JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
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The Influence of ERP Simulations on ERP Systems Implementation

Master's Thesis within Informatics

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Abstract

Companies are always trying to enhance their functioning to achieve a competitive advantage in a given market. Some of the tools that are used to improve organizational functioning include ERP systems. In fact, ERP systems are becoming very popular among firms, to the point where they are considered by some as an ailing business savior. Nevertheless, despite the attractive functions that an ERP system may display to an interested company, implementing such a system successfully is a task that is far from being easy. Several problems may arise in the implementation phase, and a failure to address them correctly can have terrible consequences on the general functioning of a firm. Two of the main factors that contribute to a failed ERP system implementation are training and resistance to change. A tool that may actually help with the ERP system implementation failure is ERP simulation.

The main purpose of this thesis is to study the potential effect that ERP simulations can have on a potential ERP system user skills and knowledge, and thereafter find the potential impact that they may have while being used during an ERP implementation to facilitate training and reduce resistance to change.

The tools that were used to successfully accomplish this research were a personal interview with an ERP simulation expert, a detailed survey with ERP simulation participants, and various information that were collected from books, articles, reports and websites.

This thesis main results show that ERP simulations can enable ERP users to improve their knowledge of ERP systems effectively, and also have potential to contribute during the implementation phase by reducing the possible problems that may arise from the training and the resistance to change perspectives.

Acknowledgement

This thesis is the culmination of months of assiduous work, constant learning, and cheerful moments. It is obvious to us that this work would not have seen light if it was not for the support that we had from several persons. This section is a display of our deep gratitude towards them.

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Finally, we would like to thank all the persons who participated in an indirect way in this thesis either by believing in us or even supporting us morally. These persons are our parents that allowed us to study, and our friends who always supported us.

Jönköping, August 2010.

Amine Alouah & Eric Smith

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1 Introduction

In this introductory chapter we will start with a quick introduction to ERP systems alongside their historical background, and what factors we believe are problematic during their implementation. Thereafter, a description of the problem under scrutiny will be stated in addition to the research questions that were derived from it. Afterwards, we will discuss the purpose, perspective, and delimitations that are linked to our thesis.

1.1 Background

Nowadays, in our highly competitive society where companies are fighting each others for supremacy and more market shares, information technology has proved to be a major factor that may highly influence how a firm may perform. Some of the major IT tools that are used by companies include Enterprise Resource Planning (ERP) systems. In fact, the use of ERP systems is becoming a trend among companies in almost all the economic sectors, every firm is trying to get that piece of technology that will boost its numbers and smooth its functioning.

ERP Systems can significantly help any company improve its functioning in different categories. Indeed, ERP systems can provide higher business agility, better productivity, less errors, better integration of information, in addition to allowing the automation of tasks and processes (erppandit, 2010). ERP systems origin can be traced to the early 60ties, back then, the main systems that were used were called Inventory Management and Control (IMC) (sysoptima, 2005). The next generations of systems that were used afterwards were named MRP (Material Resource Planning) starting 1975, and later their more advanced version MRP2 (Manufacturing Resource Planning). The MRP family systems were mainly centered on manufacturing and lacked features that would enable them to be useful in other sectors within a given company or industry in general (Sudalaimuthu & Raj, 2009). This situation prompted the creation of what is called nowadays ERP systems.

ERP systems sound at the present time to many companies as the ultimate solution to all their problems, they believe they will instantly harvest consequent benefits and ultimately improve their functioning almost instantly. It is obvious that a company planning to heavily invest in a new ERP system is expecting absolute and smooth success concerning its newly acquired piece of technology. The reality is actually quite different, ERP systems are no miracle solution, they too have their own drawbacks, which can be mostly seen in the ERP implementation phase. The problem with ERP implementations within companies is the rather poor success rate that is observed. In fact, despite the general agreement that ERP systems are important, the implementation phase success statistics are not very encouraging. According to Sudzina et al (2009), around 90% of ERP implementations suffer excess in budgeting and tardiness. This is confirmed by the Standish Group 2009 chaos report that shows that 24% of ERP implementation failed, 44% were heavily challenged in terms of cost excess or non schedule respect; while 32% actually were successful while respecting their initial budget (Standish Group, 2009). A quick comparison with the Standish Group 2006 chaos report shows that globally the ERP systems implementation success rate is stagnating. In fact, in 2006 35% of the projects were deemed as successful, 19% were total failures, and 46% were considered as challenged in both cost and schedule (Rubinstein, 2007).

Alexis Leon in his book "ERP Demystified" points out that the main causes for ERP implementation failures stems from a failure to gauge the importance of the human factor... Some appealing examples of these causes include:

- Lack of adequate ERP related education and training
- A bad fit between the ERP and the users
- Low user acceptance
- Employee resistance to change
- Unrealistic prospects towards ERP
- Lack of commitment from the top management
- Poor follow up after the implementation

As we can see, a significant amount of the possible causes that the author lists were human side related. A failure to address those potential problems will most likely hinder any ERP implementation.

1.2 Problem

As stated above, ERP implementation is quite often an uncertain phase for any company wishing to implement an ERP System. In addition, there is a huge need for any company to assess whether an ERP implementation will be successful or not, and whether a specific ERP system will allow it to improve its functioning significantly to justify the costs that have to be inquired and the risks that will be taken. The importance of the human factor while implementing an ERP system cannot be underestimated. As stated above, a significant part of the issues that a company faces in the implementation phase emanate from the potential system users.

An approach that is not very documented and that may actually help greatly in the implementation phase is the use of ERP simulations. One of the most used ERP simulations is ERPsim (Léger et al., 2008a). ERPsim is a software that involves using a practical approach based on gaming simulations to educate the users on ERP concepts and make them used to their functioning (in our case the ERP used is mySAP ECC 6.0).

What was previously stated above leads to the main problem that we want to study in our thesis. We are wondering how an ERP simulation can allow potential ERP users to better seize the functioning of such systems, and therefore the impact that it has on their ERP knowledge and technical skills. In addition, one can legitimately inquire on how such simulations can contribute in making the ERP implementation phase easier especially from the training and resistance to change side.

1.3 Research Questions

We were able to identify the following research questions that represent in our opinion the essence of our thesis:

1. How can ERP simulations help users to better understand an ERP system?
2. What is the potential impact that ERP simulations have on the training and the resistance to change factors when a company implements an ERP system?

1.4 Purpose

The purpose of the thesis is first to study the effect that ERP simulations can have on the ERP user's knowledge and skills, and then establish what potential impact they may have if used within a company during the ERP implementation phase as a tool to facilitate training and reduce the resistance to change.

It is in our belief that this subject is of utmost importance to the enterprise systems field due to the relative actual shortage in references since ERP simulations were introduced recently as a tool.

The knowledge gap that this thesis has attempted to fill is to first determine whether ERP simulations can improve their user's understanding of ERP systems, and then to evaluate the potential effects that those simulations may have on a company while implementing an ERP system.

1.5 Perspective

The perspective that will be used in this master thesis will be both from a user and a company perspective.

The user perspective will allow us to evaluate how ERP simulations can help users deal with the potential issues and problems that they may face while using an ERP system.

The company perspective will permit us to understand the potential benefits that ERP simulations may provide to a company when implementing an ERP system within its premises.

The two perspectives stated above are according to us the most important in relation to our thesis topic.

1.6 Delimitations

This thesis doesn't aim at giving a general overview of ERP simulations and their functioning. Rather, it is centred on their use when implementing an ERP system within a company. In addition, and despite the vast amount of factors that influence the success of ERP implementations, this thesis will only focus on the training and resistance to change factors due to their importance.

1.7 Definitions

- ERP: or Enterprise Resource Planning are systems that enable companies to integrate data, in addition to offering companies a total support of the major functions within them (Motiwalla & Thompson, 2008).
- Simulation: Is the application that runs on the simulator and that allow the user to experiment a similar environment to the original one.
- ERPsim: is a turn based (Seethamraju, 2008) business simulation technology that was developed mainly by HEC Montréal, in Canada (Léger et Al., 2008)

1.8 Disposition

- **Introduction**: We will introduce the main concepts that our thesis is based upon (ERP, ERP implementations, Simulations, and ERP simulations).
- **Methodology**: In this part, we shall portray the different methods that were used to access and collect data from the relevant sources.
- **Frame of reference:** We shall portray all the researches, papers, articles, and sources that can be found on the subjects of ERP implementation and especially on the use of simulations to help in achieving that goal.
- **Empirical Findings:** In this section, we will present the data that we were able to gather.
- **Analysis:** Here we will conduct an in dept analysis of the empirical data that we were able to gather to expose the potential role that simulations can have on users alongside while implementing an ERP system.
- **Conclusion:** Here we shall conclude on the whole ERP simulation subject.
- **Final Discussion:** This section would most likely contain our reflections on the work done, in addition to some suggestions that can be used by anyone planning to study ERP simulations in the future.

1.9 Interested Parties

This thesis was designed so it can be used by any company to judge the potential usefulness of ERP simulations during the ERP implementation phase. In addition, it can also be used by consulting companies in their effort to either help promote ERP simulations or even adopt it as a tool to be offered to potential clients in the future.

Students that are interested in this subject can also use this thesis as a way to enlighten their perspective on the use of ERP simulations during the ERP implementation phase.

2 Frame of Reference

This chapter will be the basis to describe the different definitions and theories that we encountered in articles, books, and the World Wide Web. The knowledge that we collected will be used to analyse the empirical results that we obtained

The frame of reference was designed in a way to allow the readers to easily understand and apprehend the subject at hand. To ensure clarity, we have decided to divide the frame of reference into several parts. The first part deals with the global definition of ERP systems alongside their lifecycle and implementation. In addition, the importance of the training and the resistance to change factors during the implementation phase will be explained. The second part will deal with the simulations in the aspects that interest our study. The third and last part will introduce ERPsim, enumerate its characteristics and benefits, and then reveal the different studies that were done previously about its efficiency.

2.1 Enterprise Resource Planning Systems

2.1.1 What is an ERP?

Coming up with a standardized ERP systems definition came up as a complicated exercise. One would consider coming up with a clear, simple and explicit definition as an easy task knowing the popularity of ERP systems in the current industry. Unfortunately, such a naive thinking is far from what reality dictates. In fact, while researching our topic we discovered that the ERP systems definition varies highly depending on the author and his own actual perception on what an ERP system is. To ensure the clarity of our paper we decided to only include the definitions that seem to be coherent with the spirit of this thesis, which would ensure an easy comprehension to any reader.

According to Motiwalla & Thompson (2008), ERP (Enterprise Resource Planning) systems are a first generation enterprise systems that aim at the integration of data across, in addition to provide support to the organizations main functions. Another definition that sheds more light on ERP systems says that: ERP systems are integrated systems that can be used to manage a wide variety of functions whether it's assets, financial resources, or human resources. In addition, it allows an easy flow of information between all the department and division of a given organization (Bidgoli, 2004).

The ERP main function would be the optimization of the information flow to unsure that it's dynamic, with immediate access capabilities, and totally useful and valuable (Motiwalla & Thompson, 2008). Moreover, Data redundancy is avoided and more flexibility is gained (Motiwalla & Thompson, 2008). Usually, each department within a specific organization uses its own systems and has its own unique procedures and rules. In this case, ERP systems allow the integration (using an integrated software environment) of the different functions and departments that may exist within a company onto a centralized and unique structure that is able to respond to each division's needs (Motiwalla & Thompson, 2008). In a simple sentence ERP systems are very efficient in providing a common language and an easy integration within global companies (Bingi et Al, 2002).

Companies have been and are still trying to implement ERP systems within their premises. For them ERP systems are the miracle solution to smooth their global functioning by enhancing the supply chain efficiency, helping the customer access the product and services in an easier way, cut the general operating cost, always be ready for any market change, and possess an efficient and easy tool to get business intelligence from that rich data that is stored within the system (Motiwalla & Thompson, 2008). Some other factors that contribute to the popularity of ERP systems with companies include the actual penchant toward globalization, the relative shorter actual product lifespan, and the increasing spread of mergers and acquisitions (Bingi et Al, 2002).

Companies wishing to implement an ERP system find a vast selection of providers to choose from. In fact, there exist a consequent number of ERP systems providers on different levels and sizes. The AMR Research "The ERP Market Sizing report, 2006-2011" provides us with an insight on how the ERP market is shaped nowadays (figure 1).

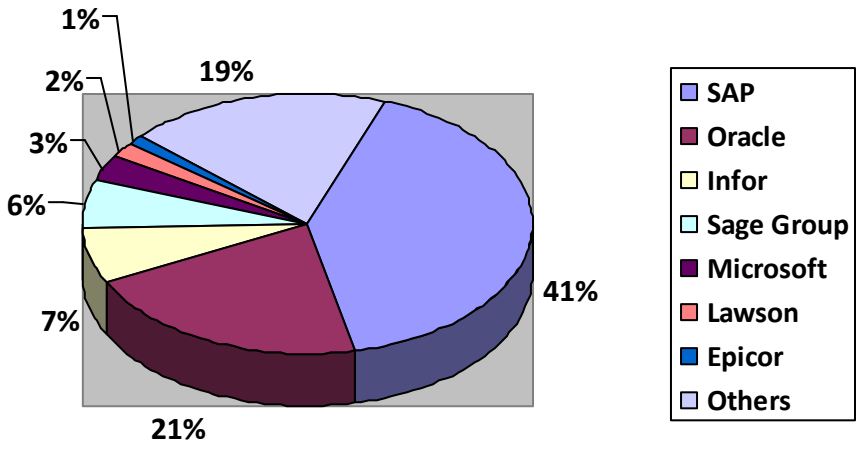

Figure 2.1 - ERP Systems Market Share by Revenue in 2006 (Jacobsson et al., 2007).

Obviously, the biggest ERP provider company SAP dominates the market outrageously followed closely by Oracle Application. Infor, Sage Group, and Microsoft complete the Top 5 of what can be considered as the ERP market tenors. Figure 2 displays the Data summarizing how ERP system revenue is divided by application segment.

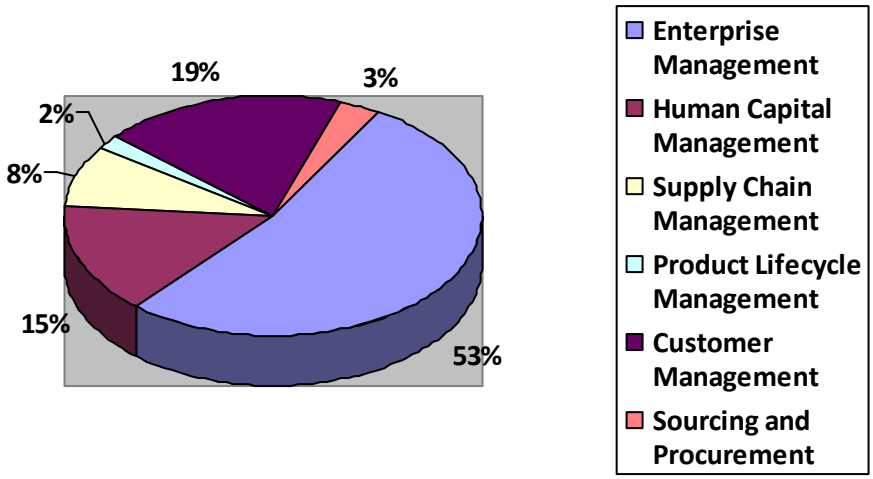

Figure 2.2 - ERP Systems Revenue Share by Application Segment in 2006 (Jacobsson et al., 2007).

(Figure 2) gives us a better view on which application segment is the more popular in term of revenue generated. As we can see, Enterprise management remains the main application segment where EPR systems are mainly used. Other segments like HR management and customer management are getting the major remaining part of such use.

2.1.2 ERP Architecture

According to Motiwalla & Thompson (2008), ERP architecture to the opposite of the other IT systems architecture is mainly defined by the vendors and not by the organizational strategy and business processes of a specific organization. In fact, each vendor is trying to promote his own ERP system by claiming that its product includes the best architecture required to ensure that business processes are correctly assimilated in its system logic (Motiwalla & Thompson, 2008). And while in normal IT software implementation the architecture choice is done way before the software selection, in ERP system the architecture conception can only be done after choosing an ERP system to be implemented (Motiwalla & Thompson, 2008).

In general, there exist 4 main types of standard architectures that are commonly used nowadays. According to Motiwalla & Thompson (2008), these architectures can be summarized as:

- Two-Tier architecture: this architecture requires the server to handle both the application and the database function. The data is presented to the users by the client. While being relatively simple, cheap, and with the ability to achieve high performance with a small number of workstations, the two-tier architecture is rather inflexible, requires expensive middleware, and changes (upgrades, tweaks) can't be made in an easy way.

- Three-Tier architecture: to the opposite of the two-tier architecture, the third tier architecture shows each layer (application, database, and presentation) as a sepa-

rate entity that works independently from the others. This architecture offers better flexibility and more reusability than the two-tier architecture. In addition security is better enforced in it, and maintenance is done in an easier way. Some drawbacks to this architecture would be the relative high cost to be inquired; in addition to the relative complexity that such an advanced architecture shows.

- Web based architecture: this architecture steamed from the use of the internet to improve the ERP experience for users. In here, the presentation tier is split into two distinct entities compared to the previous architecture. Those entities are the Web Services tier and the Web Browser tier. The main advantage of such architecture is the possibility to access the ERP system and its functions directly from the internet, which enhance greatly the usability. Still, Security risks and network quality dependence constitute the major drawbacks to such architecture.

- Service oriented architecture (SOA): According to Alouah (2009), Service Oriented Architecture (SOA) is basically a set of services that are interoperable between each other. This is achieved through the decomposition of the of the actual company system into smaller units that can taken care by a specific service. Those services are system (Operating System platform) independent and can be integrated using any language or platform (Alouah, 2009). In addition, unlike the more conventional Object Oriented Architecture, SOA enables interaction between the service provider and the service customer (Alouah, 2009).

2.1.3 ERP Implementation

Motiwalla & Thompson (2008) points out that a well planned implementation plan is needed to ensure the success of the ERP system. In addition, they point that there exists several strategies or plans to decide how the ERP system should be implemented. According to Motiwalla & Thompson (2008) these implementation plans are:

- Comprehensive: This strategy involves fully customizing the ERP system to the company's organization and business process. This strategy is expensive, and takes a lot of time. It also requires a high level of business process reengineering, and system customization.

- Middle of the Road: Here the goal is to modify just parts of the ERP modules to fit the company, while adding a great amount of business process reengineering. This strategy is less expensive than the comprehensive strategy.

- Vanilla: In this strategy, the company aligns its business processes to the ones included in the ERP system which hugely simplify the procedure since no modification to the system is required. Hence, the cost and time required to implement the ERP system is reduced.

There exist several ERP system implementation methods, with each having their own life cycle. Therefore, to enhance comprehension and avoid confusion along readers, we chose to only describe what can be called the traditional ERP life cycle, which we believe is the basis to all the other ERP implementation life cycles.

Motiwalla & Thompson (2008) point out to the existence of 5 main stages within a traditional ERP life cycle. Those stages can be detailed as:

- Scope and Commitment Stage: This stage requires companies willing to implement an ERP system to thorough fully conduct a feasibility study in addition to build an ERP implementation scope. In addition, the company needs to evaluate the relative ERP coverage on the company functions and departments. Other tasks to be performed in this stage include the long-term vision of the ERP system to be installed, how external consultants can contribute to the implementation success, how employees can help the implementation, and as a final step decide which vendor is to be selected to provide the ERP system.

- Analysis and Design Stage: This step requires the ERP team appointed to perform the implementation phase to select which software is to be used. One of the main tasks in this stage is to do a gap analysis study which would allow the creation of a proper design that encompasses a change management plan, how interfaces should be, future customization needs, and a clear list of embedded processes. The creation of a training plan alongside both data and system conversion plan is necessary also.

- Acquisition and Development Stage: Companies need to purchase the different components that are needed to install and implement the ERP. Those components include the different hardware, the product licence, the networks adapters needed, and the database. The team in charge of the change management need to work with the potential users to unsure the smooth transition to the new system, especially when users are used to work with old legacy systems that are quite different from their newest counterpart the ERP systems. The last step would be the correct security set up and the definition of the different policies that allow the connection to the ERP system.

- Implementation Stage: The focus here is on allowing the system to go live. One major part of this stage is the proper system conversion to the new system. This task can be done using 4 main approaches. The first approach is the phased approach, where the company moves slowly to the new system by incorporating small modules of the new ERP to replace its old system. The second approach is the pilot approach, where the company test live a small part of the new system to detect the potential issues that may arises before implementing the full ERP system. The third approach is the parallel approach. Here the new ERP system and the old system are run in parallel, which can be quite useful in case the risk of ERP implementation failure is high. The fourth and last approach is the big-bang or cutover approach. In this case, the company replaces its old system directly with the new ERP system, which is in a way the most direct method but the risk sustained is the highest compared to the other approaches. The last but not least important task in this stage is to ensure the proper training of the potential end users. This is very important to guarantee the well transition to the post-implementation phase.

- Operation Stage: the major tasks here involve knowledge transfer, new staff training, feedback monitoring from the users to improve the system, and the correct management of the future releases and updates of the ERP system.

2.1.4 Training Importance in an ERP implementation

According to the research that was made by Bradley & Lee (2007), training is very important for any enterprise wishing to implement an ERP system. Training is not given enough attention and importance within companies, and frequently we see that companies training practices and even their training budgets are frequently lower than what they should be (Bradley & Lee, 2007). In addition, to understand the new business process, and how the system is changing the whole work procedures, training is required alongside on site support for the managers and the employees during the implementation phase (nah et al., 2001).

Bingi et al. (1999) points to the importance and the massive challenge that training plays in the implementation phase. The authors added that the employees nowadays have more responsibilities and more decision making power due to their use of ERP systems, a failure to correctly train them to use the tool is a critical mistake (Bingi et al., 1999). Moreover, the studies have shown that of a lack of training make 30 to 40% of the workers unable to correctly handle demands on the new ERP system (Bingi et al., 1999). The training difficulty especially to employees who are reluctant, afraid or inexperienced in computers is a challenge, and knowledge transfer need to be performed in an efficient and continuous way due to the high complexity of the ERP systems (Bingi et al., 1999).

Training satisfaction play a major role in determining whether an ERP system will be popular or not, and then whether the employees are comfortable working with it (Bradley & Lee, 2007). Bradley & Lee (2007) proved that a good training is essential for any ERP implementation whether it's in a company or even in a school or an university, they also added that the more employees are satisfied from the training they had, the more usefulness they will display (usefulness is defined by the authors as the perception that an employee has on the effectiveness, efficiently and ease of use of the ERP system) (Bradley & Lee, 2007).

2.1.5 Resistance to Change During the Implementation Phase

The introduction and implementation of a new ERP system usually creates the need for major changes in a company's socio technical system, which is directly linked with the company's structure, cultures, technology, task, and people (Hong & Kim, 2001). Resistance to change is a normal product of ERP implementation especially in settings with big project sizes (Ross & Vitale, 2000).This resistance to change stems from the disruptive nature of the ERP implementation phase that requires heavy organizational changes (Hong & Kim, 2001) (Themistocleous et al. 2001).

Resistance to change is considered as being a major obstacle when implementing an ERP system and therefore is seen by most companies as a major threat to their IT expansion projects (Zairi & Al-Mashari, 2001). This phenomenon can have bad repercussions on the ERP implementation and can lead to project delays (Themistocleous et al. 2001).

Ross & Vitale (2000) described 3 types of resistance to change that they identified in their research. The first type was the "anticipated resistance to change" where an employee finds that the new system allows more people to do the tasks he was usually assigned to and therefore he tries to undermine the system instead of finding the best way to use it (Ross & Vitale, 2000). The second type of resistance is the "intellectual resis-

tance", which is created by the potential ERP users' inability to understand business processes that are required to operate the ERP system efficiently but that are on a level of responsibilities which are usually higher than their own (Ross & Vitale, 2000). The third and last type of resistance is linked to the company culture and politics (Ross & Vitale, 2000). In this case, the speech that the managers are giving and the reality that the ERP users are experimenting are different which pushes employees to hate and resist the new system (Ross & Vitale, 2000). The best way to reduce the employee's resistance to change while implementing an ERP is by making them engaged in the process and enlighten them on the profits that they'll be getting (Zairi & Al-Mashari, 2001).

2.2 Simulations

2.2.1 Definition

According to Smith (1998), a Simulation is the process of conducting experiments with a model that describes either a real or an imaginary system. In addition, Akili (2007) added that depending on the scholar, a simulation is understood to be either a simplification or abstraction of some part of real life, or an effort to create a credible imitation of a real or imaginary event/setting. Usually, mathematical algorithms and relationships are extracted from the assumptions that can be derived from the system; those elements are in return used to create a "model" that describes how the system is working (Smith, 1998).

The problem is that in the real world problems are so complex that basic thinking is not the best approach, which pushes then to the use of simulations when facing such a scenario (Smith, 1998). Having a totally exact representation of a real phenomenon is not possible, but a very high fidelity approximation can be considered as enough for most cases (Smith, 1998). Knowing that almost every aspect of the current existing systems have corresponding models that represent them, creating corresponding simulations is in most cases possible (ex: flight simulators, Dynamics simulators...) (Smith, 1998).

2.2.2 Purpose

According to Smith (1998), Simulations are the best tool to represent the different characteristics of a system (namely its capabilities, behaviours, and capacities) without having to build an expensive real system. In addition, some experimentation like Nuclear Tests and weapon testing are too dangerous to be conducted solemnly in real contexts. Simulations would allow an easy and harmless analysis to occur of such events without involving a high degree of risk (Smith, 1998).

2.2.3 Major Uses of Simulators

Simulations are used nowadays in almost every field, whether it's science, engineering, or even technology (Smith, 1998). According to Smith (1998), we can distinguish 4 main activities where simulations are used

- Design: Simulation in this case allow designers to picture a system that is yet to exist which would allow them to foresee the potential issues and therefore find an optimal solution before the actual production phase. Simulation can also allow the characterisation of all the properties that the designed system has which helps the creation process (Smith, 1998).

- Analysis: Simulation allows the study of the behaviour and capabilities of an actual system. The actual existence of the system allow the collection of data that can be used to enhance the model from which the simulation is based (Smith, 1998).

- Training: Simulations are used extensively for training to replicate the potential situations that people may face during their daily job and allow them through the ability to train to learn the correct response to any event that they may face. Flight simulators for example are a good example of training simulators that al-

low pilots to improve overall flying skills in addition to proper problem solving knowledge in a safe environment (Smith, 1998).

- Entertainment: Simulations have been used by the entertainment industry to create games that provide excitement and enjoyment for the players. Those simulations are less strictly designed in comparison to the other simulations cited above due to the fact that their main purpose is divertissement instead of describing the real world (Smith, 1998).

2.2.4 Types of Simulations

Smith (1998), pointed to the existence of 2 main types of simulations, either discrete event or continuous. According to the same author "Discrete event refers to the fact that state variables change instantaneously at distinct points in time" while "In a continuous simulation, variables change continuously, usually through a function in which time is a variable". The majority of simulations uses both types and the predominance of one type over the other defines how the simulation is to be categorised (Smith, 1998).

2.2.5 Advantages, Disadvantages, Limitations, and Value of Simulations

According to Smith (1998), the main advantages of a simulation system are its cost effectiveness, the less risk that it presents, the relative high speed that it can achieve compared to reality, and the more practicability in comparison to a real system.

In addition, simulations have proven to be an effective and efficient way of teaching complex and dynamic systems (Parush et al., 2001). This is shown by the time reduction that is obtained in the learning process (efficiency) and the improved results when applying the tasks that were learned (effectiveness) (Parush et al., 2001).

The main limitation of simulations is their relative inaccuracy in comparison to real systems (Smith, 1998). This accuracy steams for the difficulty to recreate all the aspects and variables of real systems using simulators (Smith, 1998). In addition, simulations can be hindered by the lack of data availability which would create problems to describe accurately a given system (Smith, 1998).

Then, the main disadvantage that simulations present is that the results that are obtained are just approximations of real results, but this can be corrected by using the simulation results as a general trend instead of using them as facts (Smith, 1998).

Feldstein(a) pointed that after a period ranging from 3 to 6 months people that were trained using conventional methods were having issues to fully remember or efficiently use their learning acquisitions in their job. According to him, the best way to avoid that phenomenon and improve the participant's ability to learn is by embedding the learning directly within the job to be done using simulations (Feldstein(a)).

According to Feldstein(a), simulations allow people to study and learn in a compressed environment (both time and space) that simplifies the complexities that are usually found in the real world. This compression is the key to quick learning since it allows the simulation participants to detect dysfunctions quickly which in return pushes them to acquire corporate learning that can be directly applied within the company (Feldstein(a)).

Simulations gives the users a freedom that they can't attain normally, this freedom allows them to test and get feedback almost immediately, and thereafter takes the necessary measures to adjust and correct what they have done wrong (Feldstein(a)). Freedom is in fact the essence and the basis of simulations, which makes them a valuable tool in a corporate setting (Feldstein(a)). Feldstein(a) states that simulations create what he called a "willing suspension of disbelief" where people forget that they're playing a game and instead do their best to actually win. This will to achieve victory pushes people to learn more by themselves which is on the opposite of conventional learning where an instructor usually explain and the listeners try to understand what he is saying (Feldstein(a)).

2.2.6 Some Common Features to All Simulations

Smith (1998) pointed that despite the disparities that different simulation types display; they still share some common features that are present in a large portion of them. Those potential features are:

- Event management
- Time management
- Random number generation
- Physical modelling
- Model management

In addition to those features, additional technologies are required nowadays to properly use simulations. Those technologies are mainly computer related, where the computers raw computing power is necessary to the proper computation of completes simulations (Smith, 1998). Smith (1998) listed some technologies that can be used in simulations:

- Networks
- Parallel computing
- Artificial intelligence
- Computer graphics
- Databases
- System architectures
- World Wide Web

2.2.7 Business Games

Business games direct ancestors are war games, they were very popular in mid 19th century within the German Kriegspiel, the Japanese navy prior to the Second World War, and the British and American army to test strategies and train troops (Faria, 1989). Still, the most recent origin for modern business games steam from the RAND Corporation that developed based on the Air Force logistic system a simulation named Monopologs (Faria & Nulsen, 1996). This simulation was designed so that the participants

are required to play inventory managers roles in the Air Force supply chain system (Faria & Nulsen, 1996).

Ein-Dor & Segev (1985) and Ben-Zvi (2010) defined general-purpose Business games as a "Highly complex man-made environment". They argue that their main use is as a teaching tool that can provide practical experience to users, while their effectiveness depends heavily on the level of exactitude and accuracy that they offer while mimicking the real world (the more exact the representation the better the results) (Ein-Dor & Segev, 1985).

The main objective of business games is to permit the students through real management situations to learn on the best way to deal with them (Ein-Dor & Segev, 1985). The nature of business games makes them non adapted to controlled experimentation, but it makes them a perfect candidate for field observations which are costly and tedious in real situations but pretty easily achieved in a business game context (Ein-Dor & Segev, 1985).

According to Seethamraju (2008) business game simulations are already used in a wide variety of subjects that includes ethics, business knowledge integration, ethics, information systems, knowledge management, finance, and marketing.

An example of Business games would be Virtonomics (Gamerloft Trading Ltd, 2010) which according to its authors is an online economic game that provides the potential user/games with a simulation of a business. The whole game provides a wide range of realistic parameters that makes it very similar to real life. Users can interact and compete either with each other or with artificial intelligence and experiment the thrill of managing a business in a setting that trains them for the potential challenges that they may face in their future career (Gamerloft Trading Ltd, 2010).

According to Ben-Zvi & Carton (2008), business simulation games are totally appropriate to deal with the challenges that Information Systems and Technology Management education presents. They argue also that simulations are an effective educational tool, while adding that the new technological advances makes simulation exercises more complex and user friendly (Ben-Zvi & Carton, 2008). Using games as a way to teach gives more excitement and pushes the participants to more involvement in addition to increasing their motivation to learn.

In addition to facilitating the understanding of theory concepts and the theory connection to their potential application, some of the benefits that business games are providing to student according to Ben-Zvi & Carton (2008) are:

- Possibility to endorse the responsibilities of executives
- Getting involved directly in situations that mimic the ones that are faced by people in the real world
- Get the students used to pressure while working, in addition to increasing their risk recognition abilities.

Ben-Zvi & Carton (2008) affirm through their experience that the effectiveness of business games in education present itself in 3 main ways. The first way is by allowing students to use the concepts that they learned directly in a context that appeal to real world situations. This direct application of theoretical concepts is an excellent way for students to use their reasoning and logic to effectively use the data and information that are

available to them (Ben-Zvi & Carton, 2008). The second way is by getting students involved in decision making situations that have no real consequences on the real world, while giving them a taste of what may happen in their future without any risk (Ben-Zvi & Carton, 2008).A good way to express this is to compare business games to the cadavers that are used by medical students to practice (Ben-Zvi & Carton, 2008). The third and last way is by pushing student to develop their own independence in decision making (Ben-Zvi & Carton, 2008). Ben-Zvi & Carton (2008), point that all the previous elements correlate the fact that Business games are effective in teaching, in addition to being a highly sophisticated concept to be used.

In comparing business games to traditional pedagogical methods, Ben-Zvi & Carton (2008) believe that they provide an excellent and effective alternative to conventional teaching. This is shown by the actual difficulty in motivating students through conventional methods in addition to the problem that are faced when trying to invigorate a sense of realism, excitation and competitiveness (Ben-Zvi & Carton, 2008).

2.3 ERPsim

2.3.1 About ERPsim

ERPsim is a turn based (Seethamraju, 2008) business simulation technology that was developed mainly by HEC Montréal, in Canada (Léger et Al., 2008). According to Santé academy it is considered also as being very similar to traditional business games. ERPsim allows the near real life simulation of business contexts that can occur in information systems within large corporations (Léger et Al., 2008b). The main ERP that ERPsim is based on is the mySAP ECC 6.0 system (Léger et Al., 2008a).

ERPsim is designed to satisfy 3 main functions:

- Provide the participants with a near real simulation of a market that can respond in real time to their inputs.
- Provide automation to several existing business functions, in addition to some simple administrative tasks.
- Allow the simulation of the passing time.

The ERPsim main objective is to allow the participants to manoeuvre the whole business cycle (Léger et Al., 2008b). This business cycle include planning, procurement, production, and sales business processes (Pittarese, 2009). In addition, ERPsim provides the ability to experiment the business integration over the potential silos that exists in an effort to make the principles of decision making easier to understand (Léger et Al., 2008b). Moreover, ERPsim shows the participants what is really needed to efficiently operate a company in an integrated system (Léger et Al., 2008b).

The objectives on the pedagogical part of ERPsim are mainly to improve the understanding of the main enterprise systems concepts, to directly familiarize with the enterprise integration benefits, and to gains or improve the ERP software technical skills that are needed (Léger, 2006).

While ERPsim manages automatically the selling processes including the orders and the deliveries, the participants must takes their decision depending on their customers and the market fluctuations, and are required to forecast and predict the market future in an effort to achieve maximum gains (Ibragimova, 2009).

According to Léger et Al. (2008b), ERPsim in its 2009/2010 edition is available in two different business games where the first game represents wholesale distribution and the second game is intended for discrete manufacturing. This new edition of the simulation is the first one to introduce the distribution game (Léger et Al., 2008b).

The distribution game consists of having 60days that are simulated and split into 3 rounds of 20 simulated days each. The game support 26 teams of 2 to 4 students each, and is designed to be played in 2 to 3 hours which allows it to be perfect for introductory MIS classes (Léger et Al., 2008).

The Discrete manufacturing game revolves around the production and the selling of muesli to the German market. It is designed for a maximum of 26 teams of 6 students per team and played on successive quarters that contain 30 virtual day each (Léger et Al., 2008b). In addition to providing two scenarios (introductory and extended game), ERPsim allow the simulation manager to tweak the simulation depending on the needs

(can make the game easier or harder or can accelerate the clock for example) (Léger et Al., 2008b).

Some new additions compared to the previous version of ERPsim include:

- Warehouse cost
- Possibility of making additional investment decisions
- Changes were made to the marketing model
- The existing reports were revised and improved and additional ones were included.
- A Microsoft Access data map tool was added.

2.3.2 ERPsim Benefits

According to Cournoyer-Quintal in a presentation of ERPsim in the Baton Simulation website (a company that sells professional services based on the ERPsim simulation), ERPsim is a powerful new technique to enhance the user skills in SAP. He adds that ERPsim is the perfect tool to satisfy companies basic training needs when SAP is involved. In addition Cournoyer-Quintal states that ERPsim allows the following:

- Learning instead of Teaching
- Doing instead of listening
- Solving real problems instead of mastering transactions
- Discovering by ourselves instead of just hearing the usual marketing promotional speech about how great ERPs are.
- Working together helps a lot through sharing, discussing, arguing , and making improvement and decisions

Pittarese (2009) also enumerate some additional benefits that ERPsim provides from the competition spirits between the different participating teams, to the additional incentive to discover and stand out that the game provide.

Feldstein (b) stated that according to Ellen Langer in her books Mindfulness (1989) and The Power of Mindful Learning (1997) the way someone learns has a big effect on how he actually applies it. He argues that ERPsim allow the participants to be confronted directly with the system, which reduces the boredom and pushes the person to react actively with what he's facing. He compared how navigation can be taught in a boring setting where concentration is most likely lacking, and in ERPsim where the participant is totally involved in the process which gives more learning value. Being able to actively interact with the system does not mean that the usual learning methods are not needed. In fact, an amount of learning will be needed to understand the basics on how to use SAP and how to interact with it using its own language (Feldstein (b)). But that doesn't eclipse the fact that the most important thing to focus on within ERPsim is that the participants need to run their business, which increase their excitation and interest and therefore pushes them to talk and actively communicate to achieve their goals (Feldstein(b)).

The team work aspect in ERPsim is very important since the simulation requires the participants to actively cooperate and work together while using SAP as a tool (Feldstein(b)). It also teaches them how to carefully observe and make quick modifications to solve potential situations that may present themselves (Feldstein(b)).

2.3.3 ERPsim in a Corporate Use

ERPsim is used by Baton Simulation as a product for class based business games that run on SAP (Baton Simulation, 2009). According to Baton Simulation (2009) "Baton Simulations is a corporate simulations company specializing in assisting organizations with the challenges of SAP acceptance and appreciation as well as enhancing business acumen and breaking down corporate silos. Baton Simulations is based in Sydney, Australia and Montreal, Canada". The company depicts the use of ERPsim within companies as a training tool as being faster than conventional business games while being configurable to accommodate the different contexts and audiences that results that are expected (Baton Simulation, 2009).

Greg Taylor (2009) a senior consultant within the United Group Consulting reported that the use of ERPsim through Baton Simulation allowed the employees within his firm to enjoy learning about SAP while having fun and gaining a huge load of knowledge on the way that SAP can contribute to the entire business. In addition, he states that the simulation improved the employees learning curve and made them aware of the importance of working together in end-to-end processes (Greg Taylor, 2009).

Feldstein(c) stated that the ability of ERPsim to load any content depending on the need makes it very flexible with companies. Some firms said that they used it for upper management to get them accustomed to the SAP system, some other company affirmed that it is the perfect tool to start the work on its new system implementation, while another organization used it to correct the misconceptions and the lack of communication that its employees were making while using SAP (Feldstein(c)).

Baton simulation created a demo game or ERPsim that runs for around 2hours as a way to promote ERPsim within companies. To prove that ERPsim is making a difference in the participants involvement attitude, pictures and videos of the actual users (while participating in the demo) were taken while the simulation was running. The results were astonishing for the users who saw how enthusiastic and involved they were while using ERPsim (Feldstein(c)). In addition, the possibility of adjusting the game's difficulty and parameters depending on the participants performances contributed at making the game user friendly (Feldstein(c)).

2.3.4 Previous Studies on ERPsim Efficiency

Cronan et al. (2009a, 2009b) produced two researches on the topic of how ERP simulation is impacting both students and employees in regard to their knowledge, attitudes and skills. The authors used ERPsim as the simulation that allowed them to gather their data. In both studies the main purpose was to obtain the potential improvement that the participants displayed concerning their knowledge and reaction toward ERP. The studies were both done in two parts, before, and after the simulation to gather the potential improvement that happened due to ERPsim. Moreover, a 7 points Likert scale that ranges from 1 to 7 (1 being the lowest and 7 the highest) was used (Cronan et al., 2009a, 2009b).

The main factors that were used are (see Appendix C for more details):

- Enterprise Systems Management Knowledge (used in the surveys pre and post-simulation)
- Business Process Knowledge (used in the surveys pre and post-simulation)
- SAP Transaction Skills (used in the surveys pre and post-simulation)
- Attitude (used in the surveys pre and post-simulation)
- User Acceptance of IT (used only in the surveys Post-simulation)
- About the Simulation Experience (used only in the surveys Post-simulation)

2.3.4.1 Impact on Students

The research that was performed by Cronan et al. (2009a) included a total of 48 students in the 2008 spring semester with 35 usable responses (12 female and 23 males), and 68 students in the 2008 Fall semester with 47 valid responses (16 females and 31 males). The average age was 24,7 years for the Spring and 23,9 for the fall semester (Cronan & al., 2009a).

Concerning the survey's results, it was significantly clear that the ERPsim game allowed the ERP knowledge factors (enterprise systems management knowledge, business process knowledge, SAP transaction skills) to increase for both the spring and fall samples (spring increase was from 4.3, 4.5, 4.0 to 5.3, 5.4, and 5.2 respectively, while the fall increase was from 4.5, 4.7, 4.5 to 5.2, 5.2, and 5.2 respectively) (Cronan & al., 2009a). SAP transaction skills was the factor the saw the highest increase in both spring and fall samples alongside Enterprise systems management knowledge for the fall sample only (Cronan & al., 2009a).

Regarding the attitudes results and despite the already high results that were obtained before the simulation, the results post-simulation confirmed that the participants attitudes saw a change in favor of using simulation to grasp the concepts of and benefits of ERP systems (Cronan & al., 2009a). Although all the attitude factors increased between the pre and post-simulation, the SAP ease of use was the only significant increase that is worth mentioning (around 10%) (Cronan & al., 2009a).

The results regarding the participants perception of technology after the simulation showed that a significant improvement in performance happened, in addition to an increase in the users expectations following their participation in the simulation (Cronan & al., 2009a). The conclusion that was made is that participants had a very good and positive opinion about using SAP (Cronan & al., 2009a).

Cronan et al. (2009a) concluded that further research were needed to really assert how ERP simulations were being effective in a learning context, while suggesting to study their impact on change management in the future.

2.3.4.2 Impact on Employees

The main target for this research was employees that were hired for the first time in a large firm (Cronan et al., 2009b). The research concerned 3 batches of employees that were constituted by respectively 22, 29, and 20 employees (Cronan et al., 2009b). In addition to the initial survey an additional survey was made 3 months later on 2 of the 3 groups that were concerned.

The participants satisfaction concerning the ERP Knowledge factors showed a considerable improvement between the pre and post-simulation for all 3 batches of employees (Cronan et al., 2009b). As an example, the increase in the enterprise systems management knowledge, the business process knowledge, and the SAP transaction skills improved respectively from 3.8, 3.7, 2.6 to 5.3, 5.5, and 5.3 for the A sample (Cronan et al., 2009b). The SAP transaction skills saw the highest improvement in all 3 samples with an increase of 2.7, 2.7, and 2.1 for sample A, B, and C respectively (Cronan et al., 2009b).

According to Cronan et al. (2009b), all the attitude related factors excluding the ease of use for sample B displayed a consequent increase, which show how using a simulation as an exercise tool can contribute to the improvement in the way people see an ERP system (SAP in our case).

The IT acceptance by the participants across all the sample also displayed high scores concerning how IT can contribute in making their job easier, in addition of improving their knowledge of the system that they used (Cronan et al., 2009b).

The participants also considered the simulation they participated in as being a very good learning initiative that allowed them to learn some concepts about ERP, in addition to clarifying how SAP is to be used in a corporate setting (Cronan et al., 2009b).

The Follow up survey that was made after 3 months on both group A and B to assess how well the concepts that were learnt during the simulation were understood and remembered showed that the attitudes toward ERP and the learning drive are still very high within the participants (Cronan et al., 2009b). Despite the rather noticeable differences that the sample B showed compared to the relative stable sample A results between the simulation time and 3 month later, the attitudes toward IT (SAP in particular) was still very high (the differences that sample B displayed were probably related to the job environment) (Cronan et al., 2009b).

Cronan et al. (2009b) concluded their research by pointing to the evidence that ERP simulations are most likely having a tremendous effect on how people learn and behave when facing with an ERP system especially in the case of freshly hired employees. In addition, the authors point to the potential importance that simulation can have on change management, especially knowing how well the participants were responding with their positive attitude and high expectations towards SAP (Cronan et al., 2009b).

3 Methodology

This chapter will present the methods that were used in our thesis. Moreover, a detailed description of how we conducted our data collection is included.

In order to fulfill our requirements for answering our research questions we have done an extensive literature research, as well as the use of interviews with experts and surveys with the users of ERP simulations.

3.1 Qualitative and Quantitative Data

While writing a thesis there are two general types of methodology, which are the qualitative method and the quantitative method. These two methodologies differ in many ways, especially when dealing with how a researcher should proceed to find the answers to his/her research questions.

Ghauri (2005) describes research methods as ”the systematic, focused, and orderly collection of data for the purpose of obtaining information from them, to solve/answer a particular research problem or question”. Globally, the procedures are what separate qualitative and quantitative research methods as well as what is emphasized to get out of the study.

The qualitative method emphasizes on understanding and critically analyzing situations without bias from valid information with past experience of the research playing a large role in interpretation (Ghauri, 2005). This type of methodology is especially good when a subject has little past research done in that area and exploratory mind frame must be used to grasp new ideas.

Quantitative methodology differs greatly from qualitative methodology because it emphasizes and relies more on testing and verification, focuses on facts and hypothesis testing, and is generalizable to the population (Ghauri, 2005).

3.2 Primary and Secondary Data Collection

Primary and secondary data collections are two types of collected data that are used in the type of research that were mentioned before. The term primary data refers to information that is gathered by researchers, and that is unique to that particular study. Up until the publication of the study, no one else has access to this data. An interview is an example of this type of data (Ghauri, 2005). Secondary data refers to information that has already been gathered by other researchers and has been published in one way or another for a different purpose (Ghauri, 2005). In this paper, we used secondary data such as electronically gathered journal articles, theses from previous students, and books pertaining to this subject.

In our research, both types of data collection methods were used to come to our conclusions. By weighing what others have done and published, and comparing it to the data that we have gathered and experienced, we have come to our conclusions on the research questions that we have stated (Ghauri, 2005). Past theories and examples from past authors have pointed us in a steady direction, which has led us to make certain assumptions about what we thought we were to find. This, paired with our primary data

collection has reinforced our expectations on what we found. To get a better idea about the whole data collection process that we went through a Gantt chart can be found in Appendix D.

3.3 Choice of Method

Due to the fact that our research questions are the forefront of research regarding ERP simulations and their impact on users and companies during the ERP implementation phase, we have opted to use a combination of qualitative methods in a descriptive manner, as well as quantitative research methodology to answer our research questions. This way we can look at the past literature with the additional primary data collected and use those as puzzle pieces that will reveal a larger picture of ERP simulations potential effect on users and companies while implementing an ERP system. We have used surveys as well to gather information to be analyzed using statistical testing in order to find significance in our research.

The choice of qualitative data in the form of an interview allowed us to get more understanding on how ERP simulations function, in addition to putting the spotlight on how such simulations can effectively contribute as both a training and motivational tool. The quantitative data that we have gathered from our survey allowed us to study based on our sample the effect that ERP simulations (ERPsim in our case) had on the users knowledge and attitude towards ERP systems.

From a standpoint we wanted to see the effect of ERP simulations in their natural setting (the classroom or a training place), and use our past knowledge to sift through the processes that are used by these simulations with the literature we have found. Thereafter, we critically analyzed the pieces to find the important factors that influenced the effectiveness or ineffectiveness of ERP simulations in our context. This, coupled with the results from the quantitative testing, showed us, in more detail, how much ERP simulations influenced the ERP implementation phase from a training and resistance to change perspective.

3.4 Interview

In our paper, we used a qualitative approach of primary data collection through the method of interviews. There are two types of interviews: structured and unstructured (Ghauri, 2005).

A structured interview is one designed around predetermined fixed response categories with a standardized format of attaining such responses (Ghauri, 2005). This can be done by establishing questions before the interview with the intent of obtaining answers to these and only these questions.

Unstructured interviews can be described as allowing the respondent to freely react to particular issues by stating their opinions and behaviors while the interviewer leads the interview in the direction of information that the researchers need for their study (Ghauri, 2005).

We chose for this study to use unstructured interview methods. To ensure an optimal understanding of ERP simulations, their functioning, and their potential benefits, we decided to interview a trained and certified ERPsim operator, Jonas Klingberg, who works at the Centre for Business Solutions in the School of Business, Economics and Law,

University of Gothenburg. For this interview, a series of open-ended questions that were meant for him to answer were prepared, with the purpose of giving him a total freedom to express his opinions and insights to us in an unrestrictive way. Those questions were mainly designed to provide accurate hints on how ERPsim contributes to both users and companies during ERP implementation, and then use them to answer our research questions.

The interview duration was planned to be between 60 and 90 min. Moreover, after acquiring his approval, a full audio recording of the whole interview was made, which allowed us later to provide a detailed summary transcript that was used in our result and analysis parts (Interview summary can be found Appendix A).

This interview allowed us to gather more detailed information about ERPsim that only an expert could have provided us with. In addition, his expert opinion on several points that were critical to our thesis helped us understand the problem at hand in a deeper way.

3.5 Surveys

To complement our literature review of ERP simulations, and the interview that we had with an ERPsim expert, we chose to use surveys and administer them to the students who were to play the ERPsim game in class. The surveys were taken before and after the simulation to gauge how ERPsim influenced their user's knowledge, skills and attitude.

The surveys that we used were slightly modified versions of previous surveys that were used in two other studies that were conducted by Cronan et al. (2009a, 2009b). We contacted the authors of the original survey, and were awarded permission to use the same criteria that were used within them (Personal Communication, 2010-04-27) (The Original criteria definition can be found in Appendix C). Since the version of the game that was played before us was the lighter and shorter distribution game (the original surveys were designed for the more complex production game), the modifications that were made on our surveys were mainly targeting the omission of four questions that were production related. Both surveys (the pre and post simulation) contained the same parts (mainly about the simulation results and the user attitude), with the post simulation survey having additional sections that were related to the users acceptance of IT, and their global opinion about ERPsim as a whole (a survey sample can be found in Appendix B). We also saw in using the lighter distribution game a unique opportunity to compare the results that we got with the results that Cronan et al. (2009a, 2009b) obtained with the more complex production version of ERPsim (this comparison was probably by no means analyzed before).

The survey questions (Appendix B) were formulated in a clear and straightforward way to make the task easier for the participants. All the questions that were related to the ERP simulation were using a 7 point Likert scale, ranging from 1 to 7, with 7 being the highest grade that can be attributed and 1 the lowest.

The surveys were uploaded to a web-based survey tool (Google Docs), and the links to these surveys were posted on the academic server available to the participating students at Gothenburg University. The choice of the Google Docs platform allowed us to collect the data (the different scores that the participants gave to each factor) in a preformatted table that was afterwards exported to a Microsoft Excel file.

To administer this survey we were invited to Gothenburg School of Business while ERPsim was to be played as curriculum for an undergraduate class. The simulation was planned at 8 am in the morning in a school lab. We were present while the instructor, Jonas Klingberg, split the participants into 6 groups, introduced us, and then asked the class to login to the school server to take the pre-simulation survey. The next step that Klingberg made was to introduce ERPsim to the participants, then he started explaining to them how it works, and how they should use it. Afterwards, He started the simulation, and then invited each group to start working on their respective computers. Each group had his own SAP session where it could make transactions and take decisions based on the real time feeds that the simulator was giving through SAP. After the class played the ERPsim distribution game, Mr. Klingberg asked the participants to take the post-simulation survey after it was finished. This concluded the teaching session and the students were dismissed

The data taken from the surveys and that was already in the excel file extracted before was analyzed using SPSS where we used t-tests to see if there was a significant difference in opinion and proficiency before and after ERPsim was played. Only the fully filled questionnaires (All questions answered) were included, and hence were considered as being valid for analysis.

3.6 Selection of Sample

To gain access to people with knowledge of ERP simulations and the value of the simulator that they are built on, we went to interview Jonas Klingberg at Gothenburg School of Business, Economics and Law. We also decided to administer surveys to other persons (students) who were attending the simulation training classes to better understand their point of view of the whole process of simulation and aspects of their professional lives concerning ERP systems.

The sampling type that we used can be considered as a convenience sampling since we selected the participants that were available to us at the moment. The students that participated in our survey were 24 and were all bachelor students from two different schools (Gothenburg University and Chalmers) with different backgrounds and majors. In addition, they didn't have any previous knowledge about ERPsim or SAP. From those 24 participants 19 filled the survey with 18 responses deemed valid for analysis. The 5 who didn't answer our survey were from Chalmers and couldn't login to the system in the Gothenburg School of Economics (they didn't have a login), while the other rejected response had a missing answer.

3.7 Dropout

When conducting primary data collection there tends to be data that slips through the cracks and end up not being collected; this is known as dropout. There exist two types of dropout: variable and entity.

The first type, known as the variable dropout, occurs when a question or bullet point is not answered making the survey or interview incomplete. The second type, known as entity dropout occurs when the participant's numbers are inefficient or they do not want to participate in the study. When this happens, it skews the data to not represent the population that the sample was taken from. While the survey was being administered to the students who were attending the ERPsim the choice was given to them of whether or

not to fill out the survey. Sufficient time was allotted to them to take both the pre and post surveys but our data shows that not everyone chose to fill them out. We experienced both variable and entity dropout in our surveys. Part of the problem was because some students were not being able to log into the school's servers because some students were visiting students from another university.

3.8 Method Valuation

Objective answers to the research questions are always the goals in any study and to achieve these answers the researchers need to emphasis on two factors in their research design: reliability and validity.

3.8.1 Reliability

Cohen et al. (2000), defines reliability as "a synonym for consistency and replicability over time, over instruments and over groups of respondents". This means that researchers can replicate this study repeatedly and still get the same results every time as long as the same methodology is followed and that the results are generalizable.

This study will attempt to keep the findings reliable by using empirically reviewed theories and articles pointing this research in a reliable direction while adding our input with the data we are to collect.

3.8.2 Validity

The validity is determined in many ways, namely construct, descriptive, but the two overall types of validity are internal and external (Ghauri, 2005).

If a study has internal validity then it can purport that the relationship between variables are causal (Ghauri, 2005). This means that one variable in a study has a direct cause to the other and not a merely correlational relation.

External validity refers to the extent that the findings of the research are generalizable to the sample that is being studied in terms of particular persons, settings and times (Ghauri, 2005). Accordingly, if a study has external validity then the results are generalizable to the population the sample is taken from.

In our study, we attempted to keep the internal and external validity by establishing true measures of the successfulness of ERP simulations by relating what we found to preexisting knowledge. We are aware that using a convenience sampling doesn't allow us to obtain generalizable results since it doesn't represent the general population in a sufficient manner. Nevertheless, it is in our belief that the nature of the sample used (Bachelor students who are potential future employees in big companies) allow us to at least generalize to a certain extent to the student population, while giving us also a possible glimpse at the possibilities of ERP simulations when applied to our context. We have to point that considering students as ERP simulation users and not as student using ERP simulations is what allowed us to extrapolate to some degree our results to the population at study. We used a modified version of a survey which has been peer reviewed and published. By using this survey, we hope to maintain our internal validity and with the internal factors of our study being performed as well as we can we hope to keep the external validity high and provide valuable information to the business world in regards to using ERPsim as an education tool.

4 Empirical Findings

This section presents the empirical findings that we obtained from both the interview that we had, and the survey that conducted about ERPsim.

4.1 Interview

We had our interview with Jonas Klingberg who works in the Center for Business Solutions in the School of Business, Economics and Law, in the University of Gothenburg. The interview was held on Wednesday, seventh of April 2010, and took around 60 minutes to be completed. A detailed summary of the whole interview can be found in the appendix A.

Klingberg pointed that ERPsim was conceived in the first place as an educational tool with no real planning to be used as an ERP implementation tool. He adds that ERPsim was more used at a later stage (after the implementation) to help the participants improve their understanding of ERPs (SAP in our case), and their respective organizational systems. In the events where he has shown ERPsim to companies that already implemented SAP, the feedback from them was very positive and the interest they displayed in such approach was very high.

Klingberg pointed that the main complexity resides within users and their acceptance of SAP as a tool. According to him, change management is very important and convincing the potential users to accept a new system is rather hard and time consuming. The first impression that users have when dealing with the SAP system is very important. Hence, allowing the users first contact with the system to be fun, enjoyable, and challenging allows them to evacuate any negative thoughts they had about the system, and let them work in a less stressful environment (that may have originated from SAP complexity and lack of attractiveness to the new user). As it is, ERPsim is not designed to be very deep in its functioning, and therefore would be perfect as a tool to give users confidence and interest in SAP, which is very important before introducing them to more complete and conventional trainings.

On the question of whether simulation learning is better than the conventional one, Klingberg believes that instead of talking about one or another separately we should talk about combining the two to achieve maximum efficiency. In addition, using only simulations for all the company processes is time consuming and not cost effective, while combining both approaches gives us the best of both worlds.

From an educational point of view, Klingberg explained how ERPsim could be used in different contexts depending on the student's backgrounds and the course undertaken. In fact, ERPsim could be used as an introduction to ERP systems to illustrate the basic concepts that are usually unknown to new students (especially at the bachelor level), but also the data that was extracted from the simulation game could also be used in a Business Intelligence course where the participants can analyze their own results and get corresponding conclusions about their work.

On a more professional note, Klingberg pointed to the work of Harvey Feldstein and his company Baton Simulation in using ERPsim as a training tool within companies. This work produced very positive echoes from the events where it was used and displayed. Our respondent also added that ERPsim is fully usable within companies, he also gave

the example of the production game (the Müsli production) that can be used by any manufacturing company since it follows the traditional processes that are generally used. Another positive point according to him is that the simulation game allows different participants with their distinct backgrounds to participate and blend in. The example he gave was of IT people and management people and how the simulation game allowed each one to better understand the impact and the role of everyone on the company work. In brief, it allows the management people to better understand what IT people are doing and vice versa, which leads to a much better team work since the number of tasks that have to be done simultaneously while the simulation is running requires a good communication and understanding between the different team members. In addition, ERPsim allowed some people that were against SAP (or any other ERP) to change their opinion by testing the system themselves in a near real simulated environment.

When asked about the participant opinions and attitudes towards the simulation games, Klingberg answered by exposing how the simulation game got the highest grade in the course evaluation, in addition to the student's comments on how the game allowed them to understand the different ERP concepts that were taught to them in class.

To conclude Klingberg insisted on the fact that using ERPsim makes the participants forget that they are using SAP because they are more concentrated on wining the competition against the other teams. This makes SAP just a tool that participants use to achieve their objective, which in theory should also be the same when they are using it in their companies.

4.2 Survey

There were 24 students from two different schools (Gothenburg University and Chalmers) who participated in the ERPsim game that we attended to. From those initial participants, 19 of them chose to answer our survey, with 18 valid responses that were suitable for analysis. The average age of the respondents was 24,1 year with a population comprised of 10 males and 8 females. All the participants were bachelor students, with very diverse background (9 different specializations), and very little knowledge about ERP systems according to Klingberg (Personal Communication, 2010-05-06).

Table 4.1 - ERP Simulation Results

ERP Simulation	Sample Size	Pre-Simulation mean	Post-Simulation mean	Difference	t-test	Significance	Evolution
Enterprise Systems Management Knowledge	18	3,1	4,3	1,1	4,689	,00	36,09%
Business Process knowledge	18	3,1	4,0	0,9	6,577	,00	28,11%
SAP Transactions Skills	18	1,2	3,4	2,3	7,664	,00	188,37%

Table 4.1 presents that data that we collected concerning the knowledge related to the ERP simulation in its Enterprise Systems Management Knowledge, Business Process knowledge, and SAP Transactions Skills parts. In fact, the simulation results showed an increase for those 3 previous parts from 3,1; 3,1; and 1,2 before the simulation to 4,3; 4,0; and 3,4 after the simulation respectively. The highest increase was for the SAP transactions skills with a 188,37% increase between the pre-simulation and the post-simulation results followed by the ES management knowledge with 36,09% increase and the Business process knowledge with a 28,37% increase. This data from the surveys were also analyzed using t-tests to determine if the differences were statistically significant. We used paired t-tests and the results showed that all three measured factors had a significance level of less than 0,000.

Table 4.2 - Attitude Results

Attitude	Sample Size	Pre-Simulation mean	Post-Simulation mean	Difference	t-test	Significance	Evolution
Attitude about SAP	18	2,6	4,1	1,5	8,098	,00	58,70%
Attitude about SAP ease of use	18	2,0	3,6	1,6	6,985	,00	80,56%
Attitude about integrated business processes	18	4,3	4,6	0,2	0,679	0,495	5,13%
Attitude about Enterprise Resource Planning	18	4,2	4,7	0,5	1,638	0,12	11,84%

Table 4.2 describes the attitude results of the different participants concerning ERP systems. For the attitude about SAP the values increased by 58,7% from 2,6 before the simulation to 4,1 afterwards. The Attitude about SAP ease of use saw its values increase by 80,56% from 2,0 before the simulation to 3,6 afterwards. The Attitude about integrated business processes values went from 4,3 before the simulation to 4,6 afterwards with a 5,13% increase. And the Attitude about Enterprise Resource Planning had a 11,84% increase in its values from a 4,2 before the simulation to 4,7 afterwards. The T-test significance level for the attitude about SAP and attitude about SAP ease of use was less than 0,000, while for the attitude about integrated business processes and the attitude about enterprise resource planning went up to 0,495 and 0,12 respectively.

Table 4.3 - User Acceptance of IT Results

User acceptance of IT	Sample Size	Post-Simulation mean	Min	Max
Performance Expectancy	18	4,8	3,75	6,25
Effort Expectancy	18	4,4	3	5,25
Attitude toward using Technology	18	4,6	3	6,25

The user acceptance of IT results (Likert scale based) are displayed in Table 4.3. The mean result for Performance expectancy after the simulation was done was 4,8, with a 3,75 as a minimum value and 6,25 as a maximum one. For the Effort expectancy, the post-simulation mean was 4,4 with a minimum value of 3 and a maximum of 5,25. The Attitude toward using Technology had a post-simulation mean of 4,6 and recorded 3 as a minimum result and 6,25 as a maximum one.

Table 4.4 - About the Simulation Experience Results

About the Simulation Experience	Sample Size	Simulation Experience Mean	Min	Max
The ERP simulation was a worthwhile learning experience	18	5,3	2	7
I learned about Enterprise Resource Planning as a result of the ERP simulation	18	4,8	2	7
I learned about SAP as a result of the ERP simulation	18	4,9	3	7
I learned how to use SAP to accomplish business processes as a result of the ERP simulation	18	4,4	2	6
SAP is a great system to accomplish integrated business processes	18	4,0	2	6

Table 4.4 represents the participants opinions about their simulation experience after using ERPsim. The average score obtained for "the ERP simulation was a worthwhile learning experience" question was 5,3 with a maximum score of 7 and a minimum of 2. For the "I learned about Enterprise Resource Planning as a result of the ERP simulation" question the mean score was 4,8 with a maximum score of 7 and a minimum of 2. The "I learned about SAP as a result of the ERP simulation" question had a mean score of 4,9 with a 7 as a highest value obtained and 3 as the lowest. Concerning the "I learned how to use SAP to accomplish business processes as a result of the ERP simulation" question the mean score was 4,4 with 6 as a maximum score and 2 as a minimum. Finally, the mean score regarding the "SAP is a great system to accomplish integrated business processes" question was 4,0 with a 6 as highest score and 2 as a lowest.

5 Analysis

In this part, we will analyse the data that we obtained with the use of the theory that is present in the frame of reference in an effort to answer the research questions that were stated in chapter 1.

5.1 How Can ERP Simulations Help Users to Better Understand an ERP System

Let us compare the results of our survey with the results that were obtained by Cronan et al. (2009a, 2009b) in regards to ERP knowledge. This assessment is vital to our analysis since it will allow us to compare our own results with the results that were obtained by two similar surveys that targeted both students and employees who were participating in an ERP simulation game. Our survey (Table 4.1) has demonstrated that ERPsim contributed significantly in the improvement of the Enterprise Systems Management Knowledge, the Business Process knowledge and the SAP Transactions Skills. This is corroborated by Cronan et al. (2009a, 2009b) researches, which have also shown a significant improvement for the same factors in comparison to our results. Our participant's lack of background knowledge concerning enterprise resource planning systems can justify why our general scores were not as high as the one in Cronan et al. (2009a) research (where students were involved), while being more similar to the results in the Cronan et al. (2009b) employees survey (employees had limited ERP knowledge). In addition, the fact that the simulation game in our survey was the shorter and less complex and complete distribution game (in comparison to the Production game that were used by Cronan et al. (2009a, 2009b)) most likely contributed to a less knowledge acquisition by the participants.

Still, while the differences between the pre and post-simulation scores were similar for the Enterprise Systems Management Knowledge and the Business Process Knowledge between our research and the Cronan et al. (2009a, 2009b) research, the spectacular 188,37% increase in the SAP Transactions skills (with the mean score jumping from an abysmal 1,2 score to a near average 3,4 between the pre and post-simulation) in our survey clearly shows that ERPsim had the most impact on our participants when they had to deal with tasks that were designed to polish the abilities and skills that were related to SAP manipulation. We need to note that even in the Cronan et al. (2009a, 2009b) researches, the SAP participants skills was the factor that had the bigger increase in the ERP knowledge section, which points to the positive effect that the simulation had on the participants ERP skills acquisitions.

The positive impact that ERPsim had on the participants ERP knowledge validates what Parush et al. (2001) affirmed about the impact that simulations have on teaching complex and dynamic systems (in our case ERP systems). In addition, the fact that this improvement happened in a half a day simulation event also shows that the time reduction in the learning process is significant like what Parush et al. (2001) affirmed. We can say based on our results that ERPsim as a simulation succeeded in allowing its users to improve their knowledge and understanding of ERP while also enhancing their ERP software technical skills (SAP in our case), which ultimately proves that ERPsim correctly satisfied the objectives that Léger, (2006) set for it.

In a way, ERPsim as a simulation also satisfied that 3 points that Ben-Zvi & Carton (2008) set as a basis for business games effectiveness in education. Those points were the direct application of theoretical concepts (which improves logic and reasoning), the involvement in decision making, and the user independence development. It seems pretty clear to us that ERPsim as an ERP simulation have enabled its participants to improve their grasp on basic ERP knowledge in an efficient way and in a very short period of time. We also believe that our participants would have gained even more understanding of the ERP system they were working on (SAP in our case) if they had the opportunity to play the more complete and sophisticated production version of ERPsim. We are confident that ERP simulations like ERPsim have potential as a tool to give prospective ERP users a clear view and useful knowledge on what an ERP system is and how to actually use it.

5.2 What is the Potential Impact that ERP Simulations Have on a Company that is Implementing an ERP system?

5.2.1 In Regards to Training

Bradley & Lee (2007) explained the extreme importance of training during the Implementation stage which according to Motiwalla & Thompson (2008) is one of the major stages of an ERP system life cycle within a company. In addition, according to nah et al (2001), training alongside site support for managers and employees are absolutely required to understand and grasp the changes and additions that were introduced to the company by the new ERP system. In the previous section, we established how ERP simulations are able to provide the users (in that case, students) with a much-needed knowledge in ERP systems.

The research that Cronan et al. (2009b) made about first time employees experience with ERPsim has shown that their level of ERP knowledge increased in a significant manner after participating in the simulation. Moreover, the second part of Cronan et al. (2009b) research which happened 3 months after the first simulation displayed positive results in knowledge retention and the use of IT. It also showed that despite the slight decrease in the overall scores, ERPsim had a noteworthy influence on the participants knowledge even after some significant amount of time. This is a strong indicator that simulations can be a very effective tool in training employees on ERP concepts especially since it allows them to clearly remember and use the knowledge they acquired within their actual job.

Harvey Feldstein with his Baton Simulation initiative is someone who understood the importance that simulation can have on the training procedure. He stated that the polyvalence that ERPsim display in content loading for example makes it very flexible for any company, and hence it can be used by all the level of the hierarchy to satisfy their respective training needs (Harvey Feldstein(c)). The echoes from potential users like Greg Taylor (2009) clearly show that companies can benefit from using simulators to train their own employees in the ERP field. We see the opportunity to train directly on the actual system as a bliss for employees who instead of wondering how the new system works will be able to actually learn how on use it in a simulated environment.

We need to precise that the kind of knowledge that ERPsim provides is not very deep in comparison to more conventional and traditional methods. Klingberg pointed to this fact by emphasising that ERPsim is not very deep in its functioning and would be instead a

perfect tool to initiate users to ERP systems before introducing them to deeper and more conventional trainings. In addition, when asked about whether to choose between simulations or conventional learning methods, Klingberg affirmed that due to the relatively high cost of simulations it is better to combine them with more classical learning approaches to attain a maximum level of user knowledge acquisition.

On the matter of training satisfaction, both our survey (Table 4.4) and Cronan et al. (2009a, 2009b) researches have shown that the participants displayed very good satisfaction scores after participating in the simulation. The mean scores for all surveys were largely above average and the majority of the participants displayed a high satisfaction concerning the simulation value as a training tool, the ERP knowledge they acquired through the simulation, and how they can use that knowledge to better work using an ERP system (SAP in the case of the surveys concerned). Klingberg also pointed to the high satisfaction scores that the simulation had within the students that participated in it in comparison to other parts of the course. According to Bradley & Lee (2007), training satisfaction is very important for a training initiative success, and training in general is essential for any ERP implementation. They also added that the more employees are satisfied of their training the more usefulness they will display while working on the new system.

It seemed to us that the current use of ERPsim is mainly restricted to an introduction role rather than a tool that is constantly used for training and knowledge acquisition. This doesn't hide the fact that ERPsim provides a very solid basic training educational platform. This kind of platform is for us perfect as a training initiative while implementing an ERP system. Moreover, and since according to Bingi et al (1999), a significant percentage of employees can't handle demands on their new ERP system due to their lack of training, we believe that using ERP simulations to help them train on the new system that is implemented is a great opportunity to reduce the time needed for them to start using the system both efficiently and effectively while experimenting how they will be working on it. We are also aware that a more advanced and complete training in conjunction with ERP simulation activities is mostly needed to really provide the employees with the guidance that they require, which ultimately will lead to make the training part in the ERP implementation phase a success.

5.2.2 In Regards to Resistance to Change

Having a good knowledge on how an ERP system works is not enough to make a person motivated enough to use it. The results that we obtained in our survey regarding the participants attitude towards ERP system before and after the simulation clearly pointed that their attitude towards SAP and its ease of use improved significantly between the pre and post-simulation. Table 4.2 shows that the increase was of 58,7% for the attitude about SAP and 80,56% for the attitude about its ease of use, with their respective average score increasing above average after the simulation. We consider this as a strong argument to support that an ERP simulation (ERPsim in our case) contributed in making an ERP system (SAP in our survey) more attractive to user, and therefore contribute in dissipating any negative thoughts they may before had about the system.

Nevertheless, the attitudes results about the integrated business processes and Enterprise Resource Planning saw very little improvement, while the T-test significance results (0,495 and 0,12 respectively which are above the accepted 0,1 threshold for Paired T-test) indicate that ERPsim had almost no significant effect on them. We believe that this

result leads to the conclusion that to really influence the participants about a specific ERP system, a well targeted ERP simulation with a specific emphasis on a particular ERP is needed.

The Cronan et al. (2009a, 2009b) research results are also supporting our view on the positive impact that ERP simulations have on the participants attitude toward ERP systems. The results that were obtained were very similar to ours especially for the first time hires (Cronan et al., 2009b), while the student results (Cronan et al., 2009a) showed less impact on the attitude (albeit with very pre-simulation attitude results). We believe that the explanations to those differences lie within the lack of ERP experience in our sample.

The post-simulation "user acceptance of IT" results that we obtained (Table 4.4) were way above average for the performance expectancy, effort expectancy, and attitude toward using technology. Our results were slightly lower than the ones obtained by Cronan et al. (2009a, 2009b), but still show that ERPsim had an impact on how people see technology both as a tool to work with and as a facilitator in their daily activities.

We saw during the ERPsim session that we assisted to, how the participants were responding to the simulation they were using. We saw their attitude change from a nonchalant facial expression where a potential lack of interest can be spotted, into a smiling and fully invested appearance. It was obvious for us that ERPsim enabled them to really enjoy using SAP while learning, which is rather astonishing knowing the complexity and lack of appeal of ERP systems. This observation join Klingberg view that he stated in the interview that we had with him. We think that this positive attitude is stemming from the spirit of competition and continual challenge that ERPsim provides, which pushes the participants to do their best to win, while enjoying at the same time the tasks that they have to do without even noticing that they were working on a complex ERP system, which join Feldstein(a) opinion on the matter.

Resistance to change by employees is obviously a big issue that can face any company during an ERP system implementation phase as stated by Ross & Vitale (2000) and Zairi & Al-Mashari (2001). ERP simulations seem to have some potential positive effects as a tool to reduce such resistance. Employees are evidently afraid of changing their usual habits, and fear of a new system complexity can lead them to use it in wrong way or even boycott it in the worse situation like what Ross & Vitale (2000) described before. We think that using ERP simulations can be perfect to make the employees aware of the new system to be used. Allowing them to experience the benefits of an ERP system in a fun and regulated environment (the simulation) will dissipate the potential fear and untrustworthiness they were harbouring. And as Ben-Zvi & Carton (2008) have stated, ERP simulations can motivate people more than conventional methods that retain the reputation of being boring. To complement what Klingberg said, letting the employees try by themselves the system while at the same time competing with each other will make them get used to the system, and enhance their team work.

6 Conclusion

This section will present the main conclusions that we draw from our research in an effort to answer the research questions that we formulated previously.

The main purpose of the thesis was to study the potential effect that ERP simulations have on the ERP implementation phase. This was done by first studying the impact that those simulations may have on the user's ERP knowledge and understanding of the ERP system, and then by using the knowledge gained to study how they can affect the training and the resistance to change factors within a company seeking to or implementing an ERP system.

This allowed us to answer the research questions that we formulated earlier:

Q1: How can ERP simulations help users to better understand an ERP system?

ERPsim looked as an adequate tool to teach and acclimatize people with ERP systems, despite being not very deep, and not covering all the aspects that can be found within an ERP system. This can be corrected by using more complete simulations that would cover more ERP functions and would most likely provide more value and satisfaction to their users. In addition, ERP simulations are very appropriate tools to be used to efficiently introduce ERP systems to potential users and sharpen their ERP related skills.

Q2: What is the potential impact that ERP simulations have on the training and the resistance to change factors when a company implements an ERP system?

Our study has displayed some promises for ERP simulations as a tool to help in training and resistance to change. For training, the main advantages were the reduced time required to acquire knowledge, and in the content that is made available to potential users. Moreover, a combination that would use both ERP simulations and conventional trainings had encouraging insights as an adequate formula to get a better learning experience. For the resistance to change part, ERP simulations displayed some potential as tools to fight resistance to change in an ERP system implementation phase by both providing attractive training opportunities, and presenting complex ERP systems in a fresh, fun and attractive way to employees.

It is very important here to note that since we have considered our sample size to consist of ERP simulation users (students in our case) we cannot generalize the results towards a company context. With regards to the research question at hand we have been able to touch upon the positive presence of the factors under investigation as insightful indicators towards the expectation on implementing an ERP system in a companywide context. However, it is understood that these results need to be investigated further with a much larger sample size that is representative of companies to either confirm or deny the elements that have been identified in this study on the potential effect that ERP simulation can have on ERP implementation.

We consider that this thesis contributed to the academic work by highlighting the potential positive effect that ERP simulations may have on the user's knowledge, in addition to give a glimpse at their possible benefits on ERP implementation.

7 Final Discussion

7.1 Reflections

Despite all the effort that we made while working on this thesis there were obviously some events and limitations that may have affected the general outcome of this work.

The fact that ERP simulations are such a new trend, and are still not very used especially in Europe made our work a bit hard. The only tool that we could find and that was widely used to a certain extent was ERPsim, and our search for some similar tools was unfortunately vain. Our initial goal was to have a big population of ERPsim users to be able to obtain more accurate results. The problem that we faced is that while ERPsim is widely used in North American universities, it was only used in two universities in Europe with one being a Russian university and the other one being Gothenburg University. This forced us to only pick up a convenience sample instead of a more generalizable one. We believe that if we had the opportunity to have a bigger population we would have definitely obtained more accurate and generalizable results.

Another limitation that we faced is the scarcity of academic references dealing with ERP simulations in general and ERPsim in particular. The amount of references about the simulation field is undoubtedly huge, but the particular context of our research (ERP systems) required academic articles that were more to the point. This made our data collection difficult, but we still overcame this problem and we were lucky to find references that were rich of substance and that helped us in achieving our goal.

We believe that if we could gain access to a company that would be willing to use ERPsim while implementing an ERP system, and then compare the outcome of conventional methods with ERP simulations we would most likely obtain even better results. Still, doing so would require more time than what we had, and it would also require the cooperation of several players and the use of resources that we wouldn't have been able to obtain.

Working with this particular topic was not an easy task, we had never heard of ERP simulation before we started on this thesis. Nevertheless, the topic seemed very interesting to us, and pushed us to really investigate and understand it. We know that there are different ways to approach such a topic, but we believe the way we handled it was good.

7.2 Suggestions for Further Studies

It is in our conviction that the further studies potential of ERP simulations is huge. In fact, there is so much to learn about their use in ERP implementation that a single master thesis would most likely not suffice. Some potential topics that could require some additional include:

- Comparing Different ERP simulations tool that may be available in the future
- How to design an ERP simulation that would be specifically adapted to the ERP implementation context
- A comparative study between the effectiveness of ERP simulations and conventional methods within companies implementing an ERP system
- The other effects (excluding on training and resistance to change) that ERP simulation may have on users and companies.
- A full comparison between the effectiveness of the ERPsim production version and Distribution version

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Appendices

Appendix A – Jonas Klingberg Interview

JONAS KLINGBERG: We should start from the beginning describing what ERPsim is just so there is no misinterpretation. ERPsim was developed by the HEC Montréal. That's in Montreal business school. So this is from the beginning something that was thought of as an academic tool not for ERP implementations

There is a guy that's closely connected to the guys in Montreal that developed this, (who's) called Harvey Feldstein, and he had been using simulations and business games on the consulting side earlier. So he started what is called Baton simulations, and started to use this commercially. To my knowledge what it has been used for as of today is not really during the implementation phase but as at a later stage to increase the understanding and the actual knowledge of the systems in organizations that has perhaps spend a few years in SAP and realized that I haven't gotten as far as they wished to go basically. During the fall I, in addition to the academic work, I also visited a lot of companies in Sweden and had events with ERPsim. Only SAP customers of course and only customers that had already to some extent implemented SAP but they were really enthusiastic about it and really interested and wanted more. So there is a definite need to really train the uses and really gain the acceptance of the systems because it's a really [unattractive] system if we look at the graphical user and race and the subpanel everything.

A lot of the difficulty is definitely on the user side and definitely in the change management side. How the users are convinced to do their best with the new system because it's a new system [and] it takes more time. And their supposed to. If you have a parallel implementation like you run both systems in parallel at some time they're supposed to do their own tasks and the old system at the same time.

I had a conference with the Swedish SAP user group in November where they were almost a thousand participants from different SAP user companies from Sweden and I had to think real hard because I was going to present what we were doing then and I had to think really hard: where would this be really appropriate to use, in what stage and in which departments and everything and what I've come to see is that it's change management and it's that initial phase. The first time the users get their hands on SAP we need to make it fun, to make it interesting, challenging and try to immediately get them across this kind of low confidence level that is often associated with SAP because it's so complex. We need to get them confident enough and then you can move on to more specific training because ERPsim is not deep in that way. You can go out and work during the next couple of days after having played ERPsim with your own task but um it's an enabler of a better result of the training that is to come basically.

AMINE ALOUAH: Do you believe that simulation learning, like an introduction to simulation can be better than conventional learning?

JONAS KLINGBERG: Oh definitely. But it needs to be combined with traditional learning as well because you could use simulated learning for all parts of the company of course but it takes too much money, too much time to develop those simulators. I mean ERPsim is, to my knowledge, the only business simulator directly coupled within

real a ERP system on the market today. So at present the question should not be simulation or traditional, it should be traditional or combined.

AMINE ALOUAH: When did you start using ERPsim in your school?

JONAS KLINGBERG: We had our first ERPsim actually around November but I had run it commercially since September/October or something. So we're really new to it as well. We're the only school in Sweden that uses it and that is one in four in Europe that uses it, one of four certified trainers.

AMINE ALOUAH: What is the optimal amount of time or educational background that is required to make users able to take this ERPsim as a simulation?

JONAS KLINGBERG: Actually we've come to find that there are a lot of courses that you could use it in emphasizing different things. I mean we've used it on the masters level to illustrate and visualize what enterprise systems are, what is integration, also used it for business intelligence classes or we will use it for business intelligence classes by actually downloading data from the game and having them in business intelligence tools and analyze how they played and why the result was, why it was. That's the top end, we've used it in master's classes with great results but we also see we can use this in the very first class for those in the bachelor program cause many students now come to this school and don't know what a process is; they don't know actually what a business is. And they go perhaps 6 months, a year, two years without [knowing]. They hear all these words but they don't really understand what it's all about so we've seen that this could actually be something that we do within the first couple of weeks of their bachelor program. They need some sort of ERP class, but that could be one lecture: this is ERP systems; this is actually what is out there. It's good in this way; it's good in that way. It's bad in this way. Now we're going to play, you're going to use and ERP system, you're going to follow the whole process.

AMINE ALOUAH: Does ERPsim cover all modules in SAP or are there limitations?

JONAS KLINGBERG: What we do is that we have four major processes basically. We have planning, we have procurement, we have production, and we got sales. The modules we're moving in and out of is the logistics module where they build the materials and everything. We're moving in the sales and distribution of course.

AMINE ALOUAH: Do you use virtual machines to....?

JONAS KLINGBERG: Both the original SAP client and our ERPsim client are installed in Germany, but we have a remote, we have a server here that we use to access those servers because, otherwise, we would have to install SAP on every computer.

JONAS KLINGBERG: Okay so we move basically in the logistics module where we got all the materials management, the sales and distribution, production, logistics execution and all that, um, so no, we don't. We never mess with the accounting because all of that is done automatically. We never have any HR or anything like cause the objective is money of course.

JONAS KLINGBERG: So it's mainly the logistics module and of course the module is

not really in SAP, it's material management; it covers a lot.

AMINE ALOUAH: What is your opinion on the use of simulation gaming as a training tool for companies?

JONAS KLINGBERG: yeah, I mean, what we've seen in the US, Australia, where Harvey, Baton simulation have run it, it's seen very positive feedback and the events we've had here as well have also received great feedback. What we've done is that we've offered a half day free event to get the word out and they've all used surveys at the end of these events that we've asked if these things would be valuable to your organization and they say, "definitely," cause in all organizations that use SAP. It's very common that the attitude towards SAP is not that good.

AMINE ALOUAH: Do you think ERPsim, as it is used right now can be used efficiently by companies?

JONAS KLINGBERG: As it is, there are two games now that you might be aware of. There's a distribution game where you sell bottled water and there's a musli game where you sell and produce musli. The musli game can definitely be played by a manufacturing company without a doubt because that's the standard process of any traditional company. Basically the traditional customer of SAP because SAP originates from an old MRP system so I mean even though the products differ from what you're actually doing the processes and the appearance, the interface of the system is what they see on the day to day basis. Yeah, definitely. It can be used in so many ways; it's all about the purpose; it's to train the trainer and the users. First exposure to SAP is something that can be a half day event or a full day event to basically wipe all the negative attitudes off the table and enable further training with much better results. It's also a way of forming a project group, My final point I want to make is that I've played it in groups where that were divided between business people and IT people, IT management and architects and everything like that and what you can see is that they get a whole new understanding of each other and that's one of the most crucial things and that's what we're trying to do in class. We tell business students that you have to know some IT because you have to talk to the IT people to get what you want and that's become very apparent when I visit companies that have they said that: "now I actually understand what that business man is trying to tell me when he asks for something," and vice versa. I had an architect who said that, before the game he said that "I have a personal policy of never using SAP. I work with the integration of SAP with the legacy systems and designing new transactions and everything but I've had a policy of never starting SAP." It took like half an hour and he was laughing and enjoying it. He was really into it. And then it could also satisfy the needs of others in the company. So of course that will create a more efficient organization.

AMINE ALOUAH: How (do students) perceive ERP's before and after (the course)?

JONAS KLINGBERG: The first class we had was in November. It was a five week course that's called applied enterprise systems. So we had them do theoretic models and we taught about enterprise systems and market and implementation and everything. And we had three exercises during that course. We had the first production planning in SAP so they really got down deep in the SAP systems and got lost. Then we had business process flow where they had to use another system called Jeeves to follow the

business flow from a manually entered order until that order was invoiced, then finally we played ERPsim with them and the comments after the first ERPsim session was, “Okay, we get it. Now I understand what you were trying to tell us.”

So what they say basically is, okay, this made the ball drop in my head, now I understand what this is all about, now I understand what companies need, and now I feel quite confident in my understanding of process and I actually think I have a pretty good understanding of sap. At that event we had the course evaluation, we had ten -fifteen questions on that course evaluation and ERPsim was the highest rank. It had eight point nine out of ten. That was a class of one hundred twenty students I think

JONAS KLINGBERG: The pedagogical goals perhaps we should explain that. We got four goals basically and let me show you those. It's basically to show how SAP supports the business strategies and develop hands on understanding of what an enterprise system really is and to see for themselves what integration is really all about and use the integration and the reporting possibilities to actually take decisions, not to play along but really form a strategy, evaluate it and correct it

JONAS KLINGBERG: What we do is either a half day event or a whole day event. Before I start anything at all the SAP client is loaded with product codes. The products are there but there's no stock basically. So the whole configuration of the client is set. When we start an event we see how many teams there are and I activate so many teams in the simulator. Say that there's sixteen people then each team is four players. What I do then is load a couple of hundred thousand products of each product. I think there's six products. So each team starts with products and stock. And this is the good thing, at least I think so, that we don't let them do the whole cash to cash cycle immediately but we use a counter clockwise approach so that you can play this game without even having seen SAP before.

During the first quarter, during the first simulated thirty minutes which is thirty days, they will only need to change the price of the products; try to get a clue of what the market actually likes. You know the simulator does three things: it automates certain transactions, it increases time so that each business day is only one minute, and the third thing is that it simulates [the] market that's out there somewhere. And this market has customers and these customers have preferences. So the first quarter is change the price, play around with the prices of all products to get a clue of what the customers actually like. And use the reports to see which result you get. So we play; I tell them you know you got stock now but if you run out of stock you can't order any more during this quarter and next quarter when you can produce and procure and everything I mean there are delays. This is a realistic game so you have to wait a few days. So if you sell out by day ten there's at least twenty, twenty-five days you can't sell. So don't sell you're products too low so you don't run out of stock. Of course every team sells out their stock. Every time. I mean there are some teams that might have some left of some products but every team sells out at least one of the products. I can give you this as well [hands us a paper]. This is all the transactions that are actually performed in the game. So we start here. This is the only thing they're allowed to do and they have to look at the stock levels. They have to look at their product cost, they have to look at what they're selling, and they can use the market report that is updated every five days to see the average price on the market. So you can see what each team sells but they can't get a clue if they're under or overpriced. So they play and they look at the first results from the first

quarter and I say okay you sold very much but do you have any products left. What we do then is when I launch the finished products, the musli in the beginning, I also loaded raw materials and planned orders as it's called in SAP to produce the same amount once again. So the second quarter they're allowed to release the production. They have to continue to follow the market and to change the price but they also have to release production so they can produce another set of inventory. And here they got a strategic decision because they have a lot of planned orders. I think there are 8 planned orders. $25,000 each for each product. so what they have to do/decide is: do we want to have large batches and produce all the blueberry musli at once and then move onto the original and the nut or do they know what the market likes or if they want to have smaller batches and produce a little bit of this and little bit of that. Problem is that if they have smaller batches. Every time they start producing a new product they have set up so they lose half a day of production, so that's a very important decision they have to make, to have long batches with no flexibility regarding our customer's needs or do we have short batches, very flexible. But we don't have full capacity. And the third quarter, then they have to forecast each product. Hopefully they got some sort of clue of what is selling and what is not. They have to run the MRP which creates the planned orders and it creates the purchase requisitions for the materials that are not in stock, the raw materials. So the MRP looks at the forecasts: okay we're gonna have this much blueberry müsli, it looks at the inventory, there's not enough then it creates the purchase requisition for the remainder. And then they have to convert the purchase requisition to a purchase order and then there's a few days delay and then they get the raw materials and then they can start producing again. So that's basically the whole first half day. That's a half day's game. So you play one or two quarters using all of these transactions and all the reports. What happens in an afternoon is that every team starts from scratch; they start from scratch, they've got nothing in stock, they have to decide on a strategy regarding their forecasts and everything and they are also allowed to change the building material. They could say that: we think that the customers like more high end products so we're going to increase the rate of blueberries in that one and try everything back and forth. So they do quite a lot and especially since every business day is one minute it's really fast and it's really hard to get any idea whatsoever about what the customers like. Plus one person cannot do all of these things, so they have to divide themselves. I do this, you do that, you do that. So they also have to start communicating.

AMINE ALOUAH: So basically learning how to do efficient team work?

JONAS KLINGBERG: When it goes that fast someone has to monitor the sales and let them know the pricing guys and the inventory and everything so they never run out of stock and they always have the right price so they have the highest possible profitability. It's a juggling act between low prices and high volumes and low volumes and high prices so you have find some middle ground there

JONAS KLINGBERG: yeah, that's been the struggle that we've had for the last five years. Basically, how do you teach enterprise systems? Because in a way there's always going to be differences between the understanding and the skills in the student group and if we have the traditional exercises it could be like today we're going to focus on accounting and do some transactions or general ledger postings in this system, then we're going to do production process or something, You always get these and it's the same in the business world. You always, with that kind of training, get these functional silos. It's very easy with traditional training to create functional silos because you only

train on your task. You have no idea where the data you got in your task or your transaction comes from, where it's handed off to, what happens. You have no overview, you have no holistic view of the whole process and therefore you don't realize if you take the training and which often happens is that within a couple of months you forget a lot from the training and you start getting these hybrid routines almost. You start doing things your own way and you know a little bit, and you have no idea how that affects other people after you in the process. It could lead to a lot of difficulties and a lot of sub optimization further down the road and it's perhaps on the desk of the people of the guy or girl next door, but it could lead far away from you in the business then you never realize it. So getting people to talk and getting people to understand their roll in the whole company: which value do I add, which information do I get and which information do I pass along.

I mean playing ERPsim you don't realize you're using SAP. You forget that you use SAP because you get so into the competition and winning, so SAP becomes a tool that you don't even think about and that's the way it should be in business as well.

SAP should be looked upon as a competent way to compete on the market, because that's what business is all about but it's rather some sort of distraction or something that irritates you so you put all your energy at hating SAP instead of actually using it to compete better.

Companies today are starting to buy their perhaps second or third ERP system so it's not a matter of change from black and white screens to color screens it's basically the horrors of having to change. They're used to working with ERP systems and the work with the complexity and horror of leaving something that you do know. Getting out of your comfort zone basically.

Appendix B – Survey's Questionnaire

ERPSim Survey

This is a strictly confidential academic survey.

This survey is designed to assess the user's knowledge in ERP and SAP, in addition to his attitude towards SAP after undertaking the ERPsim session

Gender

Age

Level

Major - Which major are you studying right now!

Enterprise Systems Management Knowledge

How would you rate your ability to analyze the impact of integrated information on managerial decision making

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your ability to analyze the impact of individual employee actions on the operations of other functional areas

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your ability to understand the role and complexity of technology in enterprise system software solutions

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

Business Process Knowledge

How would you rate your knowledge of business terminology in Sales and Distribution (such as Sales order, discounts, freight, transfer goods, good issues etc.)

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your knowledge of business terminology in Procurement process (such as Purchase Order, invoice verification, goods receipt, material account, etc.)

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your Knowledge of the importance of the integrated nature of the business processes

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your knowledge of the interrelationships and interdependencies between various functions (such as accounting, marketing, productions, etc.)

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your knowledge of Procurement Business Processes and Activities

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

SAP Transaction Skills

How would you rate your ability to accomplish transactions to procure inventory in SAP

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your ability to accomplish transactions to set (and change) prices and sell products in SAP

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your ability to accomplish transactions to collect from customers

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

How would you rate your ability to accomplish transactions to pay for purchases (accounts payable) in SAP

	1	2	3	4	5	6	7	
Very Low	☐	☐	☐	☐	☐	☐	☐	Very High

Attitude

Your attitude/feeling about SAP

	1	2	3	4	5	6	7	
Very Bad	☐	☐	☐	☐	☐	☐	☐	Very Good

Your attitude/feeling about SAP's ease of use

	1	2	3	4	5	6	7	
Very Bad	☐	☐	☐	☐	☐	☐	☐	Very Good

Your attitude/feeling about integrated business processes

	1	2	3	4	5	6	7	
Very Bad	☐	☐	☐	☐	☐	☐	☐	Very Good

Your attitude/feeling about Enterprise Resource Planning

	1	2	3	4	5	6	7	
Very Bad	☐	☐	☐	☐	☐	☐	☐	Very Good

About the Simulation Experience (Post-Simulation Questions Only)

The ERP simulation was a worthwhile learning experience

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

I learned about Enterprise Resource Planning as a result of the ERP simulation

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

I learned about SAP as a result of the ERP simulation

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

I learned how to use SAP to accomplish business processes as a result of the ERP simulation

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

SAP is a great system to accomplish integrated business processes

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

User acceptance of IT (Post – Simulation Questions Only)

Performance expectancy - I would find the system useful in my job

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Performance expectancy - Using the system enables me to accomplish tasks more quickly

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Performance expectancy - Using the system increases my productivity

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Performance expectancy - If I use the system, I will increase my chances of getting a raise

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Effort expectancy - My Interaction with the system would be clear and understandable

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Effort expectancy - It would be easy for me to become skillful at using the system

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Effort expectancy - I would find the system easy to use

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Effort expectancy - Learning to operate the system is easy for me

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Attitude toward using the technology - Using the system is a good idea

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Attitude toward using the technology - The system makes work more interesting

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Attitude toward using the technology - Working with the system is fun

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Attitude toward using the technology - I like working with the system

	1	2	3	4	5	6	7	
Strongly Disagree	☐	☐	☐	☐	☐	☐	☐	Strongly Agree

Thank you for your participation!

Appendix C – Survey's Details

The following are the original survey's criteria descriptions that can be found in Cronan et al. (2009a) article "Evaluating the Impact of an ERP Simulation Game in Student Knowledge, Skills, and Attitudes". The same Criteria are used in Cronan et al. (2009b).

Enterprise Systems (ES) Management Knowledge - the extent to which an individual understands the impact of an ERP (and the integrated information it provides) on the organization as a whole – including impacts on organizational structures and responsibilities, business processes, reporting, control (or assurance) and decision making. ES reflects the individual's knowledge of how enterprise management utilizes an ERP and how the use of ERP affects the enterprise. (These items were measured using a 7-point Likert scale ranging from 1 – very low to 7 – very high)

- Ability to analyze the impact of integrated information on managerial decision making
- Ability to analyze the impact of individual employee actions on the operations of other functional areas
- Ability to understand the role and complexity of technology in enterprise system software solutions

Business Process Knowledge - the extent to which an individual has a general understanding of business terminology, key operations processes and their inter-relatedness. Business process knowledge includes understanding the delineation of key business activities within and between functional areas such as financial accounting, procurement, manufacturing and sales. (These items were measured using a 7-point Likert scale ranging from 1 – very low to 7 – very high)

- Knowledge of business terminology in Sales and Distribution (such as Sales order, discounts, freight, transfer goods, good issues etc.)
- Knowledge of business terminology in Procurement process (such as Purchase Order, invoice verification, goods receipt, material account, etc.)
- Knowledge of Production Management Business Processes and Activities **(Not Used in our Survey)**
- Knowledge of the importance of the integrated nature of the business processes
- Knowledge of the interrelationships and interdependencies between various functions (such as accounting, marketing, productions, etc.)
- Knowledge of Procurement Business Processes and Activities
- Knowledge of Sales and Distribution Business Processes and Activities **(Not Used in our Survey)**
- Knowledge of Financial Accounting Business Processes and Activities **(Not Used in our Survey)**

SAP Transaction Skills – the extent to which an individual has the information systems user skills required to utilize the SAP application to perform transactions supporting business operations as well as setup and understand the associated master data. (These items were measured using a 7-point Likert scale ranging from 1 – very low to 7 – very high)

- Ability to accomplish transactions to procure inventory in SAP

- Ability to accomplish transactions to set (and change) prices and sell products in SAP
- Ability to accomplish transactions to collect from customers
- Ability to accomplish transactions to produce/manufacture goods (set up Production) in SAP **(Not Used in our Survey)**
- Ability to accomplish transactions to pay for purchases (accounts payable in SAP)

Attitude (These items were measured using a 7-point Likert scale ranging from 1 – very bad to 7 – very good)

- Your attitude/feeling about SAP
- Your attitude/feeling about SAP's ease of use
- Your attitude/feeling about integrated business processes
- Your attitude/feeling about Enterprise Resource Planning

User Acceptance of IT (These items were measured using a 7-point Likert scale ranging from 1 – strongly disagree to 7 – strongly agree)
Performance expectancy – *expectations regarding gains in job performance*

- I would find the system useful in my job.
- Using the system enables me to accomplish tasks more quickly.
- Using the system increases my productivity.
- If I use the system, I will increase my chances of getting a raise.

Effort expectancy – ease associated with the use of the system

- My interaction with the system would be clear and understandable.
- It would be easy for me to become skillful at using the system.
- I would find the system easy to use.
- Learning to operate the system is easy for me.

Attitude toward using technology – affective reaction to using the system

- Using the system is a bad/good idea.
- The system makes work more interesting.
- Working with the system is fun.
- I like working with the system.

Appendix D – Data Collection Gantt Chart