogeneous population, project members may have different backgrounds and views; hence project managers need to try to understand how these differences might affect project members and, hence, the project.

### 3.1.3 Implications for the thesis

It is important to define these important terms of "project management" and "project management context" in order to follow the same line of thinking. In practically all organizations there are projects comprising information systems which are frequently a determinant key of an organization's competitiveness. The way how organizations are able to manage these projects is a crucial skill that can help drive organizational success. The aim is to find out if knowing the way to conduct and manage an IS project might be a crucial point to consider in the IS implementation.

## 3.2 Major notions of IS failures

The subject of IS studies is interdisciplinary, integrating technological disciplines with management and other disciplines such as psychology and sociology (Avison & Fitzgerald, 1995). Applications of IS may increase operational efficiency, improve and innovate functions or restructure business processes; on the other hand IS projects can become a real problem for organizations since instead of improving and solving issues, they fail and consequently they trigger more problems or simply organizations do not obtain real benefits from their IS projects.

More than ever, organizations need to make smart decisions. Implementing IS projects inadequately or reducing operational IT budgets injudiciously can not only impair current effectiveness but also damage any future capability to respond to the opportunities that will inevitably emerge as recessionary pressures ease (Information Age, 2009). Therefore it is fundamentally significant to plan and assess the worth of the IS for organizations in order to avoid failure. The two issues of the use of IS and the impact of such use are inherently associated with assessments of the worth of an IS. In very broad terms, assessments of worth focus on considerations of the success and failure of IS (Beynon-Davies, 2002).

There are many reasons why many organizations fail when implementing IS projects, but according to Tilmann & Weinberger (2004), Al Neimat (2005) and Yeo (2002), the main reason lies on managerial issues. In addition, we consider the issues of IS failure departing from the assumption that learning from IS failures will provide us with meaningful hints for formulating successful strategies for implementing an IS project in organizations.

### 3.2.1 Dimensions of failure

According to Beynon-Davies (2002), IS failures can be considered in terms of both horizontal and vertical dimensions of the informatics model illustrated in Figure 3-1. The horizontal dimension is expressed in terms of the difference between development failure and use failure. The vertical dimension is expressed in terms of failure at the level of IT systems, IS projects, organizations or at the level of the extent environment.

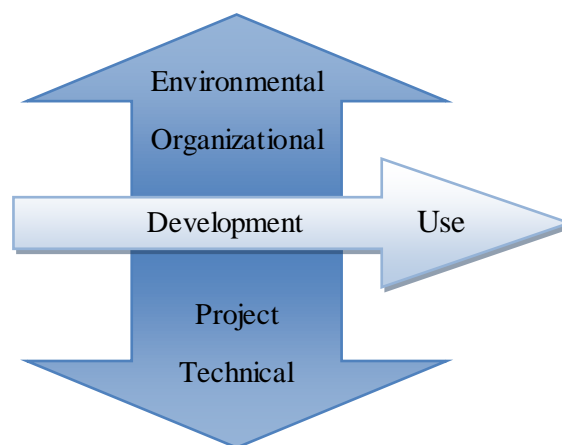


Figure 3-1. Dimensions of failure model

IS failure can be routed on a number of levels in relation to the vertical dimension: technical, project, organizational and environmental (social/economic/political). In a certain way, the four dimensions in the vertical axe are located hierarchically by their complexity in terms of information systems problems; thus environmental issues are considered to be more difficult to appeal. Thus technical issues, accordingly, are easier to manage. A brief description of each dimension is presented below:

- *Technical failure*: Failure of hardware, software and communications such as system crashes.
- *Project failure*: Failures in project management and control, such as cost or time overruns.
- *Organizational failure*: Failures of a system to deliver organizational benefits, such as decreases in efficiency or effectiveness.
- *Environmental failure*: Failures caused by changes in environmental factors, such as changes in regulation and labor relations.

Beynon-Davies (2002) argues that technical problems tend, by their very nature to be relatively tractable. At this level, the root of the problem can be quite precisely identified and therefore a suitable solution might be planned and executed. Such problems are hence best described as being “hard”. At the opposite end of the scale lie organizational and environmental problems. Problems in this area are frequently difficult to identify, if only because different stakeholder groups will have different definitions as to what problems are. Such problems are hence best described as being “soft”.

Problems at the project level tend to lie between the poles of “soft” and “hard”. By their very nature, certain problems, such as forming project teams, are relatively tractable. Other aspects of project management are less clearly definable. A good example here are the difficulties frequently experienced in terms of estimating the scale of an IS project and the resources necessary to complete it.

In this dimension model Beynon-Davies (2002) also distinguishes, in the horizontal axe, between failure during the development and failure in use. Development failure occurs when the whole or part of the system is abandoned prior to implementation. Use failure occurs during the post-implementation trajectory. Use failure may be evident if a system is abandoned after a period of use or if a system is subject to large amounts of adaptive maintenance.

### 3.2.2 Categories of IS failures

Within the IS field, studies have been conducted by specialist in the topic in order to understand IS failures with the purpose to identify the roots. Lyytinen & Hirschheim (1987) conducted a survey of the literature on IS failure and they identified and defined four major theoretical categories or notions of such phenomena (cited in Beynon-Davies, 2002 and Yeo, 2002):

1. *Correspondence failure*: This is the most common form of IS failure and typically reflects a management perspective on failure. It occurs when the system’s design objectives are not met. It is based on the idea that design objectives are clearly specified in advance, afterwards an evaluation is conducted of the IS in

terms of these objectives; if there is a lack of correspondence between objectives and evaluation the IS is regarded as a failure.

2. *Process failure*: It occurs when an IS cannot be developed within an allocated budget and/or time schedule. There are two likely outcomes of process failure. Firstly, a failure occurs when no workable system can be produced. Secondly, the IS is developed with massive overspending in both cost and time, thus negating the global benefits of the system. This is a project level failure attributed to unsatisfactory project management performance.
3. *Interaction failure*: The emphasis shifts from a mismatch of requirements and system or poor development performance to a consideration of usage of a system. Some related measures of IS usage include user attitudes and user satisfaction, the amount of data transferred or the frequency of use. However, heavy usage does not necessarily mean high user satisfaction and improved task performance, and there is little empirical evidence supporting such a claim. Heavy systems usage might be a result of legal compulsion, persuasion, or that there are simply no other alternatives besides using the system.
4. *Expectation failure*: The notion of expectation failure views IS failure as the inability of a system to meet its stakeholders' requirements, expectations, or values. Failure, therefore, does not only involve the system's inability to meet design (technical) specifications. Expectation failure is perceived as the difference between the actual and desired situation for the members of a particular stakeholder group. Unlike the other three notions, IS failure is considered holistically in this case, as the views of different stakeholders are taken into account.

Nevertheless, there are some criticisms about what is considered as an IS failure. For instance, Sauer (1993) posits a more conservative definition of IS failure; he proposes that information systems should be considered as a failure only if there is an operation termination, leaving supporters dissatisfied with the extent to which the system has served their interests (cited in Beynon-Davies, 2002 and Yeo, 2002). In other words, a system should not be classified as failure until all interest in progressing an IS project has ceased. Hence a system is not considered a failure as long as it survives and continues to attract support in resources. However, in behalf of this thesis, failure IS projects are considered those that were not implemented as previously expected, so failed sometime during its management implementation in a certain way and consequently these "unexpected" modifications alter and limit the way to implement a successful and productive IS project. Even if the IS projects are still running and attracting resources, this thesis considers as failure when those projects are not implemented as previously planned and expected.

### **3.2.3 Implications for the thesis**

Implementing IS projects inadequately or reducing operational IT budgets injudiciously can not only impair current effectiveness but also damage any future capability to respond to the opportunities that will inevitably emerge as recessionary pressures ease.

It is fundamentally significant to plan and assess the worth of the IS for organizations in order to avoid failure. According to Tilmann & Weinberger (2004) et al., the main rea-



son why organizations fail in implementing an IS project lies on managerial issues. So, we already know that managerial issues are a factor to point our attention in the information collection and analysis. According to the authors, managerial issues are a factor but how harmful it is in organizations and how companies allocate resources to deal with it is a point to consider as a crucial factor in the implementation.

Failures can appear within different dimensions and reasons. Knowing what causes failures become relevant to identify critical factors in these failures in order to create recommendations to overcome or avoid those failures in future IS projects.

### 3.3 Theories of Change

One of the main objectives of this thesis is to study different methods to lead change. According to MCallaster (2004) one of the keys to successful change is recognizing the different approaches that people and organizations go through when dealing with the reality that things will be different. The potential successful of any change lies on how people are conducted to understand and accept the change; according to Goldratt & Cox (1993) people are the most important asset in any system where the change takes place.

As MCallaster (2004) argues, transformations put pressure on leaders to improve quality, be more global, better utilize capital, maximize resources, improve shareholder wealth, and create new products and services. This paper has as an objective to offer these leaders a guide on how they can successfully implement a change, specifically an IS change, and at the same time make sure this change actually helps the organization to reach its goals. The first step to implement a successful change is to set a goal. What do we want to achieve after the implementation of a change?

In order to understand how changes should be carried out, this thesis analyzes several “change theories”. These theories will help us comprehend the steps needed to make a change transition easier. According to Latham (2003) there are five steps to follow for a behavior change:

**Superordinate goal:** Latham refers that the first step to start a change should be to set a main objective; something the employees can believe in. A superordinate goal captures the “heart” because it focuses primarily on affect; it appeals to emotion. In doing so, a superordinate goal gives people a cause they can identify with. The purpose of a superordinate or overarching goal is to capture the imagination, and hence to stimulate people to take action. Superordinate goals should inspire employees. After a superordinate goal is set the next step is to place more specific goals.

**Goal setting:** The purpose of goal setting is to make the superordinate goal concrete. To move it from emotional rhetoric to concrete action steps. To do this, the goal must be specific, measurable, attainable, relevant, and have a time-frame. This is what Latham (2003) calls “SMART” goals.

The downside of goal setting is the necessity of finding ways to obtain goal commitment. Without commitment there is no goal. In order to gain goal loyalty the leader should understand what the people expects as an outcome of achieving the goal. The

team's behavior will depend on the outcome they expect. Changing the goal result should also change the team's behavior.

Once the people have the necessary knowledge and skills to reach the goal, a performance outcome goal should be set. Good examples of performance outcomes are: revenue to be earned or costs to be reduced. Goals affect choice, effort, and persistence. But if people lack the knowledge or skills for goal achievement, a SMART learning rather than an outcome goal should be set. A learning goal, as the name implies, focuses attention on the discovery of strategies and skills necessary for goal attainment. Hence, the emphasis is on the development of procedures or systems necessary for mastering the task. Then after the tasks and/or steps to achieve a goal have been mastered it is possible to start setting performance goals.

**Integrity:** Leaders must model commitment to the superordinate and SMART goals. Hence organization's leaders need to take a long look in the mirror to see whether their words and actions are consistent with the superordinate and SMART goals that have been set. To achieve this, leaders must reflection and see if the superordinate goal is still valid and if it still inspires people. The SMART goals should also be evaluated periodically. This evaluation is necessary to see if the goals are the ones the company needs or if they are too hard or too easy. The leader should also be concern about the company environment. If there is anything that restricts goal attainment; actions should be taken. Finally leaders need to take a look at themselves. They need to see if there is anything they say or do that prevents goal attainment or that reduces goal commitment. If that is the case, they should analyze what is causing this bad influence and change it.

**Accessibility:** Leaders need to be accessible among other reasons to: let people know that what they do is both noticed and appreciated with regard to goal attainment, and to encourage dissent with the goals that are set. Leaders need to strengthen and reinforce behavior that is consistent with the superordinate and SMART goals. If they stop this reinforcement there would be lack of commitment towards the goals. Recognizing and acknowledging people is an effective way to prevent apathy.

**Measurement:** Effective leaders ensure that the measurement system is aligned with the superordinate and SMART goals. If people are rewarded and promoted on metrics that do not support the goals, no one will remain committed to the goals. People will focus on the things which get measured.

Another important contribution for change theories is established by MCallaster (2004). He proposes something called the 5 P'S of change. He argues that in order to successfully execute change initiatives, influence others and moving the organization towards your point of view, all depend on the ability to lead and manage. This 5 P's should help leaders to identify key factors for change implementation, thus making the change transition easier. The five "P's" MCallaster proposes are as follow:

**Pain:** There are three types of pain: bad, good, and imposed. The type of pain that is leveraged to impact change needs to be understood and capitalized on. It is important to seize the moment when pain exists. When pain goes away, so does the motivation and energy for change associated with it. This is especially true for good and bad pain.

When things are chaotic and the organization or the individual is moving in the wrong direction, it is easy to focus the organization's and individual's attention on the reason the change is needed. For organizations, bad pain comes with red ink, and when the fu-

ture is cast with almost certain doom and extinction. Bad pain thus came when the company is not doing well and a change is needed otherwise the firm would go bankruptcy.

Good pain can occur when an organization experiences phenomenal growth, when opportunities are breaking, and business is booming. In good times people work overtime and are tapped out trying to meet demand. Resources aren't the issue. The issue is time and energy. In good pain the change objective is to modify processes in the company to be able to handle this growth.

A common problem with both good and bad pain is that both can be very episodic, and the leaders who seize the moment have a "momentum" where the followers are willing to accept the change. That much is good, but the "momentum" created may not be sustainable. Leaders should take advantage of this "momentum" to make the change transition easier. The opposite is also true. If a leader delays acting, he or she can lose the opportunity and its potential momentum.

Imposed pain can be the most effective type of pain when it is used in a proactive manner. When using imposed pain, managers make decisions on which they will not wait for other factors, good or bad, to be the catalyst for change. Imposed pain is an example of leadership providing a stimulus for motivation and requires a firm determination and focus by the person leading the change. Managers who impose pain take the risk associated with being the focal point for the change initiative.

**Process:** Process is the essence of how one goes about changing the environment. Real change occurs when a leader and manager understands the organization (its strategy, people, and culture), identifies the problems, and seeks solutions that will work. The process that should be used to determine and implement change varies by organization and by the problems and opportunities they face. In order to facilitate change, organization structures must support the change and consequently employees must see the reason for change and concur with those reasons; employees must have the skill sets needed to implement the change.

**Politics:** The model of political power focuses on the concept that the more you know the power bases of your friends and foes the more you can leverage change through focusing on their power biases. A successful leader must understand the politics of the organization; for example, who are their supporters and antagonists, and who are the undecided, who has influence on others or who is seen to be a no-declared leader among employees.

**Payoff:** Too often managers and executives implement sweeping changes in organizations, and never think about the payoff for people affected by the change. A good way to motivate people is to offer them a reward after achieving the goal the group needs. The rewards not necessarily are monetary. Some of the potential payoffs that managers can use while working towards change include: money, relationships, opportunity and pride

**Persistence:** Spending thousands of dollars on training, trade books, and motivational speakers is worthless if management is not ready to persist and address those who are skeptical. Managers must be persistence in their change processes in order to convince and show confidence to the rest of the subordinates. A change is never easy to attain, there are always issues and barriers that may impair the process, so managers should be aware that persistence is vital to conduct a change even more when personnel resist to it.

Nguyen Huy & Mintzberg (2003) state that a change has no meaning, unless it is juxtaposed against continuity. This is because if the world would be in constant and prolonged change it would mean anarchy. In this theory of change, the change's root is analyzed to identify who causes or triggers a change in an organization and which consequences come along. Depending on the nature or the conceivability of the change, a prior understanding can be conducted and results can be foreseen in a certain way. "Obsession with change focuses on that which is imposed dramatically from the "top" (dramatic change). However effective organizational change often emerges inadvertently (organic change) or develops in a more orderly fashion (systematic change)" (Nguyen Huy & Mintzberg, 2003, p.79)

Nguyen Huy & Mintzberg (2003) argue that dramatic change normally starts when a crisis or a good business occasion arises, when authority is intense and therefore can be used to leverage the change. In other words, this kind of change is mostly triggered by top managers who want to reengineer or transform the business upside-down in order to respond quickly to an unexpected (in most of the cases) situation.

Systematic change is the slowest, more determined, more concentrated and more carefully built and structured than dramatic change. It arises from staff groups and advisors who deal with planning and organizational growth.

Finally, organic change tends to arise from the normal employees; without being formally managed it is not methodically prepared when it starts or dramatically important in its meaning, and it doesn't depend on supervisor authority or particular change agents.

The authors of this change theory propose that there has to be an interaction between the different types of changes. Dramatic change by itself can be perceived as only excitement, systematic change alone can be seen as a gentle change, and organic without the previous ones can be disordered, they must be mutual or, more progressive and gradual. If these types of changes are combined, dramatic change can supply impulsion, systematic change provides organization, and organic change can inspire concern. Leaders should identify who originated the change and then based on the corresponding advantages of each change type; use these advantages to gain goal commitment.

### **3.3.1 Implication for the thesis**

One of the keys to successful change is recognizing the different approaches that people and organizations go through when dealing with the reality that things will be different. Since IS projects mean a change in the organizations, change theories must be taken into consideration when conducting an IS project. It is important to notice that critical factors within the IS implementation lie on issues related to how the change is conducted.

Several theories have been stated in order to facilitate changes, but every change is different and carries special issues; knowing theories that might facilitate the change will be useful to identify factors that potentially elevate the chance to success within the IS implementation. Furthermore, these theories might be used to generate recommendations for future IS changes by shaping already existing change theories for the aim of this thesis.

### 3.4 Theory of Constraints

The Theory of Constraints (TOC) has been used by more and more companies around the world to improve bottom-line results, primarily in the manufacturing arena. The largest companies, such as Ford, AT&T and the U.S. military have used TOC extensively. Many TOC concepts have been applied with great benefit to project management. Many major corporations, including those mentioned above, are using these concepts today. In fact, there is every reason to believe that, despite its start in manufacturing, TOC can be even more powerful when applied to project management (Newbold, 2000).

TOC is a philosophy that is used to develop specific management techniques. TOC is an approach to continuous improvement of an enterprise, developed primarily by Eli Goldratt, which asserts that constraints determine the performance of a system (Blackstone, 2001). TOC provides such universal principles that can be applied anywhere (Mabin & Balderstone, 1999).

In order to have a better understanding of this outstanding theory, it is preferable to explain the grounded principles that TOC consider as essential for the rest of its philosophy. Therefore we clarify the concept of “system constraints” in behalf of the same sense of what a system and constraints are according to Goldratt’s Theory of Constraints.

#### 3.4.1 The concept of system constraints

All the organizations are composed of a vast number of connected systems that work together to generate a final output. These systems are integrated by stages that perform activities by using specific resources and skills. Systems are referred as chains or network of chains. The Figure 3-2 shows a simple system or chain that its goal is to transmit force from one end to the other; it is taken for granted that all systems are constrained in some way. In this case the chain is constrained by the weakest link. If the chain receives force, it will break first at only one point in the weakest link and the weakest link is the constraint that prevents the chain (system) from doing any better at achieving its goal (transmission of force).

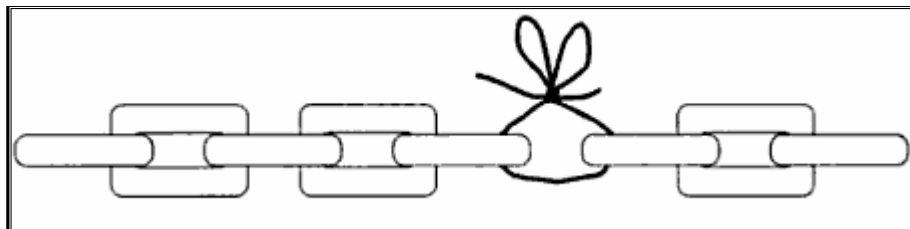


Figure 3-2. The chain (system) concept.

Hence this chain example shows that the chain has only one link constraining its current performance. The number of constraints in a chain is indeterminate but equal to the number of remaining links in the chain; therefore there is only one constraint at any giv-

en time. This one constraint limits the output of the entire system. Dettmer (1997) refers that everything else in the system, at that exact time, is a non-constraint.

For the same example in the Figure 3-2, let's assume that we are smart enough to figure out which link is the weakest, and therefore it is strengthened to the double. It is not the weakest link anymore; however some other link is now the weakest one and the chain's capability is now limited by the strength of that link. Dettmer (1997) argues that the chain has become stronger than before, but it still not as strong as it could be. The system is still constrained but the constraint has migrated to a different component. In other words, the system is always constrained by a specific link at a specific time and there will be always a weaker-link than the rest that will limit the full potential of the entire system.

Since the constraint limits the system from achieving higher performance versus its goal, any improvement effort must be directed at increasing the capacity of the constraint in order to deliver results. Improving the performance of a non-constraint has no effect on the overall capacity since the limiting effect of the constraint still controls the system (Industrial Research Institute, 2009).

### 3.4.2 Change and the Theory of Constraints

The Theory of Constraints (TOC) was developed and introduced by Eli Goldratt in 1984. In the early beginning, this theory was developed primarily to improve production processes in industries; however, TOC has been extended into other business functions in industry, including distribution, engineering, finance, marketing, sales, strategy, and change management (Jones & Dugdale, 1998). What started out as a theory concerning only production, TOC has evolved into a management philosophy with practices and principles spanning a multitude of operations management disciplines.

TOC is an approach to continuous improvement of an enterprise, which asserts that constraints determine the performance of a system. A *constraint* is defined as anything that limits the performance of a system relative to its goal; in TOC a constraint is actively limiting a system's performance (Blackstone, 2001). The principal tenet of TOC is that within each system at least one constraint exists that limits the ability of the system to achieve higher levels of performance relative to its goal. Maximum utilization of the constraint therefore should lead to maximum output from the system (Watson, Blackstone, & Gardiner, 2007).

Change is essential to adapt and respond to expectations. Organizations are always looking to satisfy customers by increasing quality and keeping costs. In this pursuit of customer satisfaction, organizations are searching for new ways of doing activities and improve their processes.

As indicated by the Goldratt Institute (2009), many organizations have realized the supreme need of applying inner continuous improvement processes rather than responding inadequately to external changes, or being part of unplanned and accidental in-house change. The Goldratt Institute (2009) refers that organizations which want to conduct processes of ongoing improvement, certain fundamental questions must be responded more accurately. TOC maintains continuous improvement philosophy by constantly cycling through these three questions:

- What to change? (Where is the constraint?)
- What to change to? (What should organizations do with the constraint to improve?)
- How to cause the change? (How do organizations implement changes?)

The answers to these questions undoubtedly have an impact on individual processes, but they are designed to focus efforts in system development. Processes are important, but organizations ultimately succeed or fail as systems. What a shame it would be to win the battle on the process level, only to lose the war at the system level (Dettmer, 1997).

### 3.4.3 Theory of Constraints principles

TOC is really a collection of systems principles for solving the problem of improving overall system performance. It will become obvious that TOC can be used to completely reengineer a business or organization as well (Steyn, 2002).

Goldratt & Cox (1993), Dettmer (1997), the Goldratt Institute (2009), Nave (2002) and the Industrial Research Institute (2009) have established a number of important TOC principles that must be considered by organizations and managers when applying this theory to conduct their activities. This thesis presents the major principles that will be used to conduct the interviews and analyze the information collected.

- The output of any system is constrained by the lowest-performing element in the system. The constraint limits the system from achieving higher performance versus its goal. All systems and processes have at least one constraint at a specific time.
- Constraints determine the performance of a system. There are few constraints in any system, management of these few key points allows for effective control of the entire system.
- Focusing on constraints does not involve close knowledge of data examination or that a large amount of employees recognize the elements of the entire system. Thus, understanding by a limited number of people with the authority to change things is all that this methodology needs.
- Systems must be seen and treated as “chains”. If systems functions like chains, weakest links can be found and strengthened.
- Organizations must set an overall goal and set the system to pursue this goal. The overriding goal in a TOC system is to make money now and in the future.
- Changes are necessary but not enough. A change might need or trigger more changes in the system in order to reach its goal.
- Improvements must be applied thinking for the global system optimum. Local optimum is not optimal at all.
- Knowing what to change requires a thorough understanding of the system’s current reality.
- Most of the constraints in systems are originated from policies, not physical things. Physical constraints are relatively easy to identify and break. Policy con-

straints are more difficult, but they normally result in a much larger degree of system improvement.

- People are the most important asset in any change. The change process must involve and enhance people to work along with the change; people must be motivated and communicated during the process.
- Inertia is the worst enemy of a process of ongoing improvement. An optimal solution deteriorates over time, as the system's environment changes. Continuous improvements are necessary to update and maintain the efficiency of a solution.

#### 3.4.4 TOC measurements

An important aspect of TOC is that this theory emphasizes that common metrics might not be enough to measure the effects of the change. In order to ascertain whether an organization is obtaining that overall goal (making money), organizations have struggled in how to measure effects of local decisions on the global system. TOC is particularly useful in this arena.

TOC makes use, in a way, of traditional measures for global performance such as Net Profit, Return on Investment, and Cash Flow; but Goldratt & Cox (1993) state that they are not applicable at all levels and they do not reach real measures of the changes applied in the global system; they are woefully inadequate to judge the impact of specific actions on the goal. The use of current cost accounting procedures leads to mismanagement and a failure to achieve the goal (Lockamy & Spencer, 2008). To bridge the gap between corporate financial measurements and business unit/plant level measurement, Goldratt & Cox (1993) introduce three level performance measurements: throughput, inventory, and operating expense (OpEx).

- **Throughput:** the rate at which the system generates money through sales
- **Inventory:** all the money the system invests in purchasing things the system intends to sell.
- **Operating Expense:** all the money the system spends in turning inventory into throughput.

The bottom line of these measurements is to allow organizations to track changes applied into their system and if they do not result in increased *throughput*, organizations may be wasting their time and probably their money. This thesis does not aim to assess productivity of IS projects using these measurements, but to emphasize on the importance of changing metrics when implementing projects. Common metrics can fail in the assessment of projects so TOC proposes these new measurements aiming that changing the way of evaluating productivity with these metrics, companies can obtain and monitor more real results. In order to become more productive, TOC refers as key to adapt new patterns of measurements as well that can get the real impact on the global system. An element to maximize performance is to have metrics aligned to the changes.



### 3.4.5 The 5 steps of TOC

Another aspect of the continuous improvement approach of TOC is what is called the Five Steps of TOC (Figure 3-3). Goldratt & Cox (1993) developed five sequential steps to concentrate improvement efforts on the component that is capable of producing the most positive impact on the system. These steps are as follows:

1. **Identify** – the constraint (bottleneck) of the system is identified and the system's goal is agreed.
2. **Exploit** – how to operate and improve the constraint in order to get as much throughput as possible from its current capacity without major expensive upgrades or changes.
3. **Subordinate** – operate the entire process at a rate to keep the constraint fully exploited and use any excess non-constraint time to help or eliminate work from the constraint. When a specific constrained process is performing at full capacity, the flow of other secondary processes is limited to the speed or capacity of the constrained process. There are cases in which individual productivity must be surrendered in favor of the whole business system.  
If the constraint is still limiting the system's performance, the constraint has not been eliminated and step 4 must be followed. If not, the constraint is eliminated and step 5 must be followed.
4. **Elevate** – if results at a global system view are not adequate, additional improvements and major changes are required in order to increase the capacity of the system's constraint. This means that whatever actions are required to eliminate the constraint. When this step is completed the constraint is broken. This step can involve considerable investment in time, energy, money or other resources.
5. **Repeat** – as long as the initial constraint is solved, a different part of the business system (chain) presents a new constraint. Hence is mandatory to follow the cycle of improvement one more time. The performance of the whole system needs to be evaluated again and it must start over from the first step.  
Do not let inertia become the next constraint. The caution about inertia reminds organizations that complacency is not allowed; the cycle never ends. Organizations must keep on looking for constraints and keep breaking them.

The 5 steps of TOC have a direct relationship with the three management questions pertaining to change: what to change, what to change to and how to cause the change. They are very useful and give guideline to answer those questions.

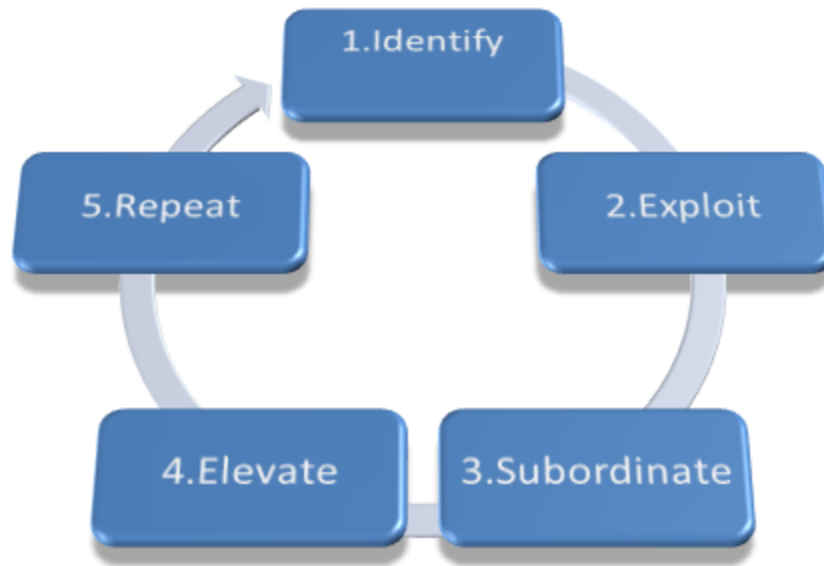


Figure 3-3. The 5 steps of TOC

#### 3.4.6 Implication for the thesis

TOC is a philosophy that is used to develop specific management techniques. TOC is an approach to continuous improvement of an enterprise, developed primarily by Eli Goldratt, which asserts that constraints determine the performance of a system.

The principal tenet of TOC is that within each system at least one constraint exists that limits the ability of the system to achieve higher levels of performance relative to its goal. Maximum utilization of the constraint therefore should lead to maximum output for the system.

This theory is the grounded theory to use and test in this thesis in order to identify critical factors within the IS project implementation. Furthermore this theory will help us to present and generate recommendations by using TOC principles for the success and performance of the IS in organizations.

Since the aim is to find critical factors to implement successful and productively IS projects, TOC is the tool that will shape our interview process and the entire research. It is important to understand deeply TOC philosophy in order to gather useful information through questionnaires and therefore analyze it in a way that theory and data emerge to substantial findings.

## 4 Empirical findings

*This chapter presents the empirical data gathered from the interview conducted within 5 companies through the experience of 5 respondents. The findings in this chapter are based on a summary of the interviews applied. In this section, it is presented the main findings we consider important to be compared to the theory in the next chapter analysis. All the findings aim to find information to give guideline to respond the research questions.*

This chapter is divided in five main sections according to every company involved in the interview process. The aim is to present empirical information that is useful to further analysis in order to come up with solutions and information for the research questions this thesis holds. Therefore, critical success factors in the implementation and issues related to enhance IS performance are guideline to conduct this chapter.

Below follows an abstract of selected respondents that took part in the research for this thesis. The Table 1 includes name position and company.

<i>Name</i>	<i>Position</i>	<i>Company</i>
Luis Cruz	Network Manager	Dell Services
Pedro Sanchez	Network Security Team Leader	Dell Services
Juan Espinoza	Engineering Manager ( <i>ex-employee until January 2010</i> )	Nortel
Juan Espinoza	Software Engineering Manager for Latin America	Ericsson
Rebeca Cortés	Technical Assistance Center (TAC) Manager	Cisco Systems
Saúl Arjona	Delivery, Support and Operations Manager	Desca

Table 1. Abstract of selected respondents.

### 4.1 Dell Services

Dell Services is a multinational information technology corporation that develops, sells and supports computers and related products and services, as a merchant. Within this company, we have taken the experiences and opinions from two respondents: Luis Cruz, Network Manager and Pedro Sanchez, Network Security Team Leader.

Luis Cruz used to be the networking services team leader of one of the biggest and most important accounts for the company. The way this account was handled was always an inspiration for the rest of the services teams within Dell. It was shown as a role model for other accounts to follow. Now Luis has been moved to a smaller account which is not performing very well, the management team moved Luis there to make sure this small account achieves the same standards the first account he participated on has by changing team members, procedures and systems.

Pedro Sanchez, the second respondent in the company, is the networking security team leader of several accounts. He explained the process of several IS changes in the security area for different Dell customers. Pedro Sanchez refers that most of the changes he implements are imposed, his team just receive a notification of what needs to be changed on the IS and they change it.

#### 4.1.1 Critical success factors

When we asked about if knowing the reasons that motivated a change are considered as crucial to implement an IS project, Luis told us that it is key to have a well and clear identification of the reason to change, *“a change must be triggered by a need to satisfy customers, this will give us guideline, targets and course of action within the IS project”* (personal communication, 2010-04-21).

According to Luis, the proper identification of the roots of the IS project also provides guidelines to set goals. Goal setting is essential to Luis in order to delimit and create attainable objectives for the company and for his team members. Everything they do is measured. The goals are not difficult to accomplish but also not that easy. In this project, he considers that *“the objective of the project is not to make more money, but to meet customer requirements, standardize processes and fulfill customer satisfaction”* (personal communication, 2010-04-21). The overall objective to implement the IS project is to solve business problems with the customers that might jeopardize future contracts for the company.

According to Luis, the implementation process is surrounded by many factors inside and outside company's boundaries. In this case, IS projects provided to customers depend in a substantial way in the capacity and resources of the customer. *“Many projects fail in scope or deadline times since customers have financial problems or other reasons that make us to stop or change the projects”* (Luis Cruz, personal communication, 2010-04-21). The IS projects are closely related to customers decisions and/or resources.

Nevertheless some projects have difficulties inside the company since people in charge to put them to work do not follow established procedures or systems. *“...sometimes our engineers do not follow the procedures stated in policies and it generates lots of future problems in other areas”* (Luis Cruz, personal communication, 2010-04-21).

Pedro Sanchez, as the second respondent in Dell Services, thinks that managerial factors are more painful than those coming from the system. *“...problems in my area are mostly managerial or political issues rather than technical or systems problems per se”* (personal communication, 2010-04-21). Projects are overtime and budget due to lack of procedures and methodologies. *“...people do not follow procedures, in this case our checklist, when implementing a project so afterwards small details become big issues,*

*they do not realize that their output is an input for the next area”* (personal communication, 2010-04-21).

*“People are a resource in the company but these resources are the most important constraint in all the projects we conduct”* (Pedro Sanchez, personal communication, 2010-04-21). Pedro believes that cultural background is a limitation when working with people in other countries. *“...when we work with people in USA, they push us to finish the project, but my Mexican team just take projects more calmly and easier so the project goes overtime...it is just a cultural issue but a crucial one”* (personal communication, 2010-04-21).

*“It is not possible for me to be available all the time due to meetings or other activities in the company, but unfortunately I am not a big fanatic of email-communication”* (Pedro Sanchez, personal communication, 2010-04-21). Communication with the person in charge of the project (project leader) sometimes does not work properly, subordinates must get to know the project and many doubts can pop up in the process.

According to Luis, the person leading the IS projects and team members must have certain knowledge within the area but is crucial to have leadership skills such as well command of communication and motivation skills. As the team leader, Luis motivates his employees with salary raises or monetary bonuses based on the goal achievements. *“...if you make Dell accomplish its goals, your IDP (Individual Development Plan) would be successful, but if you actually were able to achieve more goals than expected well that would of course been recognize, it is normally recognize with a salary raise”* (personal communication, 2010-04-21). However he also offers free days or the possibility to do home office.

#### **4.1.2 Performance enhancement**

Competition is essential to increase productivity rates, therefore Luis applies an IDP (Individual Development Plan) with all his team members. This IDP is a measurement that can control and monitor employees and projects at the same time. *“...internal measurements help me to follow employees and their projects, this IDP allows the employees to compare, compete and delimit their performance”* (personal communication, 2010-04-21). All the goals Luis sets are measurable and have a specific time frame. They have monthly reports on several indicators to evaluate their performance. *“...the intention to make everything measurable is that we can make clear to the customer what we are doing for him and what employees are doing”* (personal communication, 2010-04-21). If by some reason a project is not completed on time or requirements, Luis can prove and show that it is mostly because the customer resources and not because of Dell's fault.

The requirements and objectives of the IS projects per se are discussed and agreed with the customer and Dell's specialists, but Pedro has own goals for his area, team members and to his top manager. Every IS project he has been part of is specific and measured from the beginning to the end. *“...with this new top manager, we have recently applied SMART objectives in the area that help us to distribute workload and monitor team members performance”* (personal communication, 2010-04-21). Since the appliance of SMART goals it gave control and quality for the projects implemented but at the same time it gave guideline for the area that all members have to work along.

Furthermore Luis argues that applying changes in one area, it necessarily affects the next one, *“every change someone does here, it affects, good or badly, in other area in the business”* (personal communication, 2010-04-21). People are not aware of this issue. Luis declares that a big problem is *“...the big damage comes from unaligned systems, processes or politics within the company”* (personal communication, 2010-04-21). Dell Services wants all clients to have a standardized service instead of having just a couple of accounts well managed and the others below the consumer expectations. *“All projects must have same procedures and every activity here must be run equally in order to attain a whole system productivity”* (Luis Cruz, personal communication, 2010-04-21).

To make the IS project enhancing its performance, some changes in politics must be done as well. *“...the IS project interacts with many areas in the business, I have to make sure that other areas align in procedures and politics to the IS project, my social network is priceless in these cases”* (Luis Cruz, personal communication, 2010-04-21).

Luis also tries to make sure his subordinates are always learning new tools and getting more skills. *“...the more employees are prepared with training, the more they can contribute to the IS and to the company of course”* (personal communication, 2010-04-21).

When we referred to the fact of what carries more benefits for the business to allocate resources, either in exploiting constraints or excelling well performed activities; Luis points out that *“... working in constraints might bring some positive points, but it is better to focus our attention and resources in those activities we are doing well”* (personal communication, 2010-04-21).

## 4.2 Nortel

Nortel is a worldwide telecommunications equipment producer with headquarters in Toronto, Canada. At the beginning of 2009, Nortel announced it would close down functions and negotiate all of its business units.

Our third respondent Juan Espinoza was engineering manager at Nortel. He worked in Nortel until January 2010 due to all the problems the company was experimenting; accordingly to the multiple issues the company was facing because of the cease of operations, Juan decided to look for better opportunities to develop his career in a stronger and healthier company. However, his experiences in the company are relevant for the matter of this thesis.

### 4.2.1 Critical success factors

The company was losing money and according to Juan, many IS projects were terminated or vastly modified; all these decisions were imposed by top managers due to the crisis. *“...in January 2009, they told us that IS projects will suffer modifications in scope and probably many of them would be cancelled”* (personal communication, 2010-04-21). The shareholders started to sell the company into small pieces, there was no money and a lot of people were fired.

The global economic crisis was a meaningful factor that ruled the development of many IS projects. External factors determined the future of the projects. According to Juan, *“Many projects changed radically in requirements and others were suddenly cancelled due to the financial crisis of the company and we could not do anything else”* (personal communication, 2010-04-21).

The goals of the IS projects were totally modified, many of them did not reach the implementation stage and some others were reduced in scope, requirements and of course in budget and a minority were totally abandoned. So the goal was to work with less resources with some of the IS projects still running.

Almost all internal IS projects were cancelled and those projects already confirmed with clients were implementing with the minimum effort and resources. *“At that time, the company was demanding us to finish projects without any future objectives; the environment was surrounded by total uncertainty”* (personal communication, 2010-04-21). Hence no goals and objectives were tagged and the environment there was dark and unclear. Employees felt insecure and they did not have something to work for.

Since the announcement of the coming ceasing of activities by Nortel, rules were not longer respected and procedures were totally forgotten. Panic was emerging in the company. *“...some of them (employees) were working normally, but many others were jumping rules and procedures since they knew all the efforts would be in vain”* (personal communication, 2010-04-21).

Furthermore, Juan experimented some limitations in IS projects with USA. He found that regulations in that country do not allow people to manage and configure systems if they are not living in the country. *“We could not configure systems from here or even visiting USA since we had to live in the country to have the right to manipulate the systems”* (personal communication, 2010-04-21).

Juan tried his best as leader to help his team; he was always there for his engineers. He was persistent with selling the idea to his team that they had to keep on working as hard as they could. *“ I tried to make my team works harder, we were still Nortel employees and we were still receiving our checks but however there were nothing to fight for”* (personal communication, 2010-04-21). He helped his engineers as much as he could to make their work easier.

#### **4.2.2 Performance enhancement**

Juan’s team mission was to keep engineering operations with less people and resources. Juan refers that they had to do their same amount of work with less people. Juan points out that the aim was to finish the projects with the minimum resources. According to Juan, the term “productivity” was not longer included in the projects. *“...productivity was not a goal; instead, we had to finish with the least damage for the company”* (personal communication, 2010-04-21).

The projects that were still running had many problems since nobody was committed. *“People around here were totally unmotivated, even top managers were; everybody was worried about their future”* (personal communication, 2010-04-21). Internal metric for employees were modified as well, objectives were truncated too. Juan called all his subordinates to make modifications in their “Priorities Program” but it was useless since there were no overall objectives to align in.

### 4.3 Ericsson

After leaving Nortel because of the crisis, Juan Espinoza was hired in Ericsson as software engineering manager for Latin America. He was rapidly hired because the company is growing and expanding its businesses in Latin America and they need experienced and skilled personnel. He is actually building up an engineering area for Latin America.

Ericsson is currently going through an organizational global change planned by senior managers in the headquarters. Juan's goal is to build up a Latin America global service delivery center together with the employees in Brazil.

#### 4.3.1 Critical success factors

The tasks and systems have to change for the purpose of responding to needs of the market and Ericsson's personnel related to the processes issues. *"...a must in the company is that employees have to be involved in the continuous system improvement using a specific tool designed for these cases"* (personal communication, 2010-04-21).

According to Juan, the overall goal of this IS change is to take advantage of a business opportunity in the global market. The project aims to improve their internal procedures in order to gain market, which will result in increasing income. Juan refers that *"the objective of this IS project is to improve procedures in order to sell more and sell faster by considering high quality standards"* (personal communication, 2010-04-21).

People are the resources who run the company. All the IS projects conducted in the company depend in the way how they are managed by people. *"People are a resource for the company and they must be running productive activities for the company 80% of their time"* (Juan Espinoza, personal communication, 2010-04-21). The goal of every IS project is to deliver economical benefits for the company. *"All the activities must be productive, in terms of money, for the whole business system"* (Juan Espinoza, personal communication, 2010-04-21).

Juan works with people from different countries since he is the leader for Latin America. Cultural background affects the performance of the IS since there are different views of punctuality, quality and other factors. *"...some customers and other colleagues in Brazil believe that we (Mexicans) are lazy and always late"* (personal communication, 2010-04-21). The true is that sometimes it might be real but many others this is overestimated. Procedures when implementing and conducting IS projects are not aligned with other areas and other locations within the same business unit.

Juan considers that leaders experience in conducting an IS project is an important issue. *"These kinds of projects need a leader with a lot of previous experience and of course, a deep knowledge of what is happening in the business"* (personal communication, 2010-04-21). Inclusive leadership approach in which all opinions enrich the decisions is the way that Juan follows. *"...all the opinions are important here, but I take the decisions."* (personal communication, 2010-04-21).



### 4.3.2 Performance enhancement

Juan realizes that this project will need more changes, some expected and planned but others unexpected. *“This project is seen as a chain of changes, but the aim is to be prepared with a structured plan to face possible issues”* (personal communication, 2010-04-21). An IS project involves factors that have to play together as a unique system and in many cases unexpected problems appear. Juan points out that *“...issues must be solved thinking for the whole business, not for an isolated part of the business”* (personal communication, 2010-04-21).

Ericsson works with an IDP (Individual Performance Management) that measure the performance of each employee. Metris to compare and compete motivates personnel to perform better and more efficiently. *“...when personnel overcome performance according to their IDP’s, they receive compensation for their effort in many kinds of payoffs; with these they feel motivated and the global results are visible. Everybody gets benefits of the global performing”* (personal communication, 2010-04-22).

The company already applies continuous improvement philosophies such as Lean and Six Sigma. In this global and competitive market, quality takes a different meaning, according to Luis *“Ericsson aims to conduct projects in scope, time and budget but with high standards of quality...quality of service might be a differentiator versus the Asians”* (personal communication, 2010-04-21). All the projects must have a continuous improvement approach, IS projects must have periodical following and improvements even if they are still performing well. *“all the projects here follow a continuous improvement approach, we do know that the external environment might change so we got to do the same”* (personal communication, 2010-04-21).

In addition, Juan refers that projects must be allocated with resources to overcome limitations and constraints. *“we assign resources to our IS projects such as training, budget and personnel in order to make the projects more productive”* (personal communication, 2010-04-21). Furthermore Juan refers that limitations must be analyzed in order to allocate enough quantity of resources, *“we must analyze the limitation and its level of risk to the business and then we know the amount of resources we have to allocate to the limitation”* (personal communication, 2010-04-21).

## 4.4 Cisco Systems

Our only female interviewee Rebeca Cortes works for Cisco Systems as Technical Assistance Center (TAC) manager. The latter is an American multinational corporation that designs and sells consumer electronics, networking and communications technology and services. They just went through an organizational and system change. They restructured the team and business areas in what Cisco considers emerging markets (Russia, Brazil and Mexico). Now the engineering teams in these countries work as one and they report to the same department.

### 4.4.1 Critical success factors

This IS change was originated because Cisco was growing in the business but at the same time Rebeca just received orders from her manager to implement this new way of

working. She said *“Cisco is continuously changing its organizational structure and it is part of its vision and mission”* (personal communication, 2010-04-22). Experts in the company study the market and they decide whether the IS change suits needs both of the market and the company itself.

Rebeca refers that the overall goal of this IS project is *“...to improve procedures in order to satisfy regular customers’ base requirements and to gain new customers that allow the generation of income for the company”* (personal communication, 2010-04-22).

The IS, as a tool, does not represent an issue but the way how is this conducted. According to Rebeca, *“the tool does not represent a problem neither technical nor in functionality, but in the interaction with the users that affects the performance of the system and therefore of the company”* (personal communication, 2010-04-22).

The process of implementation of IS projects faces barriers of politics with other areas in the company. *“Processes within the IS project are well done, but the problem lies on wrong politics that slow-down the project”* (personal communication, 2010-04-22).

Teamwork is essential. Everybody must work for the same objectives in the same system. But the homogeneous culture represent an issue; *“working with people from Brazil, Russia and Mexico require a strong and defined system of procedures that nowadays is missing”* (personal communication, 2010-04-22).

Rebeca points out that there are many strategies to conduct an IS project but these strategies might not operate in all scenarios. There are external factors that are not expected and hit directly the project, so a suitable leader might facilitate the implementation. The leader is a key player, that person is the facilitator for IS projects within all the possible barriers; *“the person in charge of the IS project must have the background, knowledge, experience and most important, social-networks”* (personal communication, 2010-04-22).

#### **4.4.2 Performance enhancement**

According to Rebeca’s opinion, setting a goal provides guideline to employees and the company. *“...SMART goals provide a line of action in which people can rally around to reach results which bring benefits to themselves and to the company”* (personal communication, 2010-04-22).

The IS project does not come alone. There is also a need to change metrics within the area in order to monitor the performance of the project. Some new measurements tools are created in response to the IS project. *“...we have realized that metrics are not always the best for all the cases and they do not suit with a project, so we try to make a tuning by creating new metrics”* (personal communication, 2010-04-22).

In addition, Rebeca points out that resources must be allocate thinking more on the activities that they perform correctly, *“...we exploit processes and activities we conduct correctly, we do not see important benefits in exploiting limitations”* (personal communication, 2010-04-21). Nevertheless Rebeca argues that sometimes it is necessary to allocate some resources on constraints since these limit other activities in a harmful way. *“...sometimes we allocate 50% of resources in exploiting limitations and the other 50% on the things we are doing correctly...we want to excel our processes”* (personal communication-04-21).

## 4.5 Desca

Our last interviewee Saul Arjona works for Desca as delivery, support and operations manager. The latter company is a leader IT-solutions integrator with ample presence in Latin America. This company did not have an ERP system to monitor and control all the projects within the company; so Saul is leading the implementation of the “Project Control System” software provided by Microsoft.

### 4.5.1 Critical success factors

As Desca was growing, employees needed a more efficient way to handle more and more information. Their databases were just tables on Excel documents. Employees were those who asked for the new system in order to improve their managing of the projects handled. *“The need for the system emerged from our own employees who found out that Excel sheets were not useful due to the increment of workload, they wanted easier processes and automatic tools”* (personal communication, 2010-04-22). Saul points out that employees took an important role in the definition and design of the IS requirements, however some experts in the company decided which tool and what characteristics the new ERP should have.

The implementation of the IS was easier in this case. Saul refers that *“the need of the new IS coming from the employees makes the implementation easier and faster”* (personal communication, 2010-04-22). People are the most important player in the implementation; according to Saul, *“...people have the power to reject a good IS project or to enhance a project that is not that good”* (personal communication, 2010-04-22).

*“This new system will not generate more money to the company, but internal control and customer projects’ control”* (Saul Arjona, personal communication, 2010-04-22). According to Saul, the IS change will not improve the finance of the company but it will bring more control.

The application of these new system aims to have control all of the projects and therefore to be more productive in the long term. *“this new system will allows to monitor employees performance related to the projects and the goal is to make productive 80% of employees time ”* (personal communication, 2010-04-22).

The communication and politics within engineering area and management area is not aligned and respected. *“...management area always refers to less resources than engineering area needs, and they always promise earlier delivery times than the one we requires in the engineering area”* (personal communication, 2010-04-22).

### 4.5.2 Performance enhancement

Saul has realized that this change is triggering some changes within the business change but as he says *“this new system is popping up more changes in other systems and tools, but these have been already planned ahead”* (personal communication, 2010-04-22).

Personnel want training and courses to use the new system. People must have the knowledge to use all the functions of the system or otherwise it will not reach all its potential.

Furthermore people must be involved, in a certain way, in the development of new features and the correction of errors. “...*the users of the system are working closely to find new features and to repair bugs in the system*” ” (personal communication, 2010-04-22). The best source for information is people (users).

Saul also considers that external factors are a blind problem since nobody can control them. “*we must adapt continuously our IS projects to the normal evolution of technology and external factors*” ” (personal communication, 2010-04-22). In addition, Saul refers that projects always follow a continuous evaluation in order to adapt to external factors (such as external technology improvements) and opportunities; tools and IS are constantly in evaluation to identify bugs and opportunities to elevate their potential.

Furthermore, Saul refers that resources are allocated to monitor activities and generate IS projects that contributes with the improvement of activities that they are performing well. “...*all of our projects are conducted to improve the business in a way that IS supports and enhance those activities that we are doing in the right way; we do not see limitations as vital to develop better business opportunities or to improve our business in a substantial way*” (personal communication, 2010-04-22).

## 5 Analysis

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*Within this chapter the analysis of the empirical findings are presented. A comparison between theoretical framework and empirical data is conducted by considering the Theory of Constraints as the grounded theory. All the analysis is related to find critical factors by interpreting the principles of the grounded Theory of Constrains as a fundamental base for the entire inquiry in order to solve the research questions.*

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In order to have a better apprehension of the analysis, this chapter is divided in two main sections:

- An analysis of the critical success factors that are relevant during the implementation of IS projects using TOC principles.
- An analysis of the factors involved in the IS performance with the aim to maximize or enhance productivity for the whole business chain by applying TOC philosophy.

### 5.1 Critical success factors

A fundamental critical factor that is commonly discussed as important within the respondents is the fact that project leaders must understand the causes and roots of the IS project. It is critical to have a well understanding of what triggers or originates the project in order to have a better plan of action during the implementation.

Half of the cases we analyzed originated their change due to bad pain. The bad pain concept MCallaster (2004) wrote about, mentions that bad pain comes with red ink, and when the future is cast with almost certain doom and extinction. This was the case for Nortel. The company was losing money and according to Juan, many IS projects were terminated or vastly modified. MCallaster (2004) also mentions that when things are chaotic and the organization or the individual is moving in the wrong direction, it is easy to focus the organization's and individual's attention on the reason the change is needed.

Pedro Sanchez felt like the IS changes he was participating on were originated by imposed pain. His team receives notifications of what needs to be changed on the IS and they change it. MCallaster (2004) argues that imposed pain can be the most effective type of pain, when it is used in a proactive manner. That was the case of Rebeca Cortez manager at Cisco ordered her to implement a new way of working. This in a proactive way to face the new market challenges.

The good pain we were able to study were the ones described by Juan Espinoza at Ericsson and Saul Arjona at Desca. Ericsson is currently going through an organizational global change. This change was originated because the company's expansion. As MCallaster (2004) explains, good pain can occur when an organization experiences phenomenal growth, when opportunities are breaking and business is booming. Juan

told us that, sometimes, people work overtime and tap out while trying to meet demand. Accordingly, as Desca was growing, employees needed a more efficient way to handle more and more information. Their databases were just tables on Excel documents. If they continue like this, chaos would remain.

Even if it is a good, bad or imposed pain, all of these changes must be executed within the correct “momentum”. A critical factor is to use this normal momentum in the good or bad pain to introduce a change where the followers are willing to accept the change. On the other hand, in the imposed pain, the manager or project leader must create or force a momentum and convince subordinates that a change is needed. According to McCallister (2004), leaders should take advantage of this “momentum” to make the change transition easier. If a leader delays acting, he or she can lose the opportunity and its potential momentum.

Almost all of our interviews refer to systematic changes. “Systematic changes are promoted by staff groups and consultants who handle planning and organizational development” (Nguyen Huy & Mintzberg, 2003, p. 80). This is exactly what occurred with Luis Cruz and Rebeca Cortez. In the case of Luis a staff groups of senior engineers decided that a change in the account was needed so they moved Luis to it so that he could bring some of his previous knowledge as leader to the team. The same with Pedro Sanchez, all changes are previously review by Dell security experts or a consultant company which works for Dells customers. They are the ones who authorizes or not the changes. Nguyen Huy & Mintzberg (2003) also mention that systematic changes are less fast, more determined, more concentrated and more carefully built and serried than dramatic change. Therefore, it is seen that systematic changes have more possibility to success due to its nature of planning and execution within a calmer environment.

Nortel’s case was the only one describe as a dramatic change. Nguyen Huy & Mintzberg (2003) argue that dramatic change normally starts when a crisis or a good business occasion arises, when authority is intense and therefore can be use to leverage the change. Nortel was heading towards bankruptcy and in its way was generating several organizational changes. All these new directions the company was taking were imposed by top managers due to the crisis Nortel was facing. In dramatic changes, the success is not guaranteed; the change is done without so much planning that might be a consequence of failure. These kinds of changes are more related to react in a desperate action to readapt to the current unfavorable environment. Projects following this kind of dramatic changes tend to fail or its implementation faces many unplanned constraints.

We can say that Desca’s case can be classified as an organic change. Nguyen Huy & Mintzberg (2003) argues that organic changes tend to arise from normal employees; without being formally managed it is not systematically organized when it begins or dramatically consequential in its intentions, and it does not depend on managerial authority or specialized change agents. Desca’s Employees were the ones who asked for the new ERP. They need it to improve the way they manage projects.

Likewise, the analysis and identification of change’s roots is a crucial factor that delivers guideline in the implementation in order to assure or elevate the possibility to success. Depending on the nature or the conceivability of the change, a prior understanding can be conducted and results can be foreseen in a certain way.

Once the causes and roots of the IS project are analyzed, it is meaningful to set the final goal of the IS project. Goals setting are always present in all the companies. Managers use this strategy to guide employees to attain company's vision and mission and to have a following of each member in the company. Dell, for instance, has its own super ordinate goals, which you can find in the company webpage under mission and vision. Luis at Dell Services has a set of SMART goals towards his team. As Latham (2003) mentions, the purpose of goal setting is to make the superordinate goal concrete. Goal setting is essential to Luis. It helps him to delimit and create attainable objectives for the company and for his team members. Everything they do is measured. They have very specific numbers they should accomplish.

Nevertheless IS projects must have an overall goal. According to TOC, the main goal of any change and IS project must be the generation of income, specifically money, now and in the future. Only 2 out of 6 respondents consider that IS project's goal is to make money. The rest just take IS projects in order to improve some activities or to gain control within the organization. The majority do not see IS projects as a tool to generate incomes for the company. A crucial factor related to TOC is the definition of an overall goal that in this case, must be to make money.

Once planning is complete, it is time to carry out the project. Project implementation is where the product of the project is developed and released. According to Fuller, Valacich & George (2008), project implementation is a part of the tasks within project management. IS project implementation management is highly related to the final result of the project. The way how organizations are able to manage these projects is thus a crucial skill that can help drive organizational success.

It is already known that a large number of IT projects that fail in scope, requirements, time or budget have many causes of failures. Such projects failures waste thousands of work hours and millions of dollars each year. There are many reasons why many organizations fail when implementing IS projects, but according to Tilmann et al. (2004) the main reason lies on managerial issues. IS project management thus is considered as a factor for the success of an IS project. According to PMI, project management requires a set of skills, knowledge, tools and technologies in order to meet project requirements (cited in Fuller et al., 2008).

In the implementation process, the information gathered from the respondents shows that the system, as a tool, does not present technical or functional issues. For instance, Rebeca points out that *"the system, as a tool, does not represent a problem neither technical nor in functionality, but in the interaction with the users that affects the performance of the system and therefore of the company"* (personal communication, 2010-04-22). Beynon-Davies (2002) argues that technical problems tend, by their very nature to be relatively tractable and easy to solve. In all the cases, technical failures were not a constraint to implement the IS project; nobody argued that a technical problem was the cause of failure. It becomes very interesting when reviewing the information that none of the respondents argued that they had technical problems. According to Beynon-Davies (2002), technical failures are the least in complexity within his dimension failure model and therefore easier to manage. It is important to notice that some respondents might have had technical issues but due to the minimum harm and low complexity they do not consider technical issues as a substantial factor in the implementation of the IS projects. However, technical issues are not considered as crucial in the implementation process.

In contrast, people involved in the IS project play a determinant role in the implementation. All the interviews showed that people are treated as a resource for their companies; but this resource is the most difficult to manage and it represents a barrier for the successful implementation of any project. Pedro refers that *“People are a resource in the company but these resources are the most important constraint in all the projects we conduct”* (personal communication, 2010-04-21). According to Beynon-Davies (2002), these kind of issues related to people are described as being “soft”; these “soft” problems are frequently difficult to identify and solve. The complexity managing people demands a lot of attention and therefore “soft” issues are located in the highest position in the Beynon-Davies’ (2002) dimensions of failure model. The main critical factor in the IS implementations lie in managing people and applying the strategies to make people work along with the IS.

Moreover people have the power towards the IS project. The degree of interaction depends mostly on people’s attitude towards the IS. According to Lyytinen & Hirschheim (1987), interaction failure is the consideration of usage of a system. In this case, we found that interaction does not depend on the technical features of the system, but in how users are willing to contribute with the system and interact with it. *“...people have the power to reject a good IS project or to enhance a project that is not that good”* (Saul Arjona, personal communication, 2010-04-22). Involving users in the definition and implementation of the project might result in an easier process with better results directly to the system performance. Is in personnel hands that an IS project can take many ways during its implementation.

Environmental issues are another critical factor within the management of IS implementation. In the dimensions of failure model proposed by Beynon-Davies (2002), environmental factors represent those with the highest complexity which require a deep utilization of resource to solve them. Environmental issues are considered to be more difficult to appeal (Beynon-Davies, 2002). These factors were always present in all the IS projects, with more or less damage but always nearby. For instance, Nortel suffered the financial crisis that hit directly in its projects; due to the damage of the external financial crisis, Nortel had to cancel or vastly modified projects as a response to the environment.

In the cases when companies are providers of IS projects to customers, the external resources constraint the development and success of the project. We have noticed that customers many times modified the projects since they found new requirements or new problems to solve. Therefore provider-companies must reallocate resources to fulfill customer satisfaction but it goes over budget since those resources were not visualized ahead even if contracts are modified (price-requirements relation). Another case is when customers stop projects because of lack of resources (all kind of resources: human, economic, technologic, etc). Providers must stop the project until the customers have enough resources; this represent a failure since companies have motionless resources there without generating any income. Furthermore this modification from customers eventually affects the estimated budget and schedule. Even with protection through contracts and deals, companies many times depends in a valuable way on customers resources.

Furthermore, according to Beynon-Davies (2002), environmental factors also involve changes in regulations and labor relations. Fuller, Valacich & George (2008) also include as environmental factors, issues in standards and regulations that affect the IS



project implementation. For instance, Nortel had many troubles when a regulation in USA was applied in which was stated that only people living and residing in USA were able to configure and “touch” the equipment and systems. As a result, Nortel engineers working in Mexico had many troubles with the implementation of IS projects that had relation with USA.

IS projects are implemented surrounded by many cultural environments. In this global market, internationalization becomes more and more important in order to gain market share. Companies are breaking their borders and they are spreading all over the world. Territorial borders are not a limit anymore for IS projects and therefore business units and team works are now formed from people from many nationalities and backgrounds. This mix of heterogeneous thoughts enrich the IS project and the business; but at the same time it bring complications since different culture is equal to different ways of working. All the companies and managers are working with people outside their countries and all of them referred problems with the way of how different people have diverse way of doing activities. It was a common issue when managers have problems in the processes within different regions since a process in Mexico is different in Russia, for instance. All the respondents agree that cultural background might harm the implementation of the IS since disparate perspectives might generate conflicts. Moreover processes are not aligned and standardized that generates even more problems and bottlenecks when implementing IS projects added to the unlike of cultural backgrounds. According to Fuller, Valacich & George (2008), businesses are increasingly dynamic and global, and these aspects of the larger business environment also affect projects.

Information systems projects exist within a wider organizational context, they also exist out of organizations’ boundaries. Elements of this still broader extra organizational context can and will affect any given individual project (Fuller, Valacich & George, 2008). External factors are a source of constraints; companies are not able to totally plan ahead and control these factors. IS projects are affected vastly by this kind of environmental limitations that if they are not conducted and managed carefully, the harm in the implementation can be very painful. All the respondents declared consistently that environmental issues are even more painful than technical issues. Nortel is a good example for this case.

*“...the IS project interacts with many areas in the business, I have to make sure that other areas align in procedures and politics to the IS project, my social network is priceless in these cases”* (Pedro Sanchez, personal communication, 2010-04-21). *“Processes within the IS project are well done, but the problem lies on wrong politics that slow-down the project”* (Rebeca Cortés, personal communication, 2010-04-22). These two quotes reveal that politics damage the IS project implementation. It is meaningful to point out that issues in politics were the main and common problem within the respondents. All of them refer that bottlenecks for the IS implementation are mostly rooted in politics within the organization. Even when processes are aligned within areas and there are procedures to follow, politics make the difference when conducting changes; people alter and do not follow these procedures as they are stated. In addition, it becomes complicated to deal with a diverse kind of people who have multiple perspectives of working and thinking. IS projects are immensely affected by politics and the ability of the manager – leader – is to find out the way to overcome politics barrier within business areas and within people. According to Latham (2003), the model of political power focuses on the concept that the more you know the power bases of your compa-

ny, colleagues and foes, the more you can leverage change through focusing on their power biases. A successful leader must understand the politics of the organization; for example, who are their supporters and antagonists, and who are the undecided, who has influence on others or who is seen to be a no-declared leader among employees. The manager must visualize who is the “non-declared” leader within the organization; this “non-leader” have the power within personnel and hence it, for sure, will facilitate the IS implementation. According to Fuller et al. (2008), in information systems project the project manager needs a diverse set of skills – general management, leadership, technical, conflict management and relationship management. The role that the project manager plays in the project management is essential for the success of the project and the organization in general; thus the project manager is influential to the successful completion of any project.

It becomes attractive to consider the fact that those respondents who have had many barriers with politics issues are those that we noticed who do not have a good relationship with their subordinates, top managers or their social network is not that powerful. The common line was issues with politics but some were damaged more than others by this fact. Those who overcome these politics limitations straightforward and faster have an extensive and powerful social network, in addition with a favorable relationship with their subordinates. The tricky part is not to have many relationships, but to have those powerful contacts in the right positions in the company with the power to change and control. According to TOC principles referring by Goldratt et al. (1993), an advantage of TOC is that the change does not need to be understood deeply by a large number of people. Thus, understanding by a limited number of people with the authority to change things is all that this methodology needs.

So far, people are the central point in IS projects implementation. According to Goldratt & Cox (1993) people are the most important asset in any system where the change takes place. People are seen as resources, but an unpredictable and variable resource. People shape the IS project and not the opposite.

## **5.2 Performance enhancement**

Not only setting goals and SMART goals specifically are considered as crucial factors to give guideline when implementing an IS project. SMART goals are also relevant to assure and maintain an adequate level of competitiveness and to measure and increase productivity. In all the companies there are individual and organizational goals settings and there are periodical evaluations to employees and to the projects they manage correspondingly. These evaluations maximize performance, because it allows employees to compete against themselves and at the same time compete against their colleges in order to fulfill and reach organizations’ goals.

IS performance must be conducted to enhance productivity. In TOC, the aim is to implement an IS project successfully but at the same, to be productive in terms of money. Therefore organizations must set this as the overall goal and set the system to pursue this goal. The overriding goal in a TOC is to make money now and in the future (Goldratt & Cox, 1993). Following this principle, IS projects must be seen as a tool to enhance

productivity; even if the specific aim of the IS is to provide control, the overall goal perspective of that IS must be focused to the generation of money. Companies might have to create more changes across the business chain in order that a specific IS project generates money to the company.

As we can notice, politics are the more painful and important limitation when implementing IS projects. It is not new for the Theory of Constraints since it refers that most of the constraints in systems are originated from policies, not physical things. Physical constraints are relatively easy to identify and break. Policy constraints are more difficult, but they normally result in a much larger degree of system improvement. Considering politics issues is fundamental when implementing IS projects; bottlenecks generated by this factor might deviate the goal of the project and consequently it might result in a fail since it will probably require more resources (time, budget, personal, labor hours) to overcome and fasten the implementation. Within politics, there is a big range of possibilities to increase performance of the IS. Leaders must get to know their internal and external politics factors that surround the IS in order to eliminate or lessen bottlenecks that might jeopardize the IS performance. The less barriers or bottlenecks the IS faces within politics, the more successful in terms of performance the IS will be along the entire business chain.

IS projects are not totally planned to reach the whole business system. First of all, any IS project must be targeted to reach global improvements. Theory of Constraints is based on the idea that systems must be seen and treated as chains. Some arguments gathered from respondents are related to the lack of continuity and impact of the IS for the whole business. *“...people do not follow procedures, in this case our checklist, when implementing a project so afterwards small details become big issues, they do not realize that their output is an input for the next area”* (Pedro Sanchez, personal communication, 2010-04-21). IS must be designed and understood as chains in which all the processes are related between each other and the output of one stage depends on the input of the previous one and so on. According to Goldratt & Cox (1993), local optimum is not optimal at all. IS projects might work perfectly in one area but the link and relation to other business areas is weak; therefore the IS is not fulfilling the principle of global optimum and it might be considered as a failure for the whole business system (chain). Improvements must be applied thinking for the global system optimum (Dettmer, 1997).

Because of the principle of TOC referring that system must be treated as a global chain, this result in a chain of changes as well. Goldratt et al. (1993) state that changes are necessary but not enough. A change might trigger more changes along the whole business chain. An implementation in one area may need other changes in other area in order to reach real improvements for the whole business. An IS project implemented in a specific area of the business many times requires other modifications in some place within the business system. For instance, Luis Cruz for Dell Services argues that applying changes in one area, it necessarily affects the next one, *“every change someone does here, it affects, good or badly, in other area in the business”* (personal communication, 2010-04-21). Also Saul Arjona (Desca) refers that the implementation in the area of operations will demand some changes and maybe new systems to reinforce and support the main IS project. *“...this new system is popping up more changes in other systems and tools, but these have been already planned ahead”* (Saul Arjona, personal communication, 2010-04-22).

Goldratt & Cox (1993) point out that efficiency and productivity of any project must be measured at the end of the business chain. Local efficiency and productivity is neither desired nor productive at all. For the specific case of Desca, Saul refers that the new IS will bring control for the delivery, support and operation area but it will not bring enhance incomes for the company, at least for the short term. According to TOC, all IS projects must be conducted and targeted to be efficient and productive for the business chain in order to increase income. For example, if less resources are utilized to control projects, there must be other changes in the sales division to take advantage of the latter improvement and readapt in order to generate profits. If Saul notices improvements in his division but at the end the company is not earning more money, according to TOC, the IS is not productive and it might be considered as a failure since it is not reaching real productivity for the entire business.

Accordingly, Goldratt & Cox (1993) have proposed some new metrics to measure performance of any system. Traditional metrics do not reach real measures of the changes applied in the global system; they are woefully inadequate to judge the impact of specific actions on the goal. The use of current cost accounting procedures leads to mismanagement and a failure to achieve the goal (Lockamy & Spencer, 2008). Goldratt emphasizes in TOC the importance of changing pattern of metrics when implementing projects since common metrics can fail in the assessment of projects at a global level. Rebeca (personal communication, 2010-04-22) as a manager in Cisco Services, refers that IS projects require new tools to measure their performance. Commonly used metrics do not fit in all IS projects and within all scenarios. The total of respondents agreed that IS projects will demand new tools of measurements since they have realized that traditional measurements are not always aligned to the IS and hence, changes in metrics are imperative. There are difficulties in changing metrics for the global business since politics issues pop up again. Some areas manage well applying local metrics but as soon as the IS project is implemented, new metrics are required but changing the people perspective of this new point becomes controversial. Other areas may argue that the common metrics perform well in their area but the point is to convince and explain that metrics must be changed in order to monitor and reach real improvements for the global business and not for the local area.

TOC is a continuous improvement approach in which permanent improvement efforts must be allocated on the component that is capable of producing the most positive impact on the system. TOC refers that all systems and processes have at least one constraint at a specific time and this system is constrained by the lowest-performing element in the system. It is very interesting that only one respondent (Juan Espinosa, Ericsson) applies consciously improvement philosophies as Lean and Six Sigma in their processes. According to Juan, any IS project must be ruled and shaped by a continuous improvement approach. Saul Arjona at Desca, also considers that continuous improvement is important to identify opportunities and bugs in the IS, but they do not follow any philosophy to keep on improving. Saul refers that the only advantage of keeping on updating IS is to align to external updating of technology. Other respondents just operate IS projects and they do not apply continuous improvements methodologies in their projects.

Juan Espinoza (Ericsson) declares that all the projects in the company must have a continuous improvement approach, IS projects must have periodical following and improvements even if they are still performing well. *“all the projects here follow a conti-*

*nuous improvement approach, we do know that the external environment might change so we got to do the same” ”* (personal communication, 2010-04-21). The latter is tightly related to the term “inertia”. According to Goldratt et al. (1993), inertia is the worst enemy of a process of ongoing improvement. An optimal solution deteriorates over time, as the system’s environment changes. Continuous improvements are necessary to update and enhance the efficiency and performance of a solution. As we have noticed, environmental (external) factors have a closely relation with IS projects within organization. The environment out organizations’ boundaries is constantly changing and hence, companies must adapt to it. Goldratt & Cox (1993) developed a five steps cycle of continuous improvement based on TOC. They underline the “repeat” step in which inertia is involved. Do not let inertia become the next constraint. The caution about inertia reminds organizations that complacency is not allowed; the cycle never ends. Companies in the inquiry are not totally concerned about the high damage that inertia can create. Even when IS projects are implemented successfully, inertia may switch to become the next constraint. Just to remember that a TOC principle is that all systems have at least one constraint at a specific time, even those IS projects which are successfully implemented present a hidden constraint; otherwise the IS project would become perfect carrying infinite benefits to the business. In the real world we do know it does not exist. All businesses are limited by something, and this “something” is the barrier to reach endless earnings. The dream and goal of any company, but unreachable.

It is meaningful to consider that the majority of respondents do not contemplate to allocate resources on exploiting constraints. Only Juan Espinoza declares consciously that it is important to assess how harmful a constraint can be to the IS and to the business in order to allocate the amount of resources on it. TOC refers that constraints limit the system from achieving higher performance versus its goal and exploiting constraints results in a much larger degree of system improvement. Except from Juan at Ericsson, the rest of respondents state that constraints are important to consider but exploiting them do not bring substantial and significant benefits to the business and IS project. They rather concentrate resources in enhancing activities that already perform well than in exploiting constraints that are obviously limiting their projects and businesses to achieve their goals.

## 6 Conclusions

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*In this chapter, crucial findings are presented according to the analysis done by comparing empirical data and theories. The conclusions are based on the analysis in which already stated theories were considered in order to find out the major factors within the implementation of IS projects and performance enhancement. This chapter aims to present condense answers to the research questions. Critical factors are presented for two aspects: within the implementation of IS projects and in the IS performance (productivity) enhancement.*

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There are common critical factors within other philosophies concerning management, specifically IS projects implementation. However we have found out that Theory of Constraints has some critical differences between other management and improvement philosophies and therefore, we point out the main critical factors that are related to TOC within the analysis. These critical factors are the key to conduct and implement successfully and productive an IS project related to the principles of TOC.

### **Critical success factors in the implementation**

- **IS project management**
  - Allows companies to identify properly and accurately the causes of the IS project by answering who and why the project is needed.
  - Take advantage of the “momentum” to implement the IS project.
  - Special attention in management of the project rather than technical issues.
  - The success of the IS interaction depends on the level of managerial ability.
  
- **People as a source of constraints**
  - Source of politics constraints.
  - Special attention to what people demand. People can either destroy an IS project even if it is a master piece or excel an incomplete project.
  - Involve people strongly in the implementation process. Communicate and always communicate to them. People as a source of solutions and improvements too.
  - People shape the IS project, not the opposite.
  
- **Environmental factors**
  - These are considered as limitations with the highest complexity.
  - Be aware of external factors when implementing an IS project that highly depends on customer’s resources.
  - Take care of external regulations that are not controlled by the organization.
  - External evolution (constant technology updating) must be considered when implementing the IS project.
  - Consideration of economic external environment might avoid many issues.

- **Cultural factors**
  - Internationalization requires special attention in managing people backgrounds.
  - Due to the difference of cultural backgrounds and perspectives, procedures and politics must be standardized and aligned along the whole business.
  
- **Politics factors**
  - Most of the constraints in IS are originated from policies or politics.
  - Most common problem in all the IS projects.
  - Working on politics generates substantial benefits to the IS.
  
- **Project leader**
  - Project manager (leader) is influential to the successful completion of any project.
  - Leader with skills in the area and leadership skills. Knowing what to change requires a thorough understanding of the system's current reality.
  - Social network is vital to fasten implementation and lessen limitations, mostly politics.

#### **Performance enhancement factors**

- **Goal setting → generation of money**
  - Set goals to generate internal competition and enhance productivity.
  - All the projects must be targeted to generate money now and in the future.
  - Set productivity global goals that hit directly the entire business
  - The aim of any IS project is to help organizations to sell more and faster. Enhancing throughput.
  
- **Overcome politics bottlenecks**
  - This will allow fastening implementation and getting faster results.
  - Use social networks to eliminate or lessen politics barriers for the IS project in order to become more productive.
  
- **Reach global improvements**
  - Always conduct IS projects to attain global productivity and efficiency. Local optimum is not optimum at all.
  - IS projects must be seen as chains. No isolated improvements.
  - Changes are necessarily but not enough. In order to reach real productivity, an IS project might need another change (or another IS project) at the end of the business chain.

- **Modify metrics**
  - Common metrics can fail assessing the IS results.
  - Not all metrics fit in all the scenarios the IS project takes part.
  - Metrics must assess global performance.
  - Local modification of metrics is not desired. Modify metrics for the entire business chain.
  
- **Continuous improvement**
  - It allows adaption to external updating factors.
  - IS projects successfully implemented are always constrained by something. Therefore keeping on assessing and updating the project is vital to enhance performance.
  - Avoid inertia. It is the worst enemy when an IS project is already implemented.
  - Solutions deteriorate over time.

It is important to point out that in times of global crisis, TOC overall goal for projects cannot be followed. The overall goal that consists to make money now and in the future is jeopardized and vastly affected by the economic situation of the external environment. None of the projects could make the entire business to increase throughput since the market was not reacting favorably; buyers and consumer did not have money to purchase products or services delivered from companies. Therefore, short terms productivity was highly affected by financial crisis; projects aiming enhancing throughput might fail, according to TOC axiom, due to the inability to gain consumers with resources to buy their products or services.

Another point is that exploiting constraints is not an issue companies are aware of. Companies are more focused oriented to allocate resources within IS projects to maximize or enhance those activities that are already performing well. According to TOC, all the potential benefits that companies are losing lie to the lack of attention on exploiting constraints. Many problems and issues might be solved by allocating resources on exploiting constraints that afterward will bring more value and substantial improvements to the whole business. Therefore companies must be more “constraints oriented” if they aim to be more productive and generate more money.



## 7 Concluding discussion

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*In this chapter is presented the criticism to the method of researching within the entire inquiry. Reflections of the results and the course of action taken in this thesis are discussed as well. Furthermore, since the IS topic is vast, this chapter present a discussion of further research that this thesis does not aim to solve; hence this chapter presents new lines of investigation identified during the research and analysis process that are important for IS studies for further research.*

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### 7.1 Method Criticism

Due to the fact that this thesis aims to use TOC principles in order to identify critical factors and then generate recommendations when implementing IS projects, the choice of method this thesis has approached has been appropriated. MGT research orientation has allowed us to take both inductive and deductive ways of generating conclusions. Since we depart from already stated and proved theory, specifically Theory of Constraints, we could generate new findings within the topic but at the same time we have tested TOC's principles within different contexts and scenarios.

The whole research has been successful for the aim of our research questions, even though there are always new ways of gathering information and comparing with already stated theories. Interviews were the right method to gather information since we were trying to gather intangible and immeasurable information that cannot be allocated and analyzed through questionnaires. Focusing on few respondents gave us the chance to get high quality and very useful information directly from respondents, and at the same time we could get valuable information directly in the interview. This allowed us to come up with questions that were not planned ahead but still interesting for the research. Furthermore, our deep interviews allowed us to get a more personal and direct information in terms of how the respondents are transmitting information.

We could make more generalized our respondents, we only focused on IT companies. This might be a limitation in the way of gathering information since obtaining information from other industries would be richer. Another related fact is that we focused on Mexican respondents located only in Mexico; with this we avoided cultural issues in the answers and we tried to avoid internationalization dimension. The latter would add another scope for the thesis. However, through the empirical findings and the analysis, we have found out that even if the research is focused in IT industries, these results and recommendations can be applied to a vast range of industries.

One important fact was the level of knowledge of the respondents, even that we tried to get managers with the same level of knowledge and experience; it was difficult to align these issues. Hence some interviews were more useful than others in terms of information. Respondents with more knowledge or experience gave us more data to analyze and the interview process went smoothly.

## 7.2 Reflections

We have been able to answer our research questions. After analyzing several change theories and combine them with the theory of constraints (TOC) we were capable to identify key factors that are needed when implementing an IS change. After matching this factors with our empirical data we observed how the theory is apply on practice.

This paper should be consider a guide for any leader when implementing an IS change. We did not only consider aspects related to change theories, but the TOC gave us a procedure to make sure the IS changes actually have an impact on the business income. We observed that not all our interviewees had in mind the goal of making their company a more rental one. But that in some cases the IS change was thought as a way of reducing cost rather than increasing sells.

Now we have a list of critical success factors in the fields of theory of change and the theory of constraints. Leaders should consider all this factors every time they go through an IS change because it has been proved after recollecting our empirical data that whenever they were used they contributed to the change success.

IS changes are meant to produce benefits to a company. In this paper we give a set of aspects to implement an IS project. It is not only the well execution of the project within the company, but the way how the IS affects real productivity. An IS project must be thinking to be successfully implemented and productive in terms of money. Sometimes lowering or affecting some stages' efficiency in the business chain, will produce more money at the end of the business chain; this is to think "productively".

However after recollecting our empirical data we have observed that this is not always possible. Other external factors should be considered as well. In time of financial crisis it is not natural to find new customers or expand the market. The theory of constraints should consider these factors as well.

Finally we observed how leaders play a major role on the success of an IS change. Most of the critical successes factors we list are related to the leader's abilities to inspire, encourage, plan, set goals and establish social networks. They should be able to sense when the implementation of the change would be better accepted by their team. People are the key player in the IS field, they shape the project and its performance. It is all about people interacting with the IS project.

### **7.3 Further Research**

This thesis has been based generalizing if the respondents are customers or providers or IS projects. It is substantial in the way how respondents see constraints depending on which side of the business chain they are. A further research might analyze the view of every side of the respondents: customer and supplier. There are different perspectives and factors that respondents argued related to the way they conduct their IS projects. An external factor, such as customer's resources might be a limitation; on the other hand it is not if we are taking the opinion of the customer.

Another topic might study the effects of global crisis within IS projects. This thesis was conducted just after one of the most harmful financial crisis in the world. It really affected the IS projects and therefore many constraints were found related to this phenomena. Even when TOC is related to generate more money by enhancing throughput, it was not possible due to the financial crisis. Many projects just aimed to reduce OpEx in order to survive the crisis. Productivity was not in the organizations' dictionary for a while. They were just looking for some ways to survive and stay alive until the crisis disappears. So, an inquiry related on the effects of the crisis in IS projects might show useful information and very important factors in case a new crisis hit the world in the future. As we know, this will happen sooner or later.

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## Appendices

### Appendix 1. Interview questions

Have you implemented or been part of a change in your company?

Do you think this was a change caused by a good company performance, a bad company performance or just because a senior manager wanted the change?

Can you explain what the change process was?

How was the change politics?

Did you give employees any benefits for accepting the change? (Money, relationships, opportunity, development or pride)

Was the management area persistent during the change?

Do you have a superordinate Goal in your company?

Are your goals SMART? (Specific, Measurable, Attainable, Relevant and Time-framed)

Is there anything I'm saying or doing as the leader of this team that is getting in the way of good attainment or reducing goal commitment?

Do you think the change was something senior manager or the CEO planned? Or was it more something employees needed? Or was the change proposed by specialists in the company?

Within the IS change, what was the main focus of the change: to improve activities in the local area only or for the whole business process?

Which is the overall goal of the IS project: to reduce operational costs (save money) or increase sales (increase throughput – make money)?

During or after the IS implementation, which limitations (constraints) did you find in the process? Which ones do you consider are critical when implementing an IS project?

Which limitations cause more pain: policies or physical (technical) constraints? How do you consider "people" in your business process?

What do you consider that bring along meaningful benefits: to focus resources in exploiting limitations or to focus resources to enhance those activities that the companies are already doing well?

Did the IS change generate more changes in the business system that were not planned ahead?

Is the IS project a start-end process or is it a continuous improvement cycle process?

Was the IS change successfully implemented in terms of budget, time and requirements?

Do you change parameters of measurement to identify and judge the effect of the IS change?