Exploring the integration of enterprise systems solutions within a supply chain.
Bachelor’s Thesis in Informatics

Title: Exploring the integration of enterprise system solution within a supply chain.

Author: Ajejunma Solomon, Onoberhie Kennedy, Pasupathy Ramadevi

Tutor: Daniela Mihailescu

Date: [2011-08-18]

Subject terms: Enterprise system, Enterprise resource planning, Supply chain management, Integration, Enterprise

Abstract

Over the decades, as organizations begin to move globally there has been a sporadic flow of information in their supply chain. Competition today is forcing companies to integrate tightly with their suppliers and customers, in order to reduce the time available to flex the supply chain (SC) (Koh S.C, Saad S, Arunachalam S, 2006). The integration of firms and departments and information is getting more and more complicated. Regardless of enterprise system solutions being introduced as “integrated suites” they have failed to accomplish application and supply chain integration (Themistocleous, M. Irani, Z. O’Keefe, and R. 2001). Therefore, this thesis aims to explore, gain better understanding and to explain the balance that may occur between the challenges and benefits gained from integrating enterprise resource planning and supply chain management.

Our topic of interest could be view from both developers and user perspective. Developer/consultant’s perspective is based on the viewpoint of those involved in and responsible for developing enterprise solutions. User’s perspective, this perspective gives insight to how the integration process is perceived by organisations actually using the solutions. We chose the User perspective because we consider the user to be the direct beneficiary of whatever outcome is gotten from both the business solutions and their integration.

In order to achieve a purposeful thesis. We decided to use an interpretive perspective which focus on exploring and gaining insight into issues of integrating enterprise system solution. We used both the inductive and the deductive approaches in our research. This would be advantageous due to the nature of our research topic, as there is little existing knowledge about the integration of enterprise systems solution within supply chain and there are lots of literatures related to the enterprise system solutions (ERP and SCM) been observed. The inductive approach would guide us to choose one or a few specific interactions to explore in-depth, while the deductive approach would aid us when making an hypothesis, since we would be collecting ideas about previous research and theories in order to guide us and make comparison.

Conclusively, we found that the balance between challenges and benefits of ERP and SCM are unequivocal, as the benefits surpass the challenges and the effect of challenges on organisation’s benefit is that it prolongs the short term benefit.
Acknowledgement

First, we would like to express our profound gratitude to our families and friends who have supported us through our three years of studies and have made this bachelor thesis work a success.

Our appreciation goes to Daniela Miahilescu, who was not only our supervisor but an inspiration. We thank you for the guidance you provided us, the suggestions and feedbacks that you made helped us during the whole phase of the thesis.

Special thanks go to Nexan AB, Gislaved Folie AB, Persistent Solution, Skye AB and Systeam AB, whom have practically made this thesis possible with their sincere participation.

Last, We would like to thank all our lecturers and fellow students whom in one way or the other have shown us support and believed in our ability to deliver in the duration of this thesis work.

Jönköping, August 2011

Ajegunma Solomon, Onoberhie Kennedy, Pasupathy Ramadevi
### Table of Contents

1 Introduction ......................................................... 1  
   1.1 Background .................................................. 1  
   1.2 Problem Discussion ........................................ 2  
   1.3 Research Purpose .......................................... 3  
   1.4 Perspective ................................................ 3  
   1.5 Delimitation ............................................... 3  
   1.6 Definitions ............................................... 3  
   1.7 Thesis Deposition/ Structure ............................ 5  

2 Methodology ......................................................... 6  
   2.1 Research approach ...................................... 6  
   2.1.1 Combined Approach .................................. 7  
   2.2 Research design and data collection .................. 7  
   2.2.1 Exploratory Studies ................................ 7  
   2.2.2 Research strategy .................................. 8  
   2.2.3 Data analysis ....................................... 10  

3 Frame of reference ................................................. 12  
   3.1 System Integration ....................................... 12  
   3.1.1 Logical Versus Physical integration ................ 12  
   3.2 Enterprise System Solutions ........................... 13  
   3.2.1 Enterprise Resource Planning Software ............ 13  
   3.2.2 ERP role in Business ................................ 13  
   3.2.3 Benefits and Limitations of ERP ................... 14  
   3.2.4 ERP and Systems Integration ...................... 15  
   3.2.5 ERP’s Role in Logical Integration ................. 15  
   3.2.6 ERP’s Role in Physical Integration ............... 15  
   3.3 Supply chain management ............................... 16  
   3.3.1 Factors affecting supply chain management  
   decisions .................................................... 17  
   3.4 Supply Chain Integration ............................... 17  
   3.4.1 Integrating the internal supply chain processes  
   .............................................................. 18  
   3.4.2 Supply Chain integration key concepts .......... 20  
   3.4.3 Integrating ERP and Supply Chain Management  
   System ...................................................... 21  
   3.5 Supply Chain Partnerships ............................. 22  
   3.5.1 Information Communication ......................... 22  
   3.5.2 Types of Supply Chain Partnership ................ 22  
   3.6 Integration enablers for ERP and SCM ............... 23  
   3.6.1 EAI: (Enterprise Application Integration) ....... 23  
   3.6.2 Conformity ........................................ 24  
   3.6.3 EDI: (Electronic data interchange) ............... 24  
   3.6.4 XML: (Extensible markup language) .............. 27  

4 Empirical Findings ............................................... 28  
   4.1 USERS .................................................. 28  
   4.1.1 NEXANS IKO SWEDEN AB .......................... 28  
   Company Overview .......................................... 28
Interview Findings ................................................................. 28
4.1.2 Gislaed Folie ............................................................... 31
Company overview ................................................................. 31
Interview findings ................................................................. 31
4.2 Consultant(s) .................................................................. 33
4.2.1 Respondent 1: Per Högberg ........................................ 33
4.2.2 Respondent 2: Persistent Solutions ............................... 34
4.2.3 Respondent 3: Systeam AB ............................................ 36

5 Analysis .............................................................................. 40
5.1 Benefits achieve during ERP and SCM integration ............ 40
5.2 Challenges faced with integration and their impact on benefits .......................................................... 41
5.3 Balance between challenges and benefits from an integrated ERP and SCM ....................................... 42

6 Conclusion ........................................................................ 44
6.1 Thesis Contribution to the field of informatics ................. 45
6.2 Discussion ...................................................................... 45
6.3 Further Research ............................................................... 45
**Figures**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1-1</td>
<td>Thesis disposition</td>
<td>5</td>
</tr>
<tr>
<td>Figure 2-1</td>
<td>Research Onion [Error! Bookmark not defined.]</td>
<td></td>
</tr>
<tr>
<td>Figure 2-2</td>
<td>Research Approaches</td>
<td>7</td>
</tr>
<tr>
<td>Figure 2-3</td>
<td>Forms of Interviews</td>
<td>9</td>
</tr>
<tr>
<td>Figure 2-4</td>
<td>Dimensions of qualitative analysis</td>
<td>10</td>
</tr>
<tr>
<td>Figure 3-1</td>
<td>An integrated model of the supply chain</td>
<td>16</td>
</tr>
<tr>
<td>Figure 3-2</td>
<td>Integrating key business processes</td>
<td>19</td>
</tr>
<tr>
<td>Figure 3-3</td>
<td>Decoupling point and system boundary in a supply chain</td>
<td>20</td>
</tr>
<tr>
<td>Figure 3-4</td>
<td>Integrating ERP and Supply Chain Solutions through Application Integration</td>
<td>24</td>
</tr>
<tr>
<td>Figure 3-5</td>
<td>BASIC EDI SCENARIO</td>
<td>25</td>
</tr>
<tr>
<td>Figure 3-6</td>
<td>EDI SAMPLE SCENARIO</td>
<td>26</td>
</tr>
<tr>
<td>Figure 3-7</td>
<td>XML as the data exchange mechanism between applications.</td>
<td>27</td>
</tr>
<tr>
<td>Figure 4-1</td>
<td>Model (Main Business processes)</td>
<td>28</td>
</tr>
</tbody>
</table>

**Tables**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 3-1</td>
<td>Benefits and limitations of system integration</td>
<td>12</td>
</tr>
<tr>
<td>Table 3-2</td>
<td>Supply chain integration dimension.</td>
<td>18</td>
</tr>
<tr>
<td>Table 5-1</td>
<td>Benefits and Challenges of integrating ERP and SCM</td>
<td>42</td>
</tr>
<tr>
<td>Chart 1-1</td>
<td>Gantt Chart</td>
<td>49</td>
</tr>
</tbody>
</table>

**Appendix**

Appendix ............................................................................. 49
1 Introduction

This section provides the reader with an overview of the research area, focus on relation between the expected benefit and challenges during the integration of enterprise system solutions. It would be followed by the problem discussion, explanation of the purpose, with other sub-heading such as delimitation, perspective and definition of the relevant words use in the research.

1.1 Background

Organizations today are faced with avalanche of information. There has been a great need for organizations to remain competitive in the business environment. With the increasing challenges faced by organizations to reengineer their business processes it has resulted to great impact on various departments and business partners. Organizations are moving globally with the intention of maximizing their profits and to seek new business opportunities. In doing so the external environment has put great pressure on companies decision and operation processes. Organizations are now faced with the issues of how to react to these external changes and to be effective in their business environment. Competition today is forcing companies to integrate with their suppliers and customers, in order to reduce the time available to flex the supply chain (SC) (Koh, Saad & Arunachalam, 2006). The integration of firms and departments and information is getting more and more complicated. Regardless of enterprise system solutions being introduced as “integrated suites” they have failed to accomplish application and supply chain integration (Themistocleous, Irani & O’Keefe, 2001). Nevertheless, supply chain is still growing with the many benefits that it brings to the firms involved such as the flexibility, cost reduction and customer satisfaction (Neeley, 2006).

Growing numbers of organisations today are beginning to make use of enterprise resource planning (ERP) in integrating and automating various corporate functions, such as distribution, procurement, inventory control, project management and finance. This has enabled the collaboration between supply chain partners and eased the sharing of information across business units. In the aspect of transparency and standardization ERP is often seen as contributor to supply chain management (SCM). According to (Themistocleous et al 2004) ERP systems provide an integrated environment that supports SCM. However, ERP systems have a number of disadvantages as they are require to be customized to fit in business processes. In regards to first generation ERP, *Customization is a complex task which could lead to complex integration problems as ERP are non-flexible and are not design to collaborate with other autonomous applications (Themistocleous et al., 2001).* As a result, successful enterprise integration would be difficult to achieved because organisation would have to find a way to integrate existing applications with their new ERP solution. The introduction of enterprise system solution into business processes might require that an organisation make a linkage with its supply chain and this calls for an efficient supply chain management system.

Supply chain is dynamic process and comprises of the consistent flow of information, material and funds across multiple functional areas both within and between the supply chain members (Jain, Wadhwa & Deshmukh, 2009). Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouse and
stores, so that merchandise is produced and distributed at the right quantities, to the
right location and at the right time, in order to minimize system-wide cost while
Today’s organizations operate in a global economy; firms that are involved in the
supply chain cannot neglect the fact that the introduction of technology has made a
significant advantage to business operations. Firms now interact with their partners
oversea in search of market. As firms grow in size and broaden its supply chain, it is
important they integrate the right technology and software in order to manage the flow
of information and goods within the complex supply chain (Neely, 2006). Moreover as
ERP deals with the integration of the internal corporate processes of the organization,
SCM enables the supply chain partners to work in collaboration and facilitate the ease
of transfer of information and supplier-customer interaction to reduce costs.

1.2 Problem Discussion
In today’s business world, it is absolutely necessary for organisations to consider being
even more effective and efficient with the products and services they deliver due to the
numerous competitions they may be facing and also for them to retain a bouyant
customer base. One way to achieve this could come from integrating different functions
not just within the organisation but also externally amongst its supply chain. Integrated
systems allow companies to accomplish something that has alluded most to date: the
linking of demand- and supply-side functions in a way that enables a quick and flexible
response to changes in demand (Motiwalla and thompson, 2009). Motiwalla and
thompson (2009, p.49), go further to claim, “If done right, systems integration can
produce tremendous benefits”.
At this stage, it would be appropriate to point out that on one hand internal integration
of functional areas such as finance, accounting, customer service, inventory,
procurement, and human resources within the organisation could be achieved by using
enterprise resource planning. According to Davenport and Brooks (2006), ERP were
not primarily focused on the supply chain. On the other hand, organisations are using
the supply chain management to focus strategically on external relationships with their
business partners within the supply chain. In order to overcome natural boundaries
within the supply chain, Koh et al. (2006) suggest that integration of enterprise
resource planning and supply chain management is a natural and necessary process in
strategic and managerial consideration.
Despite many research that have been carried out concerning the ERP and supply chain
management, it should be noted here that not much research has been done on the
various approaches to integrate ERP and SCM systems as Koh et al.(2006) mentioned
that little can be found regarding the integration of ERP and SCM. This could perhaps
be the source of the contradictions relating to the challenges as well as benefit derived
in integrating these two systems. Some scholars have even gone to the extent of saying,
ERP system may thus become a strategic disadvantage in network based economy
dominated by the supply chains rather than individual enterprises. Themistocleous et
al.(2001) in their research paper pointed out that the most serious technical problems
practitioners faced, occurred during ERP integration with existing system (82% of total
technical problems investigated) and with new business software (e.g. supply chain
management, e-commerce applications etc) at (46%).
Due to this, we find it interesting to explore, gain better understanding and to explain
the balance that may occur between the challenges and benefits gained from integrating
enterprise resource planning and supply chain management. Does the benefits really outweigh the challenges faced during integration or is it vice versa?

1.3 Research Purpose

The purpose of this research paper is to explore the integration of ERP (Enterprise Resource Planning) and SCM (Supply chain management) within a supply chain. Our research would be focused on finding answers to the following questions;

a. What challenges exist in integrating ERP and SCM?

b. What are the benefits of ERP and SCM integration?

We shall carry out an exploratory study in order to determine and bring to light issues concerning our chosen topic and the manner in which we will go about achieving this can be found below in our methodology section.

1.4 Perspective

The issue discussed in this research looks into the probable relationship between potential benefits and challenges during ERP and SCM integration. This could be addressed, viewed and approached from two basic perspective. First is the Consultant’s perspective, which is based on the viewpoint of those involved in and responsible for developing business solutions and providing integration solutions used for and during ERP and supply chain management integration. Consultants play a key role in the development as they could be considered to work closely with the users organisation.

Second is the user’s perspective, this perspective gives insight to how the integration process is perceived by organisations actually using the solutions developed and provided by the developers.

We have chosen to approach the problem addressed in this research paper from both the consultant and user perspectives. This is because we consider the user to be the direct beneficiary of the outcome from integration. Moreover, they possess a wealth of knowledge and experience concerning the subject matter.

1.5 Delimitation

This research is focused on the manufacturing sector of a supply chain, this is due to the fact that a supply chain contains more than one sector and it is practically impossible for us to carry out the study amongst all sectors of the chain given the time available to conduct the research. We restricted the firms we use for the data collection to organisation located in Jonkoping County, Sweden.

1.6 Definitions

With regard to the different terminologies that is been used in this thesis. We thought it would be proper for us to provide definitions of key terminologies. Bearing in mind that this thesis would be access by professionals working with ERP as well as managers and those who are not specialize in this field of discussion. Below are some terminologies and their definitions:
• **Organization:** Organization in this thesis represents all the stakeholders that are involved in the usage and integration of an enterprise system solution.

• **System integration (SI):** System integration put simply is the linking of demand and supply functions in a way that enables a quick and flexible response to changes in demand (Motiwalla & Thompson, 2009).

• **Enterprise resource planning (ERP):** Enterprise resource planning is a comprehensive enterprise system software application whose goal is to integrate data across and be comprehensive in supporting all the major functions of the organization (Motiwalla & Thompson, 2009).

• **Supply Chain Management (SCM):** Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouse and stores, so that merchandise is produced and distributed at the right quantities, to the right location and at the right time, in order to minimize system-wide cost while satisfying service level requirements (Simchi-Levi, et al. 2000).

• **Enterprise:** An enterprise is a complex socio-technical system that comprises interdependent resources of people, information, and technology that must interact with each other and their environment in support of a common mission (Ronald, 2010).

• **Enterprise system (ES):** An enterprise system is a generic solution, which is being designed by vendors to contain best practices to seamlessly integrate information in a company.

• **Legacy system:** Legacy system is an old system currently in an organisation, technology, method or application program that is being used by an enterprise even when there are newer technology to replace it.

• **Users:** In this thesis users represent the people, or organizations that make use of the enterprise system solutions.
1.7 Thesis Deposition/ Structure

**Introduction:** This part describes our thesis topic with deeper knowledge towards “the benefits and challenges of integrating systems”. We give explanation on our motivation towards our research topic. Further, we describe the problem area, background and the purpose of this study.

**Method:** Here we describe the approaches in which this study is done and about the data collection. We used exploratory study using primary and secondary data.

**Frame of Reference:** Here we describe existing knowledge toward ES solution in SC using the model within the framework of our study.

**Empirical Findings:** Here we present the primary data collected by conducting interview with different companies located in Jonkoping Sweden.

**Analysis:** Here in this part, analysis is carried out using the empirical finding and the secondary data collected in order accomplish the purpose of this research.

**Conclusion:** We present the results that we found from our analyses of our finding.

**Discussion:** This part focus on our reflection of our finding, giving advice and stating our opinion for the future improvement of this research, followed our acknowledgement to all who have contributed directly or indirectly to this thesis.

Figure 1-1 Thesis disposition (Created by Authors)
2 Methodology

Under this section we state the methodological framework used for this research. We explain about the method we used, that is qualitative or quantitative method followed by the choice of approach that is deductive and inductive approaches, stating the reason for selection of particular method and approaches in this area of study. We also briefly explain, how the data is collected and the method of analyses of collected data, concluding with discussion on validity and reliability.

2.1 Research approach

According to Saunders, Lewis and Thornhill (2007), there are two basic approaches to choose from when it comes to how the design of a research project would be determined. First is the deductive approach where you seek to use existing theory or develop hypotheses and design a strategy to test this hypothesis. This approach carries several characteristics such as, looking to explain the cause of relationship that may occur amongst variables, development of hypothesis, the collection of data to test the developed hypothesis and finally testing the hypothesis.

Secondly, you may decide to collect data and then develop a theory as a result of your data analysis, this is known as the inductive approach. The inductive seeks to have a better insight and understanding of the nature of a problem. The work of the researcher in this case would be to interpret and extract a meaning out of the data he or she finds. This can be seen from figure 2-2.
2.1.1 **Combined Approach**

In our research paper, both the inductive and the deductive approaches are applied. This would be advantageous due to the nature of our research topic, as there is little existing knowledge about this topic and there are lots of literatures related to the enterprise system solutions (ERP and SCM) been observed. From these literatures we can define a theoretical framework to be used at a later stage in our analysis.

2.2 **Research design and data collection**

2.2.1 **Exploratory Studies**

The classification of research purpose most often used in the research methods’ literature is the threefold one of exploratory, descriptive and explanatory (Saunders *et al.* 2007).

Our research shall take the part of an exploratory study as this is a valuable way of gaining a better understanding of things we do not know enough about. Robson (2002) explains the exploratory study as means of finding out what is happening; to seek new insights; to ask questions and to assess phenomena in a new light.'
Three principal ways to carry out an exploratory research are listed below;

- Conduct a literature search;
- Carry out interviews with individuals who are enlightened in the subject area.
- Organise focus group interviews.

In our research, we have conducted literature search by combining a variety of approaches. First, we started off by gathering relevant literatures that we come across from articles and books we have studied. This process enabled us to have a clear view of how our research topic relates to previous research. Second, we used refined keywords to carry out searches on tertiary literature sources via the internet and the Jonkoping university library.

After the literature search, we developed interview questions that we used during interview sessions with our selected respondents.

Exploratory study is flexible and adaptable to change, this is considered its greatest advantage. At the initial start, the focus of our research was broad then we excised flexibility which enabled us to narrow down as we progressed.

2.2.2 Research strategy

2.2.2.1 Case Study

Robson (2002, p. 178) defines case study as ‘a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence’.

This section of our research takes the shape of a cross – sectional case study, as Morris and Wood (1991) claim that this strategy should be of interest if you wish to gain a rich understanding of the context of the research and the processes being enacted.

In this research, we have used the following companies whom are using or have experience working with ERP and SCM systems for our case studies;

Nexans IKO Sweden AB
Gislaved Folie
Persistent Solutions
Systeam AB
Skye AB (Per Högberg)

2.2.2.2 Selection of participant

Selection of participants (companies/individuals within selected companies) was based on two criteria;

1. Companies that have ERP and are members of a supply chain.
2. Consultants who have been involved in integration of enterprise systems solutions.
Formal request was sent out to many organisations within Jonkoping County, followed up with telephone calls. We received eight positive responses, and we were only able to attend to five, three consultants and two User Company.

### 2.2.2.3 Data Collection

The technique employed in this sense was carrying out literature search then interviews and below you can see the manner in which we achieve this:

- Conduct a literature review on key elements of enterprise systems solution integration of the supply chain aspect. We made use of the library to seek literatures, journals and books on this field of study. This is done to keep us informed about what the literatures say concerning the study area and also to create awareness about previous research carried out in this/related field.

**Primary data**

In order to collect our primary data, we chose to conduct one to one interviews. The use of interviews can help you to gather valid and reliable data that are relevant to your research question(s) and objectives (Saunders et al. 2007).

**Semi – structured interview**

This research employed collecting primary data using semi-structure interview technique and this is because we are trying to cover a list of themes and questions which are mostly open ended in nature. Considering that we have divided our participants into two basic groups i.e. Users and Consultants, this means that our questions will also vary and to this end, we want to encourage the respondents to feel free and give an insight about his or her experience with the subject matter, ofcourse without going off track.

![Diagram of Interview Forms](source: © Mark Saunders, Philip Lewis and Adrian Thornhill 2007)

Figure 2-2  Forms of Interviews (Mark Saunders, Philip Lewis and Adrian Thornhill, 2007, pp.313)
Five interviews were carried out in total and all were carried out in a non-standardised, one to one method. Four of this interviews were face to face, at the location preferred by the respondents, while the fifth respondent chose the telephone interview as a form of interview.

The researchers’ organise interviews with managers of organisations and IT consultants around Jonkoping to gain an insight of what the challenges and benefits of ERP and SCM integrations are, and what impact the challenges may have on anticipated benefit. Managers and IT consultants have been chosen because they are directly involved in the decision making during this process.

**Interview duration**

Duration of each interviews was no longer than one hour and it were audio-recorded. In addition, interviews were semi – structured, we started off with open topics then follow up according to the interviewee’s responses.

### 2.2.3 Data analysis

Data collected in this process shall be analysed qualitatively.

#### 2.2.3.1 Qualitative Analysis

Due to the fact that our data is collected qualitatively, it is deemed appropriate to analyse such data in a qualitative manner. Qualitative data refers to all non numeric data or data that have not been quantified and can be a product of all research strategies (Saunders et al. 2007). There are two known approaches that can be use to analyse qualitative data namely; the inductive-based analytical procedures and deductive-based analytical procedures. Figure 2-4 below gives a graphical representation of the dimensions of qualitative analysis.

![Dimensions of qualitative analysis](image)

Figure 2-3 Dimensions of qualitative analysis(Mark Saunders, Philip Lewis and Adrian Thornhill, 2007, pp.479)

The inductive – based analytical procedure is used and suitable when applying an hypothesis generating approach, and it is very useful for an exploratory studies.

On the other hand, the deductive – based analytical procedure suits perfectly when an approach based on hypothesis testing is being used. Analysis is done in a deductive – based by either the pattern matching or the explanation building procedure.

Since the classification of research purpose in this paper is that of an exploratory study and we have chosen to use a research strategy based on a cross sectional case study. It is deemed approatiate to use one or some of the procedures outlined above in the inductive – based analytical procedures. This research combines multiple approaches, i.e inductive and deductive approaches.
We used the template analysis, analytic induction and narrative analysis. According to Saunders et al. (2007), template analysis combines a deductive and an inductive approach to qualitative analysis in the sense that codes will be predetermined and then amended or added to as data are collected and analysed. Firstly, the template analysis helped us to create categories that were formed deductively by considering the frame of references in this thesis paper before we proceeded to gather and analyse the data. With the flexibility of the template analysis, we created categories such as benefits, challenges, etc. This categories were in turn refined and used to create sub headings in the analysis chapter. Secondly, the analytic induction in turns aided our analysis as we iteratively examined all the selected cases for the purpose of identifying and exploring events and finally, the narrative analysis was used to outline and demonstrate what we have understood by the data we have in our possession. Saunders et al. (2007), noted that narrative analysis preserves the integrity and narrative value of data collected.
3 Frame of reference

3.1 System Integration

The direction in which technology is driving businesses today has made organisations to see integration of systems as something of strategic importance. There is also high potential for competitive advantage to be derived but first we must start by understanding what different part of the organisation an integration can take place. The Logical and physical aspect are two key areas during systems integration.

3.1.1 Logical Versus Physical integration

Logically, people and processes are involved in organisations and integration here would mean the creation of an information system which would enable sharing of data amongst all stakeholders according to their specific needs. It also means, however, allowing access to a shared data resource by people from different functional areas of the organization (Motiwalla & Thompson, 2009). Whereas, applications and IT infrastructure are two parts considered on the physical aspect. As many organisations work with systems, some of which are provided by different vendors or on multiple platforms, integration here would therefore be in form of providing a seamless connectivity amongst systems. Although Motiwalla and Thompson (2009) stress that having seamless connectivity in this heterogeneous computing environment is a complex task, it is necessary for an organization to be efficient. The table below shows us some of the benefits and limitations of system integration;

<table>
<thead>
<tr>
<th>Benefits of System Integration</th>
<th>Limitations of Systems Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Revenue and Growth</td>
<td>High Initial Set-up Costs</td>
</tr>
<tr>
<td>Leveling the Competitive Environment</td>
<td>Power and Interdepartmental Conflicts</td>
</tr>
<tr>
<td>Enhanced Information Visibility</td>
<td>Long-term and Intangible ROIs</td>
</tr>
<tr>
<td>Increased Standardization</td>
<td>Creativity Limitations</td>
</tr>
</tbody>
</table>

On the long run, it can be seen that the benefits gained from systems integration outweighs its limitations. In the globally competitive environment, ERP systems have become a platform application and at the same time serving as a system integration enabler at several levels of the application architecture. The ERP system is used to achieve logical integration with more focus on business processes rather than functions. Coupled to this, ERP is also needed at the physical level as layered systems architecture must be adopted to integrate the systems into a common enterprise platform (Motiwalla & Thompson, 2009). According to Themistocleous et al (2002), the benefits of adopting an ERP system impact the supply chain with an outward process conformance view of the supply chain. What this suggest is that an integration of the ERP system
with the supply chain management is required as Harrison and Van Hoek (2002) mentioned that achieving visibility throughout the supply chain is of paramount importance in the search for competitive advantage.

3.2 Enterprise System Solutions

Enterprise systems are softwares that are use to integrate organizational’s transaction data and business processes including interorganizationa supply chain. Enterprise system include softwares such as ERP software, sales force automation, supply chain management and business intelligence. Organisations have a wide range of options to choose when integrating their business process. Recently, Enterprise Resource Planning (ERP) systems have become important than before because it plays important role to support various business processes. The emerging generation software is the enterprise application integration which addresses effectively the need to integrate in combination of intra and inter-organizational systems. It assures functionality from applications and combines traditional integration technology with new technologies to make the integration efficient and effective. As a result, it supports data, custom application, processes and objects.

3.2.1 Enterprise Resource Planning Software

ERP is a software system which is used to manage and coordinate all resources, information, and functions of a business from shared data stores. It can be used to integrate different business units across an organisation such as management, staff and equipment. It also controls and communicates the business activities, to handle efficiently the order processing and production scheduling. ERP is capable of synchronizing departmental activities and could be used to monitor, track and share information throughout the organization. These help the business unit to function effectively. ERP integrates and forms a single infrastructure that serves the need of each business unit across an organisation.

According to Motiwalla and Thompson (2009) ERP are the first generation enterprise systems and their goal is to integrate data across and be comprehensive giving support to all the major functions of the organization. Enterprise Resource Planning is a generic software that integrates all information and work processes of all departments in an organization into single database and it has been found to be helpful and has tremendously decrease the cost of company operating expenses (Glenn, 2008). It also acts as comprehensive software application that supports critical organizational functions. As these systems are “web enabled”, it states that, they work using web clients in order to give access across the organization units, clients, partners, vendors, employees. ERP systems are the mission-critical information systems in today’s business organization make data available internally and externally in real-time to all employees and partner. (Motiwalla & Thompson, 2009).

3.2.2 ERP role in Business

The role of ERP in business is very crucial (Motiwalla & Thompson, 2009). The reason is that it provides the organization with the single platform through which organization can integrate all of their functional systems (financial, warehousing, etc). One of the goal of ERP is to achieve dynamic and immediate information flow which increases:
1. The value and usefulness of the information.
2. Acts as a central repository eliminating data redundancy.
3. Flexibility and supply chain efficiency.
4. Customer access to products and services.

All of the above mentioned outputs help to reduce operational costs. The value of information is passed quickly across the business units, providing access to the necessary department in an organisation. As a result, it enables to provide quicker solution and solve problems externally and internally of an organisation. The customer service could work effectively and efficiently and could retain customer base.

### 3.2.3 Benefits and Limitations of ERP

During the last decades the practices in business process has increased organizations globally, which has lead to changes in the way of doing business. The organizations which are spread globally are looking for integration and supply co-ordination in order to increase their benefit and gain competitive advantage. The benefits and returns are similar to other IT project that is tangible and intangible. Highlighted below are some of the benefits of ERP in an organisation:

- The integration of data and application across functional areas of the organization will help to avoid redundancy.
- The IT staff is centralized and trained to maintain, support the user end.
- Integration will lead to less employee training, better productivity and cross functional job movements.
- Quality of customer service better and quicker as information flows both up and down the organization hierarchy and across all business units (Harrison & Van Hoek, 2002)

ERP helps to avoid redundancy. This means that data can be entered once and used by all across the business units and it increases accuracy and quality of data. It produces less employees training, better productivity and cross-functional job movements effectively; improve maintenance and support of the system. Meanwhile, Motiwalla & Thompson (2009, pp. 17-18) did highlighted some system limitation of ERP system which are listed below:

- “Complexity of installing, configuring, and maintaining the system increases, thereby requiring specialize IT staff, hardware, network and software resources.
- Consolidation of IT hardware, software, and people resources can be cumbersome and difficult to attain.
- Data conversion and transform from an old system to a new system can be an extremely tedious and complex process.
- Retaining of IT staff and personnel to the new ERP system can produce resistance and reduce productivity over a period of time.
- Retaining of all employees with the new system can be costly and time consuming”.

Proper tools, techniques and skill are key for the ERP success (Rosario, 2000).
3.2.4 ERP and Systems Integration

System integration is important for a company to be efficient and effective with their service, products and to maintain competitive advantage, be sustainable against the competitors globally. This helps an organization to retain the customer base and to grow and expand the business. The importance of integration leads a company to gain competitive advantages, improve relationships between the internal and external business process, cost reduction. ERP are the multi-module software packages, which is used to develop support to the several business functions across the organization. ERP integration is used to standardize and improve the organization’s business processes. It also used to make use of the best practices for an organization’s field of work. It also helps to understand better the amount of resource available and through this; the organization can plan for the future.

According to O’Leary (2000), integration is the major objective of ERP systems, within an organization between departments and externally between partners for example customers, distributors, suppliers. The integration is to increase the flow of information and to decrease redundancy and also denotes the efficiency of business process. ERP is a software tool needed to improve the performance of the business processes (Madhu & Kuei, 2005). ERP helps to enhance the business process by supporting the strategic opportunities of the company. ERP must be flexible and adaptable to the changing business process or adapted business process. ERP should be seen as a means of improving business process (Madhu & Kuei, 2005).

A business process is a series of tasks or activities grouped to achieve a business goal and functions (Motiwalla & Thompson, 2009). ERP has hundreds of business processes built into the logic of the system. ERP used by the organization to maximize their benefits. IT staff is centralized and trained to support the needs of users across the organization. Enhance security of data and applications.

3.2.5 ERP’s Role in Logical Integration

In this stage of integration the organization focus is on the business process. ERP system contains build in processes of wide variety of common business functions. The best practice of ERP is that according to the form of order entered; it makes the information follow according to the order it has to be processed and the final result is transmitted to external partners and suppliers. (Motiwalla & Thompson, 2009) It means that the order is processed in various stages through appropriate business unit. The best in this is that, it is possible to find the status of order whenever it is necessary. It provides the opportunity to know or calculate the time of delivery. It shows the picture of the process, which helps to avoid the unexpected situations.

3.2.6 ERP’s Role in Physical Integration

In spite of the logical integration, ERP needs physical integration too at the physical level. Here the organization make ready for the integration by upgrading or doing needed changes to the software and hardware. Due to the inefficiency to centralized architecture on legacy platforms, ERP can be used as a platform application for an organization, which helps provides flexibly and maintain sustainability. ERP system does also provide a foundation for other advanced enterprise-level applications.
(Motiwalla & Thompson, 2009). This way the firm can achieved better relationship with their partners and customer, internally and externally.

### 3.3 Supply chain management

Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouse and stores, so that merchandise is produced and distributed at the right quantities, to the right location and at the right time, in order to minimize system-wide cost while satisfying service level requirements (Simchi-Levi, et al. 2000). Moreover Lambert, (2008. p, 2) define SCM as “integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customer and other stakeholders”. A supply chain is a global network of organizations that cooperate to improve the flows of material and information between supplier with low cost and highest speed, having an objective to have efficient customer satisfaction (Govil, & Proth, 2002). SC generic definition states that supply chain as the flow of management of resources across the enterprise for the purpose of maintaining the business operations profitably (Sehgal, 2009). In a nutshell supply chain has been seen as a network, comprising of customers, distributors, retailers and manufacturers. Looking at it from the operational level of an organization; supply chain network supports three types of flow, as stated by (Henk et al 2003). These are:

- **Financial flow**: This attribute to consignment and payment schedules. It involves all credit terms and transactions.
- **Material flow**: This segment is concern with raw goods flowing from the suppliers to the consumers vice versa, recycling.
- **Information flows**: this is concern with the flow of information such as order tracking and transmission.

![An integrated model of the supply chain](image)

*Figure 3-1 An integrated model of the supply chain (Akkermans A, Henk et al, 2003)*

The role of supply chain Management is to minimize and eliminate all waste and SCM focuses on incorporating only value-added steps in these areas (Plenert, 2007).
Competition today is forcing companies to integrate tightly with their suppliers and customers, in order to reduce the time available to flex the SC (Koh et al 2006).

### 3.3.1 Factors affecting supply chain management decisions

With the growing impact of supply chain on organizations today, supply chain has been fully recognized as an important part in value creation. Customers are very eager on getting their products at the right time with the right specification. Specifically, customers are very interested in 'shorter lead time'. They want their products when they want it. Moreover, suppliers want to have lesser inventory, fewer returns of products and less risks. Supply chain management recognizes these issues and makes effort to ensure a proper integration of the supply chain links. According to Sehgal, (2009) there are factors that affect the deployment of technology for supply chain. These are:

- **Partner Collaboration:** One primary function of a supply chain is to make planning and execution of products from point of production to consumption. Organizations have their supply chain functions go through maturity stages with the tendency of collaborating with partners. The collaboration itself may further evolve from simple ability to share information, to an interactive capability with automated decision-making systems that form the foundation of an adaptive supply chain (Sehgal, 2009). The use of solutions has the ability to define numerous events, alerts, and workflows. Having this in mind, organizations selecting solutions for partners collaboration, would make certain that it does not conflict with supply chain maturity stages as a result of the technology constraint.

- **Master Data:** Master data is a data that plays a key role in referencing an organization transactions. Examples of such data could be inventory, suppliers, analytics, employees, customers, etc. Such data is shared between different people in the organization. Whereas a typical ERP has its Customer data, Item data, etc. The idea is that these data are being used at multiple applications. Therefore an error in one application could be harmful to other user of same application. An example is an incorrect address on a Customer master could mean that all bills and transactions would be sent to a wrong address.

### 3.4 Supply Chain Integration

To ensure a substantial reduction in inventory and working capital, organizations have to make a well integration of its supply chain partners. With the introduction of new technology and other economic factors, organizations are now being forced to review their supply chain strategies. The idea is that organizations that best operates its supply chain transports its product from point of production to point of consumption in a least amount of time and at a very lower cost. To remain competitive in the market, Motiwalla & Thompson (2009) explains that organizations has to proceed to achieve collaboration and coordination among supply chain partners in an approach called “supply chain integration”. He goes further to explain the four key dimensions in which the impact of supply chain can be found;

1. **Information integration:** This refers to provision of information to all members of the supply chain and ensures that this information is accessible by
all parties on a real-time basis. Examples of such information are shipment schedule, production schedule, promotion plans, inventory status etc.

2. **Planning synchronization**: This involves working with the shared information. Here there is a mutual agreement on what is to be done and a joint execution of plans for a product introduction.

3. **Workflow coordination**: This is an automated workflow activity between the supply chain partners. It involves the “how” and “what” should be done to the shared information. There is a coordination operation and planning. Here the integration of supply chain brings about improve efficiency, fast response and better services.

4. **New business model**: This gives supply chain partners the possibilities to redefine logistics flows in order that the roles of members may take a different path to improve the supply chain efficiency.

Table 3-2 Supply chain integration dimension (Motiwalla, L.F., & Thompson, J., 2009, pp. 297).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Elements</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>Information sharing and transparency</td>
<td>Reduced bullwhip effect</td>
</tr>
<tr>
<td>Integration</td>
<td>Direct and real-time accessibility</td>
<td>Early problem detection</td>
</tr>
<tr>
<td></td>
<td>Collaborative planning, forecasting, and replenishment</td>
<td>Faster response</td>
</tr>
<tr>
<td></td>
<td>Joint design</td>
<td>Trust building</td>
</tr>
<tr>
<td>Synchronized</td>
<td>Coordinated production planning</td>
<td>Reduced bullwhip effect</td>
</tr>
<tr>
<td>Planning</td>
<td>and operations, procurement, order processing, engineering change, and</td>
<td>Lower cost</td>
</tr>
<tr>
<td></td>
<td>design</td>
<td>Optimized capacity utilization</td>
</tr>
<tr>
<td></td>
<td>Integrated, automated business processes</td>
<td>Improved service</td>
</tr>
<tr>
<td>Workflow</td>
<td>Coordinated production planning</td>
<td>Efficiency and accuracy gains</td>
</tr>
<tr>
<td>Coordination</td>
<td>and operations, procurement, order processing, engineering change, and</td>
<td>Fast response</td>
</tr>
<tr>
<td></td>
<td>design</td>
<td>Improved service</td>
</tr>
<tr>
<td></td>
<td>Integrated, automated business processes</td>
<td>Earlier time to market</td>
</tr>
<tr>
<td>New Business</td>
<td>Virtual resources</td>
<td>Expanded network</td>
</tr>
<tr>
<td>Models</td>
<td>Logistics restructuring</td>
<td>Better asset utilization</td>
</tr>
<tr>
<td></td>
<td>Mass customization</td>
<td>Higher efficiency</td>
</tr>
<tr>
<td></td>
<td>New services</td>
<td>Penetrate new markets</td>
</tr>
<tr>
<td></td>
<td>Click-and-mortar models</td>
<td>Create new products</td>
</tr>
</tbody>
</table>

3.4.1 **Integrating the internal supply chain processes**

To remain competitive, most companies have achieved larger coordination between their supply chain processes. Supply chain management systems provides abilities to integrate various business processes that makes up the supply chain and enable the seamless flow of information among these processes. Conventionally, both upstream
and downstream parts of the supply chain functions separately receiving huge amount of information.

Lack of integrated supply chain process could result in higher cost. The purchasing department places orders to the suppliers as requirement is necessary. Top management might ask the manufacturing department to only make goods that sales department could sell. Davenport & Brooks (2004) states that in most firms these functions are supported by completely separate systems, designed to handle only their own piece of the business and incapable of talking to each other. There is the tendency that manufacturers might not know what is happening in the sales department.

![Integrating key business processes](image)


Figure 3-2 Integrating key business processes (Lambert M. D & Cooper C.M & J.D. Pagh, 1998, pp. 2)

As satisfying customers remains the primary focus in a supply chain, integrating an operational supply chain entails unceasing information flow and to have a good customer focused system, processing accurate information in a timely manner is a requirement to meet customer demand. According to Lambert and Cooper (2000), in order to be successful in managing product flow management would have to event a business approach. A failure to integrate the various business processes would result to inefficiency of supply chain management. Some of the business processes that need to be integrated as described by (Lambert & Cooper 2000 p. 72 ) are:

- **Customer relationship management.**
- **Customer service management.**
- **Demand management.**
• Order fulfillment.
• Manufacturing flow management.
• Procurement.
• Returns.
• Product development and commercialization.

3.4.2 Supply Chain integration key concepts

One aim of integrating supply chain partners is to direct all their value adding towards customers needs. In doing so, there are some key concepts which are very vital and affect the successful and unsuccessful flow of all supply chain. According to Sadler (2007) these concepts are:

• **Flow of products:** This represents the movement of products and services along the supply chain to the final customer. The main role here is that the customer gets the right product at the right time. This flow of products is most usually affected by the decoupling point.

• **Decoupling point:** This is the point that separates unassigned products and those assigned to a customer. This point separates the already planned provision products from those products that are being pulled by customer order.

![Decoupling point and system boundary in a supply chain](image)


Figure 3-3 depicts the overall view of a “Double Bell” model which involves a supply network of materials to the customers. The ellipse represents members which are important to be part of the supply chain. On the upstream goods and services are planned and pushed. Planned here means that goods are purchased and people are put in place. Push here means all the forecast made to carry our preparation for expected order. The vertical dotted lines in between the plan and the push represent the decoupling point, where unassigned goods are being...
separated from the goods located to a particular customer. On the other side of the ellipse goods that are being sent to customers is “Pull” according to orders made by the customers.

- **Supply Chain boundary**: In order to have supply chain boundary it is necessary to determine which stages or firm is important in the flow of products to the customer. Here managers have to decide which firms, partners are important in the flow of goods. When these boundaries are known then those partners that are important and other functions is then put inside it.

### 3.4.3 Integrating ERP and Supply Chain Management System

Nowadays there has been growing need for companies to be very efficient in their supply chain as companies are becoming more globally. As a result, integration of various applications on inter-organization and intra-organization has become a necessity. The use of Enterprise Resource Planning (ERP) has been very supportive in business process integration and it has been used as a platform by which organizations achieve flexibility. Organizations can obtain a better fluidity by the use of ERP. These could be achieved by having integrated system platform with their supply chain partners and this has gain advantage over their competitors.

Supply Chain Management (SCM) on the other hand provides abilities to better integrate various segments of the supply chain and ensures a seamless flow of information between supply chain partners. Knowing fully the benefits derived from inter-organizational and intra-organizational by ERP and SCM, the integration of both systems will derive a potential benefit. However the integration of both SCM and ERP could be a very tough task, bearing in mind that parties involved could be having different software and hardware. Moreover, as both SCM and ERP rely on the similar framework such as internet and data exchange, it is possible for their integration. Therefore it is paramount that every member in the supply chain agrees on a standard. Below are some of the integration approaches suggested by (Motiwalla & Thompson, 2009 p. 298):

- **If two companies want to integrate in their infrastructure level, and they happened to have their ERP installed, then the process would be to have the ERP system of the supply chain partners interlink to each other directly to enable seamless flow of real time information.** This is only possible when the ERP has all functionalities to interact with the supply chain management (inter-enterprise integration).

- **If the integrating companies have the same system (or vendor’s product), then the integration would be easy. If they are different, the necessary middleware software would have to be developed that could enable connectivity and integration of the disparate system so that would be a consistent and seamless information flow.** In other to achieve a better integration here, a middleware is used in processing and enabling data sharing is used to link the ERP and SCM systems.
3.5 Supply Chain Partnerships

In recent years, organizations are now moving globally as a result of new technology in information and manufacturing, which has increased the demand of customers on goods and services. Due to this development, most organizations have been forced to restructure their production and distribution network schemes. In order to maintain competency and be time efficient, several members have united to form a single organization. There are now new types of relationships with manufacturers, retailers, suppliers, and other members of the supply chain. Yu, Yan, and Cheng, (2001) defines supply chain partnership as a relationship formed between two independent members in supply channels through increased levels of information sharing to achieve specific objectives and benefits in terms of reductions in total costs and inventories. The main aim here is optimizing production, transportation, cost reduction, and a win-win situation for all the members involved.

3.5.1 Information Communication

The effect of information sharing helps supply chain partners in maintaining a better supply chain performance. Each partner of the supply chain should have a perfect knowledge about itself in order to keep the chain successful. All members involved in the chain should be able to make a forecast of their downstream product demand in order to be able to control inventory control and production planning and share the right information in order to avoid uncertainties. Therefore, to get a better chain performance each member of the chain should be willing to provide information at all time and be cooperative to other members. Sharing of information in the supply chain is an important aspect for the successful integration of supply chain partners. These will help to standardize process and reduce unwanted cost. Moreover, each partner is wary of the possibility of other partners abusing information and reaping all benefits from shared information (Lee & Whang 2000). Despite the technology solutions that are designed for collaborative supply chain partners, Sehgal (2009) explains that conventional technology solutions have been short of providing an interactive and collaborative process.

3.5.2 Types of Supply Chain Partnership

Sadler (2007) defines partnering as a defined business relationship based on mutual trust, openness, shared risk and shared rewards that yield a competitive advantage (and provide value and build resources for stockholders), resulting in greater business performance than the companies could achieve individually. Partnership has become a strategic medium in which organizations use to maintain competitive advantage. This requires commitment, common goals, trust, openness etc. To remain collaborative and maintain a better supply chain integration, organizations must strive to keep close relationship with important partners in the supply chain.

Sadler (2007) explains three types of partnership that are important in supply chain:

- **Transactional partnering**: This represents a type of a partnership which is based on transactional relationship and it has little loyalty. This type of relationship is carried out by two organizations with no intention of having a long-term relationship. Examples of transactional partnership are service provider, retail stores.
• **Strategic partnering**: Here the organizations involve form a business alliance that is long term. In this partnership either the buying partner or the customer wishes to add value to the supplier by providing goods and services. An example of alliance is code sharing arrangement in airlines.

• **Exclusive partnering**: This implies that customers will have exclusive right over some supplier abilities, such as product lines, capacities in order to have a committed growth.

Organizations decide which of those partnership is best for them depending on how the supply chain is been designed. Moreover, other organizations may decide to employ one or two of those strategies.

### 3.6 Integration enablers for ERP and SCM.

#### 3.6.1 EAI: (Enterprise Application Integration)

The use of Enterprise application integration is an emerging concept amongst organisations in the business environment. The EAI is a software designed to be used for effective integration of an organisations various systems. This software could be used on both inter and intra organisation level, depending on the organisations’ need for integration. The EAI aids the assimilation of information systems through the combination of conventional and lastest EAI technologies such as Integration brokers, enterprise service Buses (ESB), standalone adapter suites etc.

Enterprise application integration serves as a facilitator of information flow and binds transactions among complex and different applications and business processes within and among the organizations. To define the flow of data and functionality in the application, a number of services is provided by EAI ranging from data mapping, security management to protocol management and related functions. End to end visibility is provided by EAI solutions and this benefits organisations as a better control of business operations is achieved. Motiwalla and thompson (2009, p.299) states that, “In case of application-integration, the focus lies largely on integrating one production application with the other, for EAI middleware is implemented in the form of connectors that handle data transformation and business logic with such outside systems as the ERP Systems (i.e., SAP, PeopleSoft), Database Systems (i.e., DB2, MS SQL Server, Oracle), Message Queuing Systems (i.e., Mqseries, MSMQ) and the like.”

Figure 3-4 Integrating ERP and Supply Chain Solutions through Application Integration (Themistocleous, M., Irani, Z., & Love, P.E.D., 2002, pp. 1092).

The above figure depicts an integrated infrastructure coupling various and disparate application such as supply chain management solutions and ERP together with other custom application. Applications, as well as business processes are all integrated based on application integration technologies. The infrastructure located in the center aids the communication amongst all the various applications connected to it by receiving data from one application and then translating it so that the recipient application has no problem in accommodating and understanding the message(data). The EAI is considered a very good tool for integration as limited part of applications involved would be affected in terms of coding and the exit of one application or solution would have little or no effect on other solutions that are connected to such infrastructure.

3.6.1.1 Advantage of using enterprise application integration

Some of the benefits that can be derived by using EAI includes:

- Limiting the issue of data redundancy.
- Upgrades and transactional cost reduction
- Integrating disparate applications
- Diverse data set merger.
- Improved customer service.

3.6.2 Conformity

Another method identified is that of conformity, this means organisations within a supply chain come together and agree or encouraged on using common applications in other to enable a smooth, easy and directing communication, thereby improving efficiency and effectiveness. This way of integration is very good for small and medium type enterprise. Tarn, Yen & Beaumont (2002), mentioned that in a large supply chain this form of integration should be viewed as impractical. They added that issues of trust and security further complicate any chance of success with this method.

3.6.3 EDI: (Electronic data interchange)

“Electronic data interchange (EDI) is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention (IBM Corporation, 2010). IBM Corporation (2010) further explain that, EDI can be formally defined as 'The transfer of structured data, by agreed message standards, from one computer system to another without human intervention'.

Mackay and Rosier (1996); Parsa and Popa, (2003) have noted that the definition of EDI needs to be amended by substituting the term ‘computer-to-computer’ with ‘application-to-application’ as users could merely enjoy greater benefits when they have fully integrated EDI with other business applications (cited in Anuar, Gengeswari, & Hamid, 2008).
According to the information provided by Maxonis Ltd (2009), The EDI provider is responsible to translate / convert the customer generated EDI messages from any standard (EDIFACT, VDA, Odette, ANSI X12) to the supplier’s EDI standard format (EDIFACT, VDA, Odette, ANSI X12). The translation is made by the map which is developed by the EDI provider based on the customer's EDI message Implementation Guideline (IG), where the subset is defined, and based on the supplier's additional requirements. The result of the translations is sent to the supplier in the expected format but still having customer data content. Supplier is responsible for processing and uploading the EDI messages and make the communicated information available for the business.

Business decisions and agreements are reached by the supplier and customers regarding message standards, delivery schedule horizon and frequency of EDI messages.
Figure 3-6  EDI SAMPLE SCENARIO (Maxonis Ltd., 2009).

Figure – above gives a scenario for using EDI to monitor and control transactions step by step, giving a visible business process rather than just a technical check of message file transfer. You can see how standard message types are used in communicating customer demand. Along side the shipment of goods by the supplier, an EDI notification is sent out about shipment and a functional acknowledgement is done on application level. The customer also confirms the receipt of goods by sending an EDI message in one of the agreed message type format. The process goes on and on, but what is important here is that members of a supply chain using EDI as a medium of integration can have easy control over transactions such as invoicing and shipping procedures. There is also the possibility of comparing estimates and actual figures using documents containg historic data.

3.6.3.1  **Benefits of using EDI**

Some benefits associated with EDI includes;

- Transactional Cost reduction.
- Reduced length of data transmission and processing .
- Facilitating the reengineering of critical business processes.
- Improving customer service as well as relationship with supply chain partners.
- Overall competitive advantage derived.
3.6.4 XML: (Extensible markup language)

Similar to EDI which has being explain above is the extensible markup language. XML is seen by many as merely a format in which documents are translated into. Yes it is, but there is actually more to XML than that. XML can be used to exchange data between compatible and incompatible applications on Web and non-Web applications (Kahate, 2009). The figure below illustrates this concept;

![Diagram](Retrieved from (Kahate, 2009).)

Figure 3-7 XML as the data exchange mechanism between applications(Kahate, 2009, pp.5)

According to Motiwalla and Thompson (2009), XML has emerged as the leading business-to-business integration and enterprise application candidate. They also point out that XML is fast becoming the unifier among integrated systems.
4 Empirical Findings

In this part of our thesis, we describe the empirical findings derived from companies and individuals that we interviewed.

4.1 USERS

4.1.1 NEXANS IKO SWEDEN AB

Company Overview

Nexans company is located in Grimsas, Sweden. They work with Finland, Denmark, Estonia, Latvia, Lithuania and local markets in Sweden. In the automobile sector they sell to Volvo. They produce cables for utility that is telecom cables, fiber cables. They have their headquarters in Paris, France. They have around 18 factory in France and around 6 factory in Germany. They use EDI and their 50 percent of the order comes through using EDI.

The company used different ERP systems since 1994. In 2006, they implemented MS Dynamics. During February 2011, they upgraded the system.

We conducted an interview with the IT Manager Kant Halldén who is responsible for quality, environment and developing and maintaining IT support processes on 10th may 2011 at 9.30 a.m. in the office of Nexans, Grimsas, Sweden. He is working in Nexans since 1986.

Interview Findings

Business Process

They have an operating system that develop and market their products. They make products known to their customers through fairs, newspapers and sometimes one on one contact with customers. Their major market concentration is in Finland, Denmark and Sweden. This department makes use of business intelligence for marketing analysis.

![Diagram](http://example.com/diagram.png)

Marketing → Sales → Delivery

(CRM support) (ERP)

Figure 4-1 Model (Main Business processes)

The sales department manages and sells their products. In this department they go around to source for customer and makes agreement base on a long or short term goal example agreement could be made to make a supply of 20,000 meters or 40,000 meters of cables during a certain period of time. This department is being supported by Microsoft dynamics customer relationship management (CRM) which makes all the necessary agreement, quotations and calculations. After which the customer comes to the delivery department and place an order.
The delivery department ensures products get to the final consumer and it is very large. Under the delivery department they have the following processes:

- Planning
- Sourcing
- Making
- Delivery: The logistic unit is found under the delivery department which is responsible for making products get to customers.

In most cases they buy finish products for delivery. They have a strategy department that is organised by management in the head office which is located in Paris (France) and strategies are centered around ‘Lead and develop’ while taking care of:

- Budget
- Short term strategy
- Types of product to develop
- Can change the market?
- How is market developing?

There is a long term strategy and a short term strategy (BUDGET). About 50% of their orders come through EDI notification. Short term strategy is concerned with budgeting and it has to do with what kind of product should be develop and how it should be develop, can we go to another market?

Training

They have trained users which are called key users. These key users undergo special training from the consultants. There are one or two key users in the marketing and order entering unit. These key users in turn train other users on how to use their business solution. One major goal of the training is that other users should be able to understand the different parameters from the ERP. There are thousands of parameters in ERP and this has become a problem for their users to learn. It is also difficult to find a consultant who has a complete knowledge of these parameters and this has posed problem to the users. As a result of these problem it is difficult for the IT and business units to understand each other.

Achieved Benefits

Nexans anticipated the following benefits during the integration of their enterprise system.

- Integration: They had mixed software and old development which need to be better integrated.
- Planning synchronisation: They wanted a better way to manage their production planning. Efficient planning.
- Shorter lead time.
- Lesser inventory.

They have achieved all of the above expectations over a period of time.

Challenges
They had problem during the change of software which affected the change process. Some of the challenges faced include:

- **Time Factor:** They underestimated the time required for them to effect the change process. They underestimated the complexity of the project.
- **Data Migration:** They had to transfer data from the old system to the new one.

After the integration process they were not impressed with the financial module of the ERP. The problem surrounding the financial department was addressed by developing some new functions which was not included in the ERP. They have a best planning of production and better secure delivery process. They have had a successful integration of their ERP system and they have no problem in using it now.

**Supply chain management.**

They have two definition of supply chain. (1) They have the internal supply chain which manage the control of raw materials from the manufacturing to the delivery. (2) Externally. Here they make use of EDI with their partners in making and supplying orders. In other cases they have customers who have their warehouse in which the company store their products on until it is being ordered. The products in this factory are still owned and controlled by the company. When a product is being picked from the factory the customer sends an automated message through EDI to the company which is being notified on their ERP system. About 50% of their order comes in through EDI. They have a customize supply chain management.

**Relationship with supply chain partners.**

Nexans company maintains a close relationship with most of its suppliers but only one interacts with their ERP via the company’s biztalk server (EAI tools) . The supplier sends EDI messages to the biztalk which then translate this message to the Microsoft dynamics ERP. Moreover other suppliers make paper order with the company.

**Method of integration**

The company makes use of biztalk to integrate their external system and their suppliers. When an invoice is sent to a partner it has to be standardised for the partner to receive it. Therefore user of the ERP creates a standard for every invoice sent to a customer. When the company has a new supplier they come into agreement via telephone call, e-mails or discussion on a particular standard they should adopt for sending messages. In order to have particular standard messages with Nexans the partner most be a big organization.

**Problem with their method of integration**

When there is a failure with telecom then they would not be able to receive messages to the biztalk. In some other cases as a result of server down when customers place order they would not be able to receive this order. One way in which they tackle this issue is through the support of their help desk. When orders are not receive customers call the help desk in Paris (France).

On the other hand they have problem with message standardization. A partner could insist on a specific standard for messaging which might not be suitable for Nexans. In some cases the company has to restructure their standard to fit in that have the partner.
4.1.2 Gislaved Folie

Company overview

Gilaved Folie company is existing since 1945. In 1969 the company was taken over by Hagaplast AB. In 1989 they established gislaved Folie as AB Company. They have the work force of around 100 employees. They are located in Gislaved, Sweden. The company ranks, the world’s leading suppliers of foils to several industries.

The company Gislaved Folie works with surface materials to add colour, shape and functionality. The foils that company products are used to provide decorative finishes with a variety of functions, tailored to the application and setting of the finished product. The company’s products can be seen in various forms and settings all over the world, for example

- furniture and kitchen cabinets
- cushions for ear defenders, inflatable mattresses for healthcare
- vehicle dashboards and door interior panels
- walls, ceiling and floors on board ships.

Gislaved Folie company offer the market newly developed materials with environmental advantages, as an alternative or substitute to traditional materials. They recycle and reuse waste to minimize environmental impact. Gislaved Folie is certified to ISO 14001.

Production is carried out using highly automated processes and they use the latest technology to optimize these processes and safeguard quality. The process of manufacturing begins with raw material - polymers, which are extruded or calendered to obtain products such as pattern printing, painting, lamination or embossing, before the finished product is delivered to the customer. During the 60 years of time they invest in continuous development which helps them to adapt to market demands.

We conducted an interview with Mats Hallberg who is the the IT Manager. His department is responsible for supporting the organisations overall IT. He has worked with Gislaved Folie AB for 25 years. The interview was held on the 12th of May 2011 at 2 p.m. in the main office of Gislaved Folie, Gislaved Sweden.

Interview findings.

Business Process

The company Gislaved Folie use ERP Oracle system. They are the first company in Sweden, who wanted to use the system in Swedish version. The main working process is divided into Material production system, warehouse management system and delivery. In the material production system, the work includes quality management and the product manufacture planning. The warehouse management system takes care of raw material needed for the production, working process, material purchasing and final product send to delivery. The material they purchase are waste material and they reuse it during production. SCM, which is internally located in the company, has the normal flow, which is of 4-6 weeks until the finished product is produced. Business process is integrated amongst different business units and are fully automated using ERP systems. They have financial department which takes care of payables and receivables. Human
resource department is located outside ERP system. They use Swedish system which is optimized to Swedish market.

Asset Management: They have around 10 machines. The machines are very expensive. Each costs around 100 to 200 million SEK.

Training

The IT department gives training to the super users of the ERP system. The super user of the system has much more knowledge about the system. For example, sales, they know more information within the area of sales. They train the key user. The key user knows what is needed to work with the system. The super users make manuals and help them in using the system. Every year they have meetings with IT department to discuss the problems that appeared during the year and to make it better. When the super user cannot solve the problem then they go to IT department for help. They use this system since 2002.

Achieved Benefits

The IT manager said that “IT department had minimum problem after integration. It is much easier from technical point of view for instance, no problem with exchange of data between the systems but it is problematic when there is more than one system during the exchange of data. They now produce more efficiently using less resources.

Challenges

Some of the challenges they faced during the integration are the time factor and the problems due to bugs in the system. They started the integration in May 2001 with the estimation period of completion in Feb 2002, but in January they had to extend the period till May 2002. The extension of each month cost them nearly one million kronor. They had 4 to 5 consultants working with them. They also used their own resource of 15-20 employees during the integration and it makes it difficult to use own resource for such a long period of time. Also, they are the first customer who decided to run the system in Swedish version and they faced problems with bugs in system.

Relationship with supply chain partners

The suppliers they use are very big companies. They are not too dependent on their orders. The supplier supplies good quality products. They have long term relationship that they buy from them nearly 10-15 years. They maintain good relationship with the supplier. They do not buy from other supplier just considering the price. The most important for them is quality. They have long term relationship with their customers. They have customer who are buying from them for nearly 20 years.

Method of integration

They use EDI which is integrated with customer. But they do not use EDI with their supplier. Since they have just few suppliers and it is not necessary to have EDI. The information is entered manually. But inside the company that is the internal part of supply chain is fully integrated. The work process begins with the purchase of raw material by the purchasing department and stored in the warehouse. The production part
make use of these materials to manufacture a product and the final product is send to customer. EDI have communication engine to communicate with other systems (It works well). It is a kind of middleware Ex. Biztalk whose function is to translate message. The customer and supplier exchange information between them through sending invoice and receiving order using email and pdf files. The employee enters information manually into the system. They do not give access to customer to enter the system. The feedback received from the customer is entered manually. The process is same with the supplier side. The purchasing order is send from purchasing department using pdf file or email.

4.2 Consultant(s)

4.2.1 Respondent 1: Per Högberg

Per Högberg is a consultant with many years of experience within the business information system sector. He is currently the managing partner, chief collaboration officer and CFO of Skye AB, a company which he is a founding member. His current portfolio shows him to be a member of the Swedish User Group for SAP(SAPSA), Vice chairman of SUGEN which is a global federation of 14 user group with approximately 10,000 companies and 20 million employee. He is responsible for strategic alignment amongst user companies of SAP, also Development involvement (STC participation, beta verify). He has worked for Kongsberg Automotive for 22years (1986 – 2007) taking the following roles; Logistics manager, IT manager, Business System Director, Project and international alignment and deployment director. His experience working with ERP has made him a qualified candidate for this research. He has worked with development and maintenance group for ERP since 1989, ERP manager since 1995 and ERP consultant since 2007. Worked with organisations having both ERP and SCM since 1986.

Interview Findings

Confronted with the question of what he thinks the motivation to procure ERP or SCM is, he reponded by putting the size of the organisation as the main factor saying that large organisation really require ERP to be fully functional and remain competitive whereas smaller companies could do with easy system or even excel. He also noted that normally, you use ERP at very early stages in SCM focused companies. He sees ERP and SCM integration from one system approach i.e ERP with SCM which he says is the normal solution. Ofcourse he agreed that some aspect of SCM are integrated with ERP, like EDI (communication for delivery plans etc). Regarding challenges faced by organisations when it comes to integrating ERP with SCM, Per Högberg considers shop floor integration to be the most challenging, especially when you also have complete integration with production steering system as well. Normally he said, we don’t integrate machine system with the ERP, because of the risk of stopping the entire production if ERP is down. The normal integration gives a one view and a master data harmonization. It’s always a risk to run independent systems with different result. The managing of the entire business could get problem on getting accurate information.

Furthermore, he explained that running an ERP/SCM system requires training. Normally they do not get enough Joint Training i.e standardised throughout the supply chain.
Benefits

Some ERP and SCM integration benefits highlighted by him include;

- Good capability to ensure a homogenous production managing capability.
- Less manual work to ensure the enterprise integration and enterprise reporting.

According to him, he sees more challenges in unintegrated environment. System in different environment that could have different data and different result, and from there give different guidelines for decision of production etc.

“I support enterprise integration, don’t keep any small islands of information”, he said. He did mention that problems of integration could be solved if people involved have knowledge of the entire information model, and also understand the information quality in the entire chain of the processes, this is underestimated when beginning integration of systems.

We then proceed to ask him this question? Does the problem faced during integration have any specific effects on some organisations achieved benefits? He responded by saying, this problems create knowledge and that’s always good. Finally, we gathered that no matter any challenges faced, It’s’ always better with integration!

4.2.2  Respondent 2: Persistent Solutions

Company Overview

Persistent Solutions is an Information Technology consulting firm that was founded in 2000, having headquartered in Jönköping, Sweden. The company works with the management and development of support systems, primarily within the telecom and data communication. They also do consulting in the field of systems development, business, expertise, project management. Most recently, they have developed deep interest in Business Intelligence and consulting. The company develops and maintains lasting solution for their customers. They have worked practically with TeliaSonia, Swedish Police, authority of agriculture, Volvo Astera. They virtually work with most organizations using ERP, but customize to telecom.

The interview was carried out on Wednesday 11th May 2011 at 10:00am at the office of Persistent Solution in Jonkoping. The interviewee is Bosse Plym, he is the CEO of the company and have worked with the company for few years.

Interview Findings

Persistent Solution is a company that provides and maintains enterprise solutions for their customers. They are basically a consulting Company in the IT field and they should not be regarded as users of these enterprise solutions. They have worked with companies such as Telia which use this system solution, and they have a system for provisioning.

When asked what could be some of the motivation for companies wanting to buy these business solution. He highlighted the following points:
• **Cost Effectiveness:** He sees companies as being cost effective and would want to cut down cost in every possible situation, this has been the case of most companies.

• **Quality:** Moreover other companies would want to employ quality. As these organizations have different systems with lots of people using it, it makes it prone to the attack of malwares.

• **Information:** The middle managers are very keen to know lots of information about the daily transactions. They want to know how many purchases, orders are made and what is the level of their stock inventory. These managers seek information on how data are moving around in the company at the present for them to make a forecast on the future.

Even though he is not using any of the business solutions, they have great knowledge on these solutions from the past working with other companies. When asked what link exist between the connection on ERP and SCM system? He said the company is mainly concern with the provision of services to customers rather than products. Moreover he sees the ERP and other systems being use as fit for integration. Integration is basically carried out using some integration tools such as I-core. He does not see any technical issues involve with integration rather it is just a business process, how you want it to work? Which kind of information you want it to go through. Maintenance of the solution is another issue which should be address by the integrating organization. He said most times it is better to have a monitoring team overlooking the integration process in order to avoid incorrect procedures which could take longer time to be detected. Thus it is a matter of competence issue to technicality.

**Challenges**

Despite the numerous challenges that occur during integration of systems, the issue of master data should not be left out. What other challenges do you see in the integration process? That is a very big challenge because people have to be sure which data belongs to which source. There is also the issue of syntax that can be easily neglected. Much consideration should be applied in the use of syntax. Example if you are using a capital letter for a company then it should be noted around or if you want to spell a Telia as Teliascionia AB. Such spellings should be applied as single way of writing it. These are low level way of organizing data but it is very important not to neglect their importance. However he sees the biggest challenge as how one would manage the interaction between systems when a data is deleted from one system, what effect does it have on another system. How do you keep consistency?

Bosse Plym explains that Persistent solutions is mostly concerned with the competence and technicality of the integrating company. Therefore, their organisation have well formed technical crew to initiate the integrating process. The bigger company has complex organization with lots of people being involved and they have numerous wants from their ERP. Most times it is very difficult to ascertain what they want from the ERP and this problem is a result of the different business process. It is very important to monitor, check and inform time to time. An example was a project they had from a X
company, someone from the security department complained of a bad function and they were notified, having contacted this company they noticed it was a documented format issue and not a system solution problem.

We understand that you have worked for several companies such Telia and you have knowledge on how integration is done in some of these companies. How do you think these companies would benefit from integration? He said, if you have two systems, you must know which information is necessary and process should be use. It is a matter of technicality issues.

**Training**

Users are the key players here. On the part of Persistent Solution they provide enterprise system solutions to organizations. Most of these organizations do not have better knowledge in enterprise solutions. How do you manage to pass knowledge to them?. Bosse Plym explains that when you have a good project and a good sponsor it is necessary that you have workshops with these users in order to inculcate them of all necessity. Unfortunately not everyone starts with a workshop, there is a feeling that the whole project cost too much and such step should be avoided. Additionally, he said that project managers are to be aware of the need for users to be trained and they should understand how the solution works. This should be done to maintain better consultant-users relationship.

In an overview there are so many challenges and problems attached to systems integration. The integrating organization and consulting firms have their own roles to play in order to avert these challenges. Moreover, planning is also a vital tool in the process of integrating. Especially in this era where there are mobile phones everywhere it makes planning much easier. He (Bosse Plym) said “managers should have an overall picture of the integration and keep it alive while planning is put into consideration on how and when is the right time to start”. However the question on whether the benefits of integration outweigh its challenges is a matter of technicality. When integration is done in the right procedure with the right technology, there will be a satisfying result but if done in the wrong procedure then the result would be bad, vice versa.

**4.2.3 Respondent 3: Systeam AB**

**Company Overview**

The interview was carried out on Friday 20th of May 2011 at 10:00am at the office of Systeam in Jonkoping. The interviewee is Gustaf Meland, Team manager working with the group of 9 people. They work with in integration projects like ERP systems, application within production etc., they use Microsoft platform called Biz talk server. It also acts as enterprise application tool.

There are other systems but they have chosen Microsoft because many of their customer use Microsoft and have Microsoft policies, strategies and also because it is possible to find consultant who knows about it, that is the reason they mainly use BizTalk server.

Mr. Gustaf opinion about their customer is that sometimes the company wants to handle integration first, but the difficulty is that they have to change the old system to new ERP system. Then it is mainly the integration within the application when they finish their
internal integration the company start to work with the integration part of supplier and customer.

He gave us an example that now they work with a company who has many suppliers around (200 supplier), which consists of big and small companies. The company does not hold stock as this has been outsourced. They wanted to integrate all the suppliers with ERP but some are too small companies, this caused challenge to them. They have to find different solutions to make the work efficient. They have to integrate with the main suppliers and come up with other solution with the smaller supplier. They usually suggest using web portal, so the smaller supplier can have standardized form of information exchange. In that way they can reduce the manual work and error. He also mentioned that this is the common problem faced by many companies.

Web portal is used to integrate the smaller supplier with bigger companies and can call it as interface. The companies can decide whether they want EDI, portal etc., adoption of this method result in reduction of manual work, error and increase the quality of information.

When asked, how do the companies integrate? He mentioned that there are many ways to integrate not just only the integration but by using the integration platform. When they have to change the application, the company may have ERP integration but they will also have many applications and it has to be integrated. They also have many application developed by other companies.

Benefits of integration and expected benefits

- Mr. Gustaf showed some slides and explained the benefits of integration with giving some examples
  - Flexibility and Processes
    - Business processes across corporate boundaries
    - Agility a success factor
  - Lower costs
    - Lower IT-costs over time
    - Efficiency within the organisation
    - Dependencies to key personnel or suppliers
  - Information and Control
    - Error handling
    - Monitoring
    - KPI/BAM

Flexibility

Mr. Gustaf mentioned that the companies could keep their own interface to work with ERP, this way they get flexibility. If they have lot of integration then it is hard to calculate the cost. Since the connection to other systems is not known exactly.

Article in ERP system and other system want to share, this can be integrated using Biz and can be done separately. This method helps to reduce the cost for governance.
Mr. Gutaf mentioned about the expected benefits is that company may want to have control, manage demand from customer, flexibility. The challenges he mentioned was the technical issues and there is lots of need to communicate and understand.

**Time factor**

Mr. Gustaf said he has many years of experience and they have good planning method. They have done it so many times and they have their own formula for each process and depend upon the integration whether it is simple or complex, they could guess the time needed for project. Firstly, he makes the overview of the application, to know the number of integration then with developers they decide how long it will take and this way they calculate the time needed for a project including the time for testing and deployment. He mentioned that the challenge is planning but not the time frame. He mentioned that how they overcome the Technical challenge during planning is that they need more time for specification, but developing is not difficult. They cannot test the integration because they need to do with the other applications. Therefore, communication is very important. Test is the hardest part because they cannot do all the test. They can make the application communicate but for this purpose they need to know how ERP works, but it only known by the companies IT department and they take of care of it.

Regarding time factors, he mentioned that they have very good planning method and they are able to manage to be within the said time limit. He also mentioned about the risk and success factors that are given as follows

**Most common risks /problems**

- Poor conditions of testing, lack of understanding
- The requirements (mapping document) change
- The importance of communication is underestimated
- Technology issues (communication, access, new adapters, etc.)
- Dependencies to many different parties
- Manual handling in deployment process (human factor)

**Success factors**

- Verify technology early, implement a complete integration flow
- Be clear in the interface with other parties
- Common conceptual model for the integrations
- Prepare the tests (test environment, test bench, examples to work with
- Follow the developed standards / guidelines / strategy

**Benefits of using BizTalk**

- Reuse- lower costs
- Proven methodology
- Reduce risk in ERP implementation
- Allow implementation in stages
- Improved monitoring and error handling
- Improved governance
- Less dependencies to key personnel
- Easier to make demands on supplier of IT- solutions
- Access to common data
He mentioned that about the expected benefits that some company want to have structure and control for the governance to keep it long over the year. For other company to improve the demands, for example to work with Volvo, Saab etc., but if the bigger companies demand for integration, they have no choice.

Some benefits the company look for is the need to be flexible and do not want to dependent on our IT system and structure, we need to establish the business in other country you have to act quick. There are different incentives to be looked over when companies want to integrate.

Mr. Gustaf stated how they contact the customer and provide their solution, he said that they first talk to person responsible for marketing or vice president to know the companies strategies, vision and to get an idea of their business processes. Then they decide upon which type of integration they will need and suggest them the solution.

For the question “What are challenges that organisation face during with the integration of ERP with supply chain?”, he answered that the challenges are same that no matter the integration is with supplier or customers etc. The first is technical, internal structure of integration that is not seen, so communication is very important here. The systems are different and the databases are different so they have to map the systems from one application to other. This is the biggest challenge.

**Mapping document**

It is the basic documentation. It consists of specification; For example, article no, quantity and size. They have to map so that it suit other supplier format and all can understand the transformed message.

When asked about competence on the part of team involved in the integration, He said that, ofcourse it is needed. He said that they could not be expert in all the database and application. However, what is important is understanding. They focus on good understanding of processes. It is not uncommon, as they have more knowledge than the customers do, since they have worked with different issues. Here it is just more competitive knowledge than the technical knowledge, because technical knowledge is easy to learn.

For our questions regarding how challenges affect expected benefits?” he answered that in the end the benefits are achieved. The more challenges indicates the higher the cost it is to integrate. They make the challenges visible to customer and work with them to reduce the cost.

Benefits bigger than the challenges, It is easy to look at it in the short time. Initially the cost goes up and in certain period the benefits starts increasing. They help them to integrate and most of the company they use their own IT resource to work further. They like to work further to help with benefits and have partnership but the company decides it.

Challenge they face is communication, they need to understand well to reuse the integration what the company has at present. They split and give them a way to reduce cost. If communication is good so they can make the integration faster and can achieve better benefits. However, sometime they do not have good communication and it takes longer but later they can reuse it so in certain parts and this way he mentions they do not any difference in the end. For example mentioned that maybe the first architecture is wrong and cannot reuse then there is no benefits. In this case, the expected benefits are affected as a result.
5 Analysis

5.1 Benefits achieve during ERP and SCM integration

Determining the benefits related to ERP and SCM integration comes with several other factors which could be attributed to contribute to the achieved benefits. Going by the frame of reference presented in this thesis, it is shown clearly that integration enablers (EAI, EDI, etc.) for example, which we discussed each has their various advantages and these advantage could translate into various benefits for the implementing organisation.

The type of supply chain partnership was also identified in our frame of reference, and we consider this as a factor which could influence achieved benefits, as Sadler (2007) noted 3 types of partnerships namely; transactional partnering, strategic patnering and exclusive partners. Generally, system integration benefits highlighted by Motiwalla et al. (2009) include increased revenue and growth, leveling the competitive environment, enhanced information visibility and increased standardization. When asked about the reason why organisation would like to integrate enterprise systems, Bosse Ply of Persistent Solution did mention that cost effectiveness, quality and quest for information update and visibility are the major reasons why most organisation would want to integrate. Although some of what he expressed like quality are not reflected by Motiwalla et al.(2009), if we sum up all the benefits, they would surely lead to enhanced quality and if we take Cost reduction, we can see that this appears on most part of our frame of reference, most of the integration enablers we identified all bring about cost reduction and competitive environment.

As Per Hogberg also did highlight some benefits of integrating ERP and SCM such as; Good capability to ensure a homogenous production managing capability, and less manual work to ensure the enterprise integration and enterprise reporting. Both of this benefits are reflected upon in the supply chain dimension mentioned by Motiwalla et al. (2009) in our frame of reference. Per Hogberg pointed out the issue of master data harmonization as benefit that normal integration of ERP and SCM should achieve, this is the same point Sehgal, (2009) mentioned when he talked about factors affecting the deployment of technology for supply chain. This we understand to be a benefit because an error in one application could be harmful to other user of same application and then work flow is disrupted.

Some of the integration benefits we found from our interview with Kent Hallden of Nexans led to those already mentioned above by Motiwalla et al. (2009), Nexans use to have a mix of software and old legacy system which they replaced with an ERP system which serves as a platform which was used to integrate their internal supply chain. This led Nexans to achieve standardization and information visibility as well as other benefit which vary from those mentioned in Table 3.1 these benefits include shorter lead time, keeping lesser inventory and planning synchronization. An interesting thing here is that planning synchronization, which we found as benefits of integration at Nexan was regarded as one of the dimensions of supply chain integration and this particular dimension could lead to even more benefits.

Mats Hallberg from Gislaved Folie also mentioned process automation, information integration, improved workflow coordination and improved productivity as the major
benefit they achieved during their supply chain management integration with ERP, the case with Gislaved Folie is very similar to that of Nexans AB, integration of internal supply chain was done using the Oracle ERP systems. Although the benefits achieved by the two user companies we interviewed are linked back to the four key dimensions which impact supply chain, these can be said to be related to the pattern adopted by these two organisations. The integration of their internal supply chain was carried out directly using their ERP.

5.2 Challenges faced with integration and their impact on benefits.

To start the analysis of the challenges, we take a look back at the limitations of system integration listed in table 3.1. These challenges include high initial set-up cost, power and inter department conflict, long term and intangible ROIs, creativity limitations. From our empirical data, Nexans mentioned the challenge of long term and intangible ROIs they faced after integration, although the IT manager Kant Hallden said all their expected benefits have been attained but this only happened 2 to 3 years after integration to effect.

Moreover, we found out that time is a factor which most organisations neglect during projects planning scheduling and this results into a even bigger challenge during ERP and SCM integration as projects timeframe have to be extended and this normally means extra cost or if they have to keep to their initial time plan, due to complexity of ERP and SCM, this might mean project failure or project may fail to achieve expected benefits. In the case of Nexans, they under estimated the complexity of their integration project leading to them extending the completion date. Gislaved also encountered the time factor challenge, they had to extend the integration project with three months additional and each month costing an estimated one million swedish kronor. Mat Hallberg did mention as well that resources (employees) are stretched during this period as well.

Kant Hallden of Nexans goes further to discuss the challenges faced during integration, he mentioned “data migration” to be an issue that caused a big headache as data needed for production planning were not completely available inside the new system used for integration and what this means is that processes are disrupted in some way. The challenge of data migration was elaborated on our frame of reference, Motiwalla and Thompson (2009) touched on the issue of data conversion and transformation from an old system to a new system, they said this process can be extremely tedious and complex. This is very true, as our empirical data shows this.

Training is another aspect we looked into when we collected our empirical data. Both of the user company that participated in this study mention that they provided training to certain employees whom they regarded as key/super users and these key users in turn educate other employees across the organisation on how to use the newly integrated systems. The IT manager of Nexans did emphasize that there are too many parameters included in their newly integrated system and this is a problem for users. Although, none of the user company touched on the issue of employee resistance, Motiwalla and Thompson (2009) elaborated more by saying retraining of IT staff and personnel to the new ERP system can produce resistance and reduce productivity over a period of time. Training is one reason why it took Nexans a longer period before all their expected
benefits were achieve from integration. Consultants opinion on this isnt different, Per Högb erg says to run an ERP / SCM system, much training is require. Bosse Plym of Persistent Solutions believes it is necessary that you have workshops with users in other to inculcate them of all necessity. Bosse continued by mentioning that unfortunately not everyone starts with a workshop.

Competence is very important according to both respondent 1 and 2, they both say that the matter of integrating ERP and SCM really lies on technical competency. If competent people are not handling the integration then management should be blamed. The only challenge that could be experienced if organisations have competent people on integration project, according to Bosse would be that of business process, how you want it to work? Which kind of information you want it to go through.

Bosse did mention that some integration tools are used in the integration of system. This is true with the both user companies involved in this study. Nexans used Biztalk as an enterprise application integration tool.

5.3 **Balance between challenges and benefits from an integrated ERP and SCM.**

Here we would examine the balance that may occur between the challenges and benefits of ERP and SCM integration but first it would be appropriate to summarise the benefits as well as the challenges. The table below provides the summary;

Table 5-1  **Benefits and Challenges of integrating ERP and SCM**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Superior quality of data, production and services</td>
<td>1. Long term and intangible ROIs</td>
</tr>
<tr>
<td>2. Enhanced information visibility</td>
<td>2. Time Factor –Project duration</td>
</tr>
<tr>
<td>3. Transactional cost reduction</td>
<td>3. Unforeseen cost</td>
</tr>
<tr>
<td>4. Improved competitive environment</td>
<td>4. Data Migration</td>
</tr>
<tr>
<td>5. Ensured homogenous production managing capability.</td>
<td>5. Difficulty in finding a conducive test environment.</td>
</tr>
<tr>
<td>8. Increased standardization</td>
<td>8. Communication gap</td>
</tr>
<tr>
<td>9. Shorter lead time</td>
<td></td>
</tr>
<tr>
<td>10. Planning synchronization</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>11. keeping lesser inventory</td>
<td></td>
</tr>
<tr>
<td>12. Improved workflow coordination</td>
<td></td>
</tr>
</tbody>
</table>

As we can see from the table above, there are more benefits to be achieve than challenges faced and high tendency that lesser integration challenges would be faced if there is competence on the part of those involved in the integration project. Per Hogberg, did state clearly that if there is technical competency many problems can be avoided. Although, Bosse Plym does not see any major issue arising from a technical aspect. He considers integration challenges to be generating from the understanding of various business processes involved.
6 Conclusion

The main objective we want to achieve in this thesis is to find the challenges and benefits that exist in integrating ERP and SCM. Then by using the knowledge gained we try to find the impact of the challenges on the anticipated benefits. This we have succeeded to find out from our research. As enumerated from the previous chapter, some of the challenges and benefits faced in integrating ERP and SCM are:

Challenges

- Long term and intangible ROIs.
- Time factor-project duration.
- Unforeseen cost.
- Data migration.
- Difficulty in finding a conducive test environment.
- Requirement change.
- Communication gap.
- Platform specification for integration.

Benefits

- Superior quality of data, production and services.
- Enhanced information visibility.
- Transaction cost reduction.
- Improved competitive environment.
- Ensure homogenous production managing capabilities.
- Master data harmonization and information integration.
- Increased standardization.
- Shorter lead time.
- Planning synchronization.
- Keep lesser inventory.
- Improved workflow coordination.

Considering our analysis from above we were able to draw a line between the effect of challenges on organization’s attain benefits. We have seen that challenges faced in integration could lead to process disruption in system integration. This has helped us to answer the question on how the challenges faced during systems integration (ERP and SCM) impact an organization’s achieved benefits. Moreover we saw that these challenges have impact on what we called the short term benefits. This is elaborated below.

Improve competitive environment. As explained by Motiwalla and Thompsom (2009) an integrated system would give a better enhanced information visibility, increase standardization which in turn would improve competitive environment. Gustaf Meland of Systeam explained that organization that have flexibility as the expected benefit would have to realize such benefit in a long term where there is challenge which could not be tackle immediately. Conclusively the effect of challenges on organization’s
benefit is that it makes prolonged the short term benefit. Organizations now find it difficult to differentiate between the short term and long term benefits.

We find it evident that the benefit of integration outweighs the challenges. Organisations are sure to reap enormous benefits by integrating and might even achieve benefits that they did not anticipate initially. Challenges also exist but with the degree at which knowledge about ERP and SCM integration is been acquired, most of the challenges can be avoided, and as one of our respondent mentioned; Challenges are there to be experienced as any problem experienced with integration creates knowledge and this is always good, no matter any challenges faced, Its’ always better with integration. Therefore, we say the balance between challenges and benefits of ERP and SCM are unequivocal, as the benefits surpass the challenges.

6.1 Thesis Contribution to the field of informatics

This thesis aims to contribute to the understanding of what balance that may occur between the challenges and benefits gained from integrating enterprise resource planning and supply chain management. We also aim to explore the impact of these challenges on organisation short term benefits.

6.2 Discussion

In this part of this thesis, we aim at describing and reflecting on what we could have done better and what we have done best in this thesis. We also addressed issues on further studies, to which researcher may be interested to look at later and acknowledge those that have contributed to the success of this thesis.

Despite all the efforts we put into making the thesis a success. We did come across some events and hurdles which may have one way or the other affected the general outcome of this thesis. With the method of data collection we have chosen, we thought it would be easy to get companies for interview. Surprisingly, we came across just a few companies whom are ready to conduct interview with us in English language. Additionally, we would have involved many user companies but we were limited as a result of time constraint.

Moreover, we discovered that most this companies were mostly concerned with the integration of their internal supply chain and give little attention to the external supply chain. Since some of these organizations are manufacturing companies they had little suppliers.

We believe that if we had privilege to more companies, that would have helped us to bring more light on the issue of the impact of challenges on organization benefit from integration of ERP and SCM.

6.3 Further Research

In the course of our research, we find out that it would be interesting to explore how the challenges faced during systems integration (ERP and SCM) impact on potential
benefits and to investigate the balance that may exist between the challenges and benefits.

we saw that companies were making use of integration enablers such as BizTalk and other integration platforms. These integration enablers/ integration platform do come with their own benefits and challenges and it would therefore be interesting to investigate whether such challenges and benefits could translate into the benefits and challenges of ERP and SCM integration. We could not get answers to this since this is beyond the scope of our research. We therefore leave this for further research.
List of references

Appendix

Chart 6-1  Gantt Chart

<table>
<thead>
<tr>
<th>Number</th>
<th>Task</th>
<th>Resource</th>
<th>Start</th>
<th>End</th>
<th>% Complete</th>
<th>Q1 - 2011</th>
<th>Q2 - 2011</th>
<th>Q3 - 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>January</td>
<td>February</td>
<td>March</td>
</tr>
<tr>
<td>1</td>
<td>Choose a research topic</td>
<td></td>
<td>2/11/2011</td>
<td>2/11/2011</td>
<td>1</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Start preparing the first draft of research proposal</td>
<td></td>
<td>2/12/2011</td>
<td>2/15/2011</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Review of research topic/ proposal</td>
<td></td>
<td>2/15/2011</td>
<td>2/20/2011</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Literature evaluation and article search</td>
<td></td>
<td>2/15/2011</td>
<td>3/30/2011</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Contacting and arranging interviews with companies</td>
<td></td>
<td>2/15/2011</td>
<td>3/20/2011</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Meeting with company representatives</td>
<td></td>
<td>2/28/2011</td>
<td>3/20/2011</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Weekly group meeting to discuss progress</td>
<td></td>
<td>3/15/2011</td>
<td>5/20/2011</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Conduct interviews</td>
<td></td>
<td>3/15/2011</td>
<td>4/7/2011</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Supervisory briefing on the process assumed</td>
<td></td>
<td>3/15/2011</td>
<td>5/20/2011</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Finalize project report</td>
<td></td>
<td>5/1/2011</td>
<td>5/30/2011</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interview

The interview questions have been developed base on the non-standardized interview form. In order for us to remain adaptable and open to the interviewee, we (interviewer) took flow of the interview. The interview questions have been grouped into two sets, the users and the consultants. The interview questions have been structured in the following order; basic questions, system integration, enterprise system solution, supply chain management and integration of ERP and SCM.

Interview Questions (User Companies).

1. Can you give us an overview of your experience with ERP systems?
2. Have you been involved with organisations that are using ERP and SCM?
3. What are some of the motivation that leads to procurement of these systems?
4. How do the systems mentioned above support business?
5. How do you think these two systems (ERP and SCM) can be integrated?
6. In your opinion, what are the most difficult challenges faced by many organisations when it comes to integrating an ERP with SCM?

7. What benefits do you think such integration would bring to an organisation?

8. Are there any specific training provided or education required by employees during and after the integration period?

9. What do you think most organisations expect to achieve by integrating ERP and SCM?

10. Do you think they are aware of probable challenges they may encounter trying to achieve integration of ERP and SCM?

11. What aspect(s) of your ERP and SCM do you think organisation should be concerned about the most?

12. Should the integration be limited or restricted to any specific business unit?

13. How do you think some of these problems that occur with systems integration could have been avoided?

14. Does the problem faced during integration have any specific effects on some organisations expected benefits?

15. Finally, do you think the benefits really outweigh the challenges faced during integration or is it vice versa?

**Interview Questions (Consultant Companies)**

16. Can you briefly give some information about yourself and your position in this organisation?

17. Have you been involved with organisations that are using ERP and SCM?

18. What are some of the motivation that leads to procurement of these systems?

19. How do the systems mentioned above support business?

20. How do you think these two systems (ERP and SCM) can be integrated?

21. What benefits do you think such integration would bring to an organisation?

22. In your opinion, what are the challenges faced by many organisations when it comes to integrating an ERP with SCM?

23. What do you think most organisations expect to achieve by integrating ERP and SCM?

24. What benefits do they achieve after integration?

25. What aspect(s) of ERP and SCM do you think organisation should be concerned about the most?

26. How do you think some of the problems that occur with systems integration could have been avoided?

27. Does the problem faced during integration have any specific effects on some organisations expected benefits?

28. Finally, Do you think the benefits really outweigh the challenges faced during integration or is it vice versa?