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Enterprise Application Software

Metropolia

Abstract

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This thesis was motivated by my professional interest in Enterprise Application Software (EAS). Before I would be able to address the subject of my interest I needed to build a framework that could be used for the thesis.

The goal of this thesis was to create a framework which can be used to analyze the applicability of EAS for different industries by certain applicability criteria. There are so many different EAS today for each software category that companies and organizations struggle during software acquisition processes with the challenge to determine the best candidate to their particular business. This thesis aimed to analyze the factors to be considered before and during the evaluation of the acquisition options.

The theoretical part of this thesis was built to separately determine the software and industry categories and applicability criteria. The theory on software consists of Business Intelligence (BI), Customer Relationship Management (CRM) and Database and Enterprise Resource Planning (ERP). The theory on industries covers the banking, manufacturing and telecommunications industries where telecommunications is considered as a service provider.

When the framework was finished it was utilized to perform an applicability analysis with it. The analysis was focused on every software category at a time. Every software category was analyzed for every industry by the chosen applicability criteria. The analysis led to conclusions on how to weigh different evaluation factors during the acquisition process.

Key words	IT, enterprise, software, framework

Opinnäytetyön motivaation taustalla on ollut ammatillinen kiinnostukseni yritysohjelmistoja kohtaan. Ennen kuin pystyin aloittamaan kiinnostukseni kohteena olevan aiheen käsittelyn minun tuli luoda tarkastelukehys, jota voisi käyttää opinnäytetyötä varten.

Opinnäytetyön tavoitteena oli luoda tarkastelukehys, jota voi käyttää yritysohjelmistojen soveltuuden analysointiin erilaisille toimialoille tiettyjen soveltuvuuskriitereiden mukaan. Nykypäivänä on olemassa niin monia eri yritysohjelmistoja jokaiseen ohjelmistokategoriaan, että hankkiessaan ohjelmistoja yritykset ja organisaatiot kokevat haastavaksi määritellä mikä ohjelmisto olisi juuri heille paras vaihtoehto. Opinnäytetyön tarkoitus oli analysoida tekijöitä, joita tulee huomioida ennen ja samalla, kun ohjelmistokandidaatteja arviodaan.

Teoria rakennettiin niin, että ohjelmisto- ja toimialakategoriat sekä soveltuvuuskriteerit määritellään erikseen. Ohjelmistokategoria koostuu liiketoimintatiedon hallinta-, asiakkuudenhallinta-, tietokanta- ja toiminnanohjausjärjestelmistä. Toimialakategoria koostuu pankki-, valmistus- ja telekommunikaatioaloista, joista telekommunikaatiota käsitellään palveluntarjoajana.

Kun tarkastelukehys valmistui, niin sitä hyödynnettiin suorittamalla soveltuvuusanalyysi sen avulla. Se kohdistettiin jokaiseen yrityskategoriaan kerrallaan. Jokaisen ohjelmistokategorian soveltuvuus analysoitiin jokaiselle toimialalle soveltuvuuskriteereiden mukaisesti. Analyysi johti johtopäätöksiin siitä, kuinka erilaisia arviointikriteereitä tulisi painottaa ohjelmistohankinnan aikana.

Contents

1   Introduction

In this thesis I look into the world of Enterprise Application Software (EAS). EAS is manufactured mainly for the purpose of large companies and organizations, but can also be benefitted from by different sized operators if their requirements meet the product properly.

A company with multiple departments often operates by utilizing processes which are relatively large. It these processes are not working properly, the company risks losing a huge amount of its efficiency, profitability and customer satisfaction. Large companies utilize EAS in many different ways to support their processes. Often it would be a pure impossibility for a company to run and perform the way they do without efficient and well utilized EAS software.

For this study, four different software types were chosen to represent their particular business purpose. In every EAS category at least a few software by different vendors are introduced. In some categories a particular software vendor and its product are understood to represent the software category itself (e.g. SAP ⇔ ERP).

Different EAS categories offer different kinds of benefits and have to be utilized in a unique way. EAS software of each category possesses an enormous amount of potential to support growth, enable major processes to function properly and assist management in decision making by offering accurate information in real time. To put it bluntly, without EAS businesses would be in the Stone Age.

1.1   Backround and Motivation

At the time I started to plan this thesis I had just finished working at International Business Machines (IBM) where I worked as a service coordinator for one and a half years. During that time I worked in various projects and performed a wide range of different tasks. My department at the company was service management and for the greater part of the time I was responsible for the management and development of

IBM Finland's internal infrastructure which required me to manage the licenses and coordinate the patching of a vast amount of different types of software.

Later I realized that even though I had learned much and was genuinely happy about the professional experience, I didn't fully get to understand the business purpose of the software. To understand the value that IBM and their customers were getting from owning or purchasing EAS software I would have to study the purpose and functions of EAS software more deeply. This led me to perform research and learning during my free time and finally concluded with my choosing to use EAS as the subject of my bachelor's thesis.

When I had finally decided on the subject of my thesis I struggled to delimit the amount of different software and categories to be covered. In order to allow me properly familiarize myself with the software I would cover in the thesis I had to choose some main software and categories to analyze and was forced to leave something out. I decided that Business Intelligence (BI), Customer Relationship Management (CRM), Database and Enterprise Resource Management (ERP) would form a comprehensive picture of the EAS and when explored deeply, would give me a strong foundation on the EAS field.

Introduction to Software

Software is a way for a user to take control of hardware. It allows its user to get value out of hardware which would otherwise only exist as a physical object. This value can be almost anything and only the mind is the limit of the potential of software. Software is developed to either allow a computer (hardware) to be run by a user or allow user to perform tasks on the already functioning operating system. Even though Spraul states that software can be categorized in many different ways a common way is to divide them into system, application and programming software. (Spraul 2005, p. 64).

The category of system software consists of all the programs necessary to run a computer. The main part of this section is the operating system, the most important software required on a computer. The operating system is a platform on which all the other programs on the computer are ran. The programs and computer are both useless without a working operating system installed on the computer. System software also

includes drivers which are required to enable particular hardware to work properly (e.g. printer, scanner or graphic card). (Spraul 2005, p. 64).
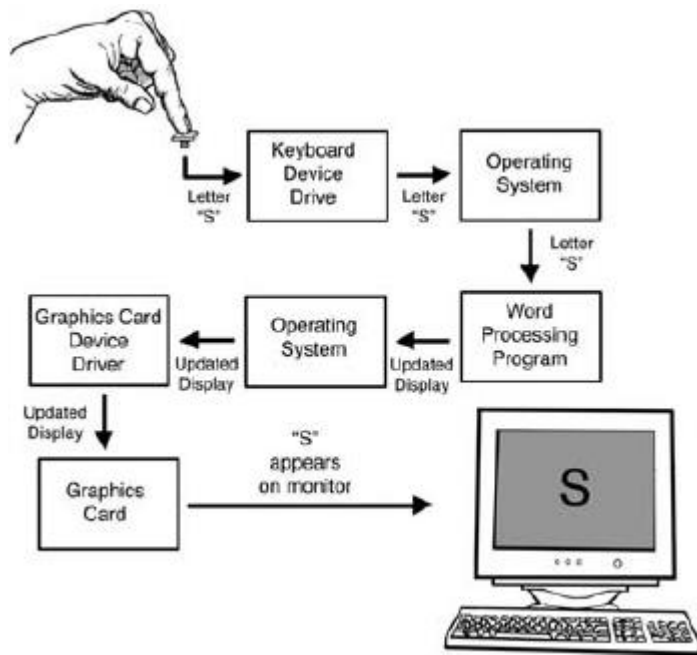

Figure 1. Chain of Actions. (Spraul 2005, p. 74).

Figure 1 shows the chain of action that takes place when a user presses button S on the keyboard. Every step is required in this flow to make the end result possible. If any step fails in this process the S will not appear on the screen.

Software engineering mainly focuses on developing new programs. Programming software is created for the purpose of writing new programs or software with a chosen code language. There are many to choose from. The best language for a current project at hand is often chosen among a few popular ones which include C, C++, Visual Basic, Java and Perl. Other well-known languages are C#, JavaScript, PHP, Python, Ruby, and SQL. (Spraul 2005, p. 82-83, 95-96).

Application software provides a method for a user to perform a specific task. Tasks can for example be either a need to browse the internet with a chosen browser or create and edit text with a tool suitable for it. (Spraul 2005, p. 64-65). This is the category from which a user is getting its value from. For almost every imaginable task that a computer is able to perform there exists a software to run it. Today it anymore isn't

about the capabilities of software, but actually user's capabilities to utilize the software in the correct way to bring him the best value. The user often is a company or an organization utilizing the Enterprise Application Software to support their business functions.

Introduction to Enterprise Application Software (EAS)

Enterprise Application Software (EAS) is developed for the purpose of businesses. Different business functions require different software with unique capabilities. EAS are utilized by companies and organizations all around the world to support their processes, departments and business functions and enable them to work properly. For companies already working with EAS systems they serve as the backbone of the companies' important functions. Companies which are not yet using EAS face a process of analyzing the need and benefits of possible EAS implementation and if continued eventually the selection between the different products.

Various different EAS categories exist and they are all developed to either support certain business functions or certain types of business. This is true to some extent, but there are software types which cross the boundaries of software categories. One example is Enterprise Resource Planning (ERP) software which with its various different modules can perform some Business Intelligence (BI) and Customer Relationship Management (CRM) tasks. This makes it even more complicated for companies to perform an analysis about what product types and products to choose for use in their particular businesses.

EAS types:
- Business Intelligence (BI)
- Customer Relationship Management (CRM)
- Enterprise Resource Management
- Database

In addition to the ones mentioned on this list, EAS categorization often includes Accounting Software, Business Process Management and Content Management System. These types are mostly linked to certain types of businesses and this is why their evaluation in the same context with the above four is ineffectual.

1.2   Goal

The goal of the thesis is to create a framework which can be used to evaluate the applicability of different EAS for different types of industries. When the framework is finished, it will be used to analyze the suitability of different types of EAS for different types of industries according to the chosen applicabilities.

The final goal will be to determine accurate conclusions about the applicability of different EAS for different types of industries. This will ease offering recommendations for companies that are planning software acquisition.

1.3   Research Methodology

The thesis has a strong foundation in theory. I studied books authored by professionals on their particular EAS area and was therefore able to form comprehensive picture of all four EAS. To achieve broader knowledge about customer needs regarding EAS I studied and analyzed how different EAS work, what their business purpose is and how they can be utilized to bring value.

The methodology of the thesis is based on building a framework which can be utilized to analyze the applicability of different EAS for different types of industries. The framework is to be built of different software categories, certain industry categories and suitable applicability criteria. The framework is then to be utilized by performing applicability analysis with it. This analysis will then lead into results and recommendations.

1.3.1   Research Process Chart

1. Determining the goal
2. Determining the research methodology
3. Creation of analysis framework
4. Applicability analysis by utilizing the analysis framework
5. Results and recommendations

2   Creation of Analysis Framework

This section concentrates on the creation process of the analysis framework. The framework will consist of different software and industry categories and applicability criteria. The applicability analysis will be performed by utilizing the framework.

2.1   Software Categories

Four different types of Enterprise Application Software (EAS) are chosen be used in the framework. These are Business Intelligence software, Customer Relationship Management software, Database software and Enterprise Resource Planning software. These four are chosen as they all are major contributors in the EAS field and are crucial factors for many businesses today.

2.1.1   Business Intelligence (BI)

Business Intelligence (BI) systems are used to gain valuable information out of raw data. Utilization of BI is essential for businesses working with enormous amounts of data e.g. a mobile communication operator which is responsible for storing all the data from their client phone call durations to bills. BI combines efforts with Database systems which are often the source of data.

Overview of Business Intelligence

A BI system or a tool offers its user a way to handle otherwise useless data by transforming it into a meaningful form. Methods of BI include data mining, forecasting, business analysis, visualization, reporting, charting and knowledge management. (Moss; Atre 2003, p. 29).

Transformed data can serve businesses in various different ways. It can e.g. assist in decision making, guide in channeling resources and cutting costs in many ways. Even though BI acquisition does possess great potential for business, beneficial results are achieved only with good utilization. To harness a BI system in the way that it produces full benefits one must have good management, process modification and trained users working with it. Experts have stated that "good data" is the key to BI's success. This

means that - in addition to the previously mentioned requirements to gain benefits – the data the company has stored must be organized in a manner that can be presented to business. IT (Information Technology) alone isn't able to develop the business, but business functions (e.g. operations and sales) must have the possibility to understand and utilize the company data. By this way different departments can benefit from each other and set common goals. (Volitich 2008, p. 28).

BI systems contain a technological element. Generally it is always IT-based, but in principle could be anything that stores data, e.g. yellow post-it notes. IT brings BI systems great possibilities and allows the handling of enormous amounts of data. BI systems linked with innovative utilization of IT form a competitive advantage to any business. (Laursen 2010, p. 15).

Figure 2 below represents process development by comparing the growth of process performance over time. It shows two types of information – lead and lag information. Lead information consists of Business Analytics, Revolutionary change, Innovation, Business process reengineering and potential new differentiation. The lag information methods of development are Traditional BI reporting, Evolutionary change, Maintaining, Process optimization and Mastering the basics. Lag information consists of basic business methods. These can be utilized to balance trade-offs and optimize performance. This rarely results in high developments, but it can produce moderate benefits over time. Lead information on the other hand is a way to aim at higher levels of innovation. Lead information requires a high amount of rethinking, changes and sometimes even luck to come true, but with these methods it's possible to accomplish major developments. (Laursen; Thorlund 2010, p. 15).
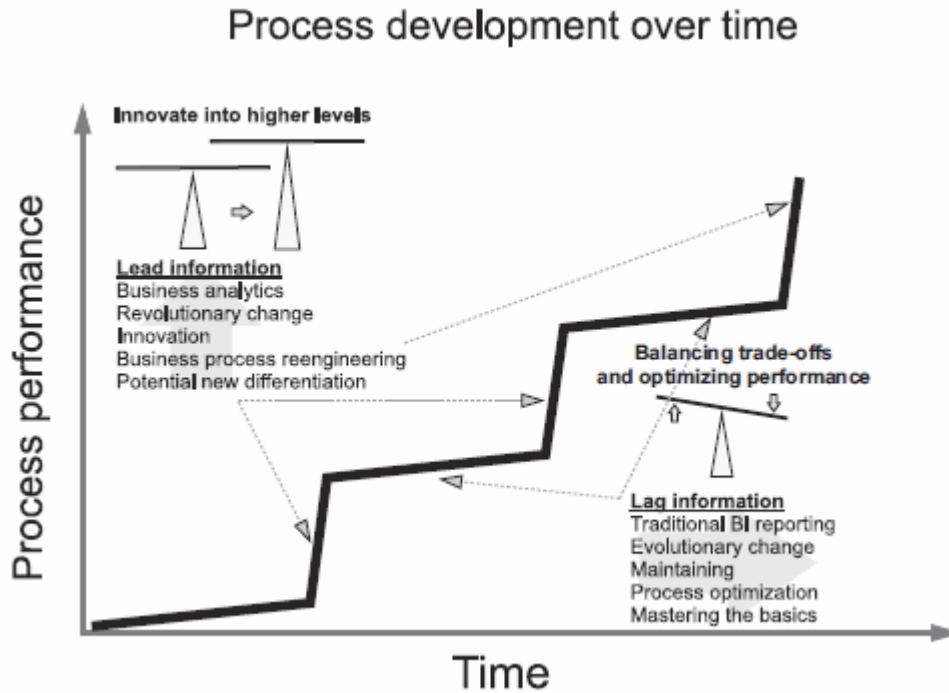
Figure 2. The Stairway Chart: Emphasizing the Difference between Lead and Lag Information. (Laursen 2010, p. 15).

It is important for the organization to understand that BI has potential to affect the way which decisions are made. The more the organization is willing and able to change, the more significant results are achievable. (Volitich 2008, p. 25).

Warehouses

BI systems are generally in connection with different databases from which data is received. Without data a BI tool is ineffectual. Data and its transformation are required to be able to determine the necessary conclusions and thus enable better decision making. Databases for BI decision-support can be e.g. enterprise-wide data warehouses, data marts, data mining databases, web warehouses and operational data stores, but they are not limited only to these. (Moss 2003, p. 29-30).

Vendors of Business Intelligence

Vendors of Business Intelligence consist of various different developers but IBM, Microsoft and Oracle together possess a large portion of the market share with their products.

IBM

- IBM Cognos 8

Microsoft

- Dynamics GP Business Intelligence

Oracle

- Business Intelligence Enterprise Edition

IBM is well-known on the BI field with their Cognos 8 product. Microsoft competes with their Dynamics product family which consists of different EAS types. Oracle has multiple BI solutions. Business Intelligence Enterprise Edition is one of the best-known of those.

2.1.2 Customer Relationship Management (CRM)

Customer Relationship Management (CRM) as a term has only been in use since the early 1990s. Since then it has been described by various different ways and it still causes many misunderstandings among people. This section aims to offer basic, correct and trustworthy facts about CRM to expand the knowledge of the reader. (Buttle 2009, p. 26).

Overview of Customer Relationship Management

In the information industry CRM is considered to represent the methodologies, software and internet capabilities that help a company to manage customer relationships in an organized way.

> *CRM is the process of managing all aspects of interaction a company has with its customers, including prospecting, sales and service. CRM applications attempt to provide insight into and improve the company/customer relationship by combining all these views of customer interaction into one picture. (Buttle 2009, p. 27).*

As Buttle states above, CRM is the core of a company's strategy to integrate internal processes and functions and external networks, in a way that aims to create and deliver value to customers at a profit. (Buttle 2009, p. 38).

Types of CRM

CRM can be divided into four different types. One method of categorization is used in figure 3 below and explained more thoroughly below the figure.

Type of CRM	Dominant characteristic
Strategic	Strategic CRM is a core customer-centric business strategy that aims at winning and keeping profitable customers
Operational	Operational CRM focuses on the automation of customer-facing processes such as selling, marketing and customer service
Analytical	Analytical CRM focuses on the intelligent mining of customer-related data for strategic or tactical purposes
Collaborative	Collaborative CRM applies technology across organizational boundaries with a view to optimizing company, partner and customer value

Figure 3. Definitions of CRM. (Buttle 2009, p. 27).

Strategic CRM

Strategic CRM focuses on the development of customer-centric business culture. The goal of this culture is to win and maintain customers by better creation and delivery of value compared to the competitors. In a culture that encourages customer-centric behavior it is common to allocate resources where they best enhance customer value. Reward systems are set in place to promote employee actions that enhance customer satisfaction. Customer information is to be collected, shared and applied across the business. Many companies claim themselves as customer-centric, customer-led or customer-oriented, but in reality only a few are. (Buttle 2009, p. 27-29).

Operational CRM

Operational CRM aims to automate and improve business processes. Processes which often benefit from this are customer-facing and customer supporting processes. With CRM software applications it is possible to enable automation and integrate marketing, selling and service functions. Marketing automation (MA) is used to apply technology to marketing processes. Sales-force automation (SFA) was previously the original form of operational CRM. SFA's task is to apply technology to the management of company's selling activities. Service automation assists companies in managing their service operations, whether delivered through call center, contact center, web or face-to-face. (Buttle 2009, p. 32).

Buttle clearly encapsulates the potential of SFA by stating:

> *CRM software enables companies to handle and coordinate their service-related inbound and outbound communications across all channels. Software vendors claim that this enables users to become more efficient and effective by reducing service costs, improving service quality, lifting productivity and increasing customer satisfaction. (Buttle 2009, p. 32).*

Analytical CRM

Analytical CRM concentrates on capturing, storing, extracting, integrating, processing, interpreting, distributing, using and reporting customer-related data to enhance the value for both the customer and the company. It builds on the foundation of information regarding the customer. This information and data can be found in enterprise-wide repositories: sales data (purchase history), financial data (payment history, credit score), marketing data (campaign response, loyalty scheme data) and service data. Analytical CRM has become an essential segment of many implementations of CRM. (Buttle 2009, p. 33-34).

Collaborative CRM

Collaborative CRM represents the strategic and tactical alignment of normally fully separate enterprises. By modifying the supply chain it is possible to more profitably identify, attract, retain, and develop customers. Collaborative CRM communicates and transacts across organizational boundaries by using CRM technologies.

Buttle well summarizes the value of collaborative CRM with the below statement:

> *Collaborative CRM enables separate organizations to align their efforts to service customers more effectively. It allows valuable information to be shared along the supply chain. (Buttle 2009, p. 34).*

Vendors of CRM software

The technology research organization Forrest estimated that the worldwide spending on CRM technologies will reach 11 billion US dollars per annum by 2010. (Buttle 2009, p. 26). Multiple vendors compete of this enormous market share and there has recently been considerable consolidation of the CRM vendor marketplace.

Notable CRM vendors of today include names such as Oracle, SAP, SAS, KANA, Microsoft and StayinFront. Below are listed a few well-known vendors with their CRM products:

Microsoft
- Microsoft Dynamics CRM

Oracle
- Oracle Siebel CRM
- Oracle CRM on Demand
- Oracle E-Business Suite (EBS)
- Oracle PeopleSoft Enterprise
- Oracle Contact Center Anywhere (CCA)

SAP
- SAP CRM

As can be noticed, Oracle has divided their CRM into different product lines which is anomalous to how e.g. Microsoft works. Microsoft concentrates on releasing new product versions every few years and offers CRM as a complete package. The SAP CRM works somewhat similarly to Microsoft Dynamics CRM, but consists of multiple (10+) different modules which jointly form their CRM. (Buttle 2009, p. 39).

2.1.3 Database

A database is one of the most typical applications used by companies. A database is best described by Spraul as "any machine-readable collection of facts that is organized for easy retrieval and modification." (Spraul 2005, p. 159).

Overview of Database

A large portion of database applications are client/server applications. In this scenario the database is stored in a server or set of servers. This can be accessed by the user's computer via network. Internet actually works analogous to this. A web browser works as a client program to display the web pages to user after the browser has received the stored data from the web servers. (Spraul 2005, p. 159).

Often the only way for a business to run and work with a massive amount of data is to use a database. A database is the only tool to store endless amounts of data that has to be retrievable in seconds. (Coronel; Morris; Rob 2011, p. 4-5).

The reason behind a database's existence is well summarized by Coronel in the following:

> "Good decisions require good information that is derived from raw facts. These raw facts are known as data. Data are likely to be managed most efficiently when they are stored in a database." (Coronel 2011, p. 4).

Database management system (DBMS)

A database management system (DBMS) is a program that manages the database itself. It enables the managing of structure and controlling of access to the stored data in the database. As shown in the below picture, DBMS serves as the intermediary be-

tween the user and the database. The only way to access the data in the database is through DBMS. The database structure itself is stored as a collection of files. (Coronel 2011, p. 7-8).
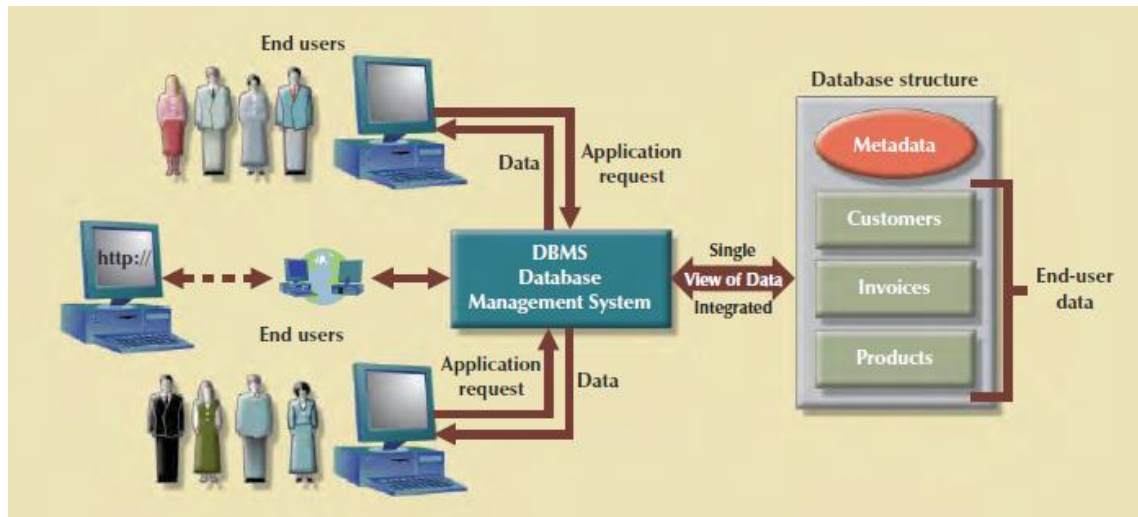

Figure 4. The DBMS manages the interaction between the end user and the database. (Coronel 2011, p. 8).

The advantages of DBMS are, though not limited to:

- Improved data sharing
- Improved data security
- Better data integration
- Minimized data inconsistency
- Improved data access

DBMS is the central piece in the symbiosis between the user and database. A well-managed database can give the user and organization a vast amount of benefits compared to a database lacking proper management. (Coronel 2011, p. 8).

Information Compared to Data

A database stores raw data. By the use of the word *raw* is indicated that facts have not yet been processed. Again, information is the result of processing raw data as Coronel describes: "Information is the result of processing raw data to reveal its meaning." (Coronel 2011, p. 4). Processing data can be anything that is done to reveal patterns

by organizing it, making forecasts or drawn inferences using statistical modeling. (Coronel 2011, p. 4-7).

SQL Queries

A subset of data stored in a relational database is requested by querying. The simplest query is a scenario where a unique key is used and a single record received. The more complex version of this is when the key is unknown and therefore a query needs to perform the request by examining every record in a chosen table. (Spraul 2005, p. 162).

The standardized way to perform a query from a relational database is Structured Query Language (SQL). SQL query is a text command sent to a database server. The database then replies with the results matching that query. (Spraul 2005, p. 162).

Below is an example of how a simple SQL query can look like in a case of requesting a certain title 'Appeal to Reason' (the album name of a band called Rise Against) from a database which stores all the music records:

```
SELECT * FROM TitleTable WHERE Title = "Appeal to Reason"
```

In this query the asterisk (*) stands for "all columns". With this query from the database an entire record of the album of 'Appeal to Reason' is received. (Spraul 2005, p. 162).

When the needed data is scattered across multiple tables it is necessary to use more complex queries. (Spraul 2005, p. 162-163).

Most queries need multiple steps to carry out the required action. The order of these steps can enormously affect the quickness of the execution query. (Spraul 2005, p. 163).

Indexes

Working with SQL queries is very time consuming and therefore it is often common to create an index on certain items. An index is called a table and its purpose is to relate a single item, e.g. the title, back to the records in which the item is found.

Indexes are able to be designed in various different ways. In the above record example one solution is to keep the records sorted by alphabetical order. It is important for the database designer to work closely with the intended users of the database. This allows the databases to be indexed the proper way and maximizes the benefits its users will receive. By analogy, phonebook allows a user to find someone's phone number using the person's name, but it doesn't help in finding the name of a person using just the phone number. (Spraul 2005, p. 163).

Vendors of Database

Databases are the hidden workhorses of many IT systems ran by today's organizations. Vendor's products differ widely on price, performance and functionalities. The main database suppliers include companies such as Fujitsu, Hewlett-Packard, IBM, Microsoft, Oracle, SAS Institute and Sybase. Below is listed the product names from three major operators on the database field.

IBM
- DB2

Microsoft
- Microsoft SQL Server

Oracle
- Oracle Database

2.1.4   Enterprise Resource Planning (ERP)

Enterprise resource planning (ERP) can be quickly understood with one sentence from Alexis stating that "ERP software is a mirror image of the major business processes of

an organization, such as customer order fulfillment and manufacturing." (Alexis 2006, p. 19). ERP aims to connect the different departments and functions of an organization in a way that even a large enterprise can function as a unified team and avoid the fission into different divisions with different goals.

Overview of Enterprise Resource Planning

Information technology (IT) has revolutionized the way we live and work and continues do so. It has done the same in business and ERP alone is great evidence about that. Companies have gained enormous benefits and possibilities after the implementations of ERP systems and many businesses today simply wouldn't be able to run, at least on their current level and size, without an operational ERP system. (Alexis 2006, p. 15). As figure 5 shows, before ERP it was common for an organization to have multiple different departments working to achieve their own departmental goals. Without a proper tool or system the information simply wasn't transferring between the departments as it should.
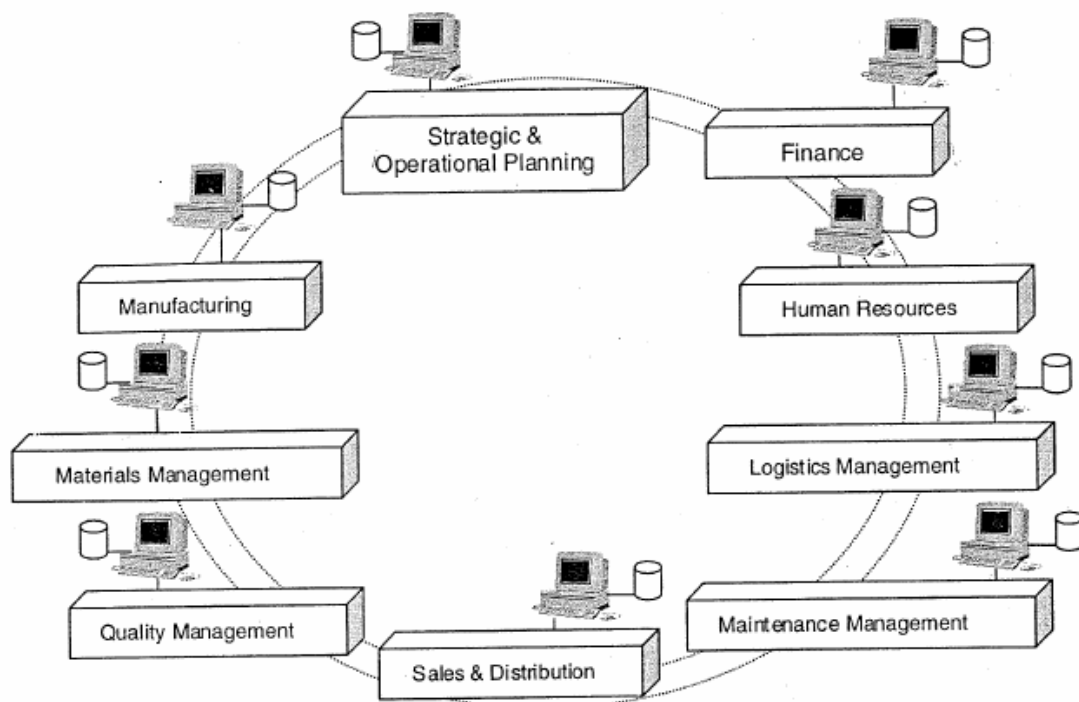

Figure 5. Isolated information systems – a pre-ERP scenario. (Alexis 2006, p. 17).

By ERP is meant all the techniques and concepts for the integrated management of businesses as a whole to improve the efficiency of an enterprise and it aims to achieve effective use of management resources. ERP systems integrate separate business functions – materials management, product planning, sales, distribution, finance and accounting and others – into a single application. Figure 6 shows the scenario after an ERP system implementation in an organization compared to the pre-ERP situation in figure 5. Figure 6 demonstrates the constant communication and immediate information transferring over boarders of departments which leads to better adjusted decisions by management. (Alexis 2006, p. 36).
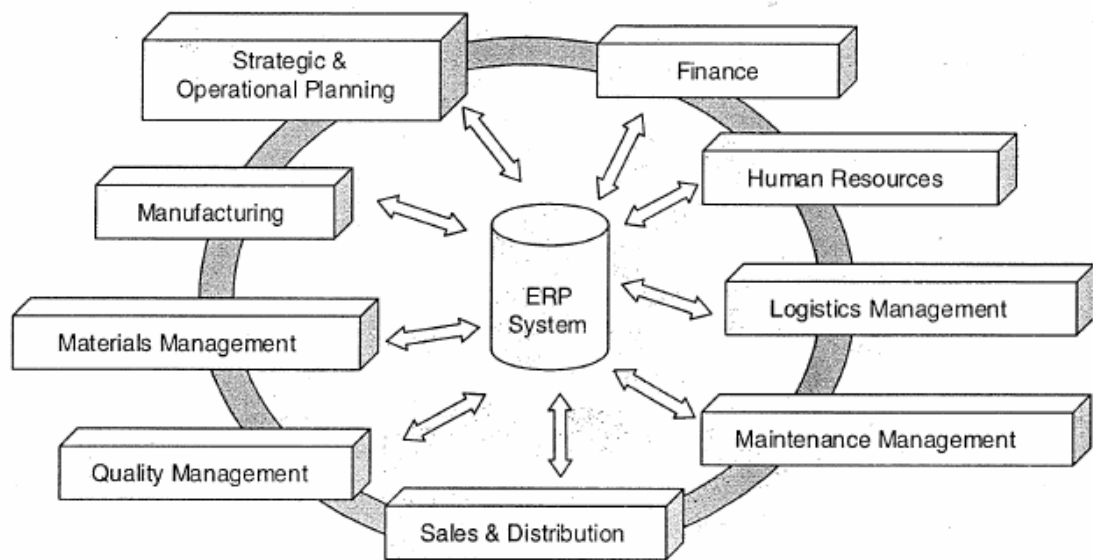

Figure 6. Information integration through ERP systems. (Alexis 2006, p. 19).

Commonness of ERP systems in IT environments of businesses has grown rapidly. According to Grabski the amount of large business organizations that have implemented an ERP system is reported in many studies to be 90% (Olhager and Selldin, 2003; Manufacturing Business Technology, 2008). (Grabski 2009, p. 6). For a long time ERP was only obtainable for the large businesses due to its size, complexity, requirements and price. Since then developers have realized the wider need for ERP systems and today ERP implementations are often done also in mid-sized organizations. (Grabski 2009, p. 6-8).

The Advantages of ERP

Purchasing of an ERP system may bring an organization many advantages – both direct and indirect. The direct advantages can affect positively the efficiency and integration of information which allows better decision making. The indirect benefits may be seen as a better corporate image, improved customer goodwill and customer satisfaction. Right decisions and utilization as well as time are definitely required to receive indirect benefits via an ERP installation. Below are listed some direct benefits Alexis (2006) lists an ERP system has:

- Business Integration
- Flexibility
- Better Analysis and Planning Capabilities
- Use of Latest Technology

Business integration is considered as the first and most important advantage of ERP. It can be the most essential reason for a company to purchase ERP software. ERP packages are being integrated because it allows the automatic data exchange among application. Well integrated ERP brings all company functions together and simultaneously gives the management the possibility to make better decisions in a timely manner. (Alexis 2006, p. 21).

ERP software brings flexibility by allowing different languages, currencies, accounting standards and so on to be covered in one single system. Particularly important flexibility is described by Alexis as he emphasizes below:

> *Functions that comprehensively manage multiple locations of a company can be packaged and implemented automatically. To cope with company globalization and system unification, this flexibility is essential, and one can say that it has major advantages, not simply for development and maintenance, but also in terms of management. (Alexis 2006, p. 21-22).*

Another possible benefit is the boost to the planning functions. To fully utilize many types of decision support systems and simulation functions it is necessary to enable comprehensive and unified management of related business and its data. This allows

better analysis and planning capabilities for the management as a whole. (Alexis 2006, p. 22).

The use of the latest technology guarantees the latest developments in information technology (IT) to the company. The ERP vendors have learned that in order to sustain growth, they need to utilize the latest developments and technology. Therefore they have adapted their software to take the advantage of many new technologies. Examples of these developments in the past include open systems, client/server technology, internet/intranet, CALS (Computer-Aided Acquisition and Logistics Support) and electronic-commerce. Alexis greatly crystalizes the future-minded ideology in ERP systems when he stresses the role of "quick adaptation to the latest changes in Information Technology that makes the flexible adaptation to changes in future business environments possible." (Alexis 2006, p. 22).

Vendors of Enterprise Resource Planning

For a long time SAP has dominated the ERP field. Recently Oracle has, however, significantly closed the gap to SAP's market share with their recent acquisitions. Currently their margin is fairly hard to distinguish. Below are listed the ERP product names of three major contributors:

Microsoft
- Microsoft Dynamics

Oracle
- eBusiness Suite
- Peoplesoft
- JD Edwards EnterpriseOne

SAP
- SAP ERP (Former SAP R/3)

Microsoft has built their ERP under the Dynamics product family. It consists of four primary products which are Microsoft Dynamics AX, Microsoft Dynamics GP, Microsoft Dynamics NAV and Microsoft Dynamics SL. Oracle on the other hand hasn't divided

their products, but has obtained two external products via acquisitions. Their own product eBusiness Suite is joined by Peoplesoft and JD Edwards Enterprise one. SAP's product is called simply SAP ERP. Their product was previously called SAP R/3, but changed after a name change to simplify the product. SAP consists of multiple different modules and can be modified for the different needs businesses and companies have.

2.2   Industry Categories

In this section the industries to be applied in the framework are chosen. The industries are described and the reasoning behind the selection is explained. The chosen industries are among the target audience of many EAS.

Banking

Technology has transformed businesses in many different areas. The banking industry is a great example of this. IT has enabled banking to shift their focus on which kind of services to offer and how. The transformation is still ongoing, but the possibilities of EAS in banking are truly enormous. (Buttle 2009, p. 37, 58).

The utilization of IT is a key factor in the banking industry when a company seeks to stand out compared to its competitors. Coltman maintains that organizations with superior CRM capability show a greater tendency to achieve higher levels of performance relative to competitors. (Coltman 2007, p. 10).

According to Coltman, superior CRM capability will arise when sufficient technical, human and business related capabilities exist in the firm. It is unreasonable to assume that IT capability alone will make the difference as the data needs to be interpreted correctly in the context of the business. The same applies to several IT technologies. (Coltman 2007, p. 7-8).

> *The first implication for managers is that CRM programs should be directed towards an adroit combination of capabilities that competitors may struggle to match. On this point the results are quite clear: high performing banks base their CRM program success on business structures first,*

> human skills second, and IT third. Bringing these capabilities together is not easy, but that is exactly why effective CRM can be a source of competitive advantage. (Coltman 2007, p. 21).

Well implemented and utilized IT can, as Coltman states above, bring company competitive advantage. Even if better decision making is achievable with CRM and IT, it requires skills and know-how possessed by staff in converting the data to customer knowledge to really make a difference.

The several IT utilization possibilities of the banking industry and the fact that the industry is currently shaping by the ongoing transformation from solid offices to internet and remote services led to the decisions to use it as an industry in the framework.

Manufacturing

A company which concentrates on manufacturing has an incredible amount of tasks it must be able to perform. These tasks include for example purchasing from suppliers, assembling and packaging the parts, preparing manuals and marketing plans as well as selling the products. Additionally the company also has a large number of support functions. Someone must take care of the well-being of its employees, new staff must be recruited and hired, people must receive their salaries and the place must be cleaned. (Laursen 2010, p. 15).

This type of a company possesses a large amount of functions that can be supported by different EAS. ERP systems, if utilized successfully, can bestow impressive benefits to adopting firms. These benefits may either be strategic, operational or information related. (Muscatello; Small; Chen 2003: p. 850).

> While ERP installations often help small and midsize manufacturers to improve their strategic and competitive capabilities, there are several reasons why some firms are not rushing to install the systems. First, the ERP implementation efforts of many of their larger counterparts have resulted in partial failure, and in some cases total abandonment. (Muscatello 2003: p. 851).

As Muscatello states above, even though the potential of IT and ERP is high for the manufacturing industry, the companies are being careful and trying to avoid rushing into acquisitions. It has been reported (Trunick 1999, pp. 23-6) that 40 percent of all ERP installations achieve partial implementation and that nearly 20 percent are scrapped as total failures. (Muscatello 2003: p. 851).

ERP is being promoted as a desirable and critical link to enhance integration between all functional areas within the manufacturing organization. This may even enhance the integration with an organization's upstream and downstream trading partners. The manufacturing industry is a great example to be used as an industry for the framework in this thesis as it is an interesting combination of production and surrounding functions which can, if designed and executed well, be linked efficiently together to improve information integration and flow. (Muscatello 2003: p. 851).

Telecommunications

Telecommunications companies operate by offering telecommunications services to their clients and business clients. In addition to basic company functions, the telecommunication company succeeds by having a strong IT department, efficient marketing strategies and active customer service. (Laursen 2010, p. 68-72).

Wright, Stone and Merlin manage to clearly encapsulate the industry's target audience by stating that many telecommunications companies are now aiming to use CRM techniques to concentrate on the development and retention of higher-value customers. This is the group that telecommunications companies desire to find and eventually shape their services for. (Wright; Stone; Merlin 2002, p. 342).

Companies are seeking for new ways to reach customers, and to monitor and reduce the costs of managing them through products and systems harnessed to the Internet. Cost effective customer support is almost without exception delivered online. The IT is the key for the telecommunications industry to find the ways to offer services with better profits and to reduce costs as well. (Wright 2002, p. 342-343).

The telecommunications industry is to be one of three industries in the thesis' framework. It is interesting industry to be analyzed as telecommunications companies often

possess enormous amounts of raw data which they struggle to efficiently transform into meaningful form. Additionally their services are always growing and developing which makes it open to technology innovations. The industry is to be regarded as a service provider rather than manufacturer.

2.3   Applicability Criteria

This section concentrates on the software acquisition process and its applicability criteria. The software acquisition process, performed by a company when determining the most suitable software option, is often very complex and risky. Therefore it is essential that it is planned precisely and with utmost care and professionalism.

The software acquisitions always start with the need and it must be met with the software. The journey from the need to the choice process and actual implementation is long and troublesome. The journey consists of planning the process, establishing evaluation criteria, establishing requirements, selection process, evaluation process, choice process and negotiation process. When performed efficiently the planning process continues during the whole process as by time to time examining the current status followed by required steering actions. (Verville; Halingten, 2002: p. 211-215).

Every section of the acquisition process possesses its own unique challenges which cannot be hurried. The key of this section though is to establish clear applicability criteria to serve as one corner of the framework when performing applicability analysis for EAS. Thus the overall picture of the acquisition process is bypassed and the focus is on finding applicability criteria.

The common elements of an acquisition or purchase are cost, duration, challenges and gains. Other important factors and evaluation criteria are found only by performing a deeper analysis. Verville states that when establishing the evaluation criteria it is efficient to divide them into three different groups: vendor, functionality and technical. (Verville, 2002: p. 212, 214), (Buttle 2009, p. 86).

The vendor category includes size, financial stability and reputation of the vendor. Vendor evaluation may also include a financial report and statement analysis and the

requesting of not only the software price but total cost proposal. Additionally the long-term viability and vendor's vision/corporate direction can be taken into account during analysis. (Verville, 2002: p. 212, 214).

The functionality category includes features of the software, functionalities specific to front-end interfaces and user-friendliness. The functionality is evaluated by arranging a demonstrated test of the software for the group of test users. Technical aspects of the functionalities are on the other hand evaluated solely by technical personnel. According to Verville functional evaluation is often considered to be one of the most important processes of acquisition. (Verville, 2002: p. 212, 214).

The technical category itself includes specifics of systems architecture, integration, performance and security. The responsibility of technical testing again belongs to technical personnel or in some scenarios an assigned consulting group. This process is quite straight forward and able to be planned accurately. (Verville, 2002: p. 212, 214).

Nelson, Richmond and Seidmann urge to notify the difference between packaged and customized software. Nelson illustrates the difference by stating that customized software is developed in the situation when it is not cost-beneficial to meet the user requirements through modifications to packaged software. Another necessary factor to be taken into account is the code language by which the software is written with. For the more popular language it is later easier to find a customizer. (Nelson; Richmond; Seidmann, 1996: p. 30, 34).

The applicability criteria to be used in the analysis framework are functionality, technical and customizability. Functionality greatly affects the amount of benefits users are able to gain from the software. The technical aspect may affect the costs and duration of the acquisition and implementation. Customizability on the other hand may ease in future when e.g. adding modifications or additional modules to the software and therefore it can assist with growth. (Buttle 2009, p. 86) (Coronel 2011, p. 219, 516).

2.4   Analysis Framework

	Business Intelligence	Customer Relationship Management	Database	Enterprise Resource Planning
Banking	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?
Manufacturing	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?
Telecommunications	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?	• Functionality ? • Technical ? • Customizability ?

Figure 7. Analysis framework before utilization.

Above figure 7 visualizes the analysis framework. The software categories are on the top and industry categories on the side. The sections with question marks are yet un-filled and express the applicability analysis.

3   Applicability Analysis

Applicability analysis will be performed in this section. It will be carried out by utilizing the earlier developed analysis framework. The framework consists of three different dimensions. These are software and industry categories and applicability criteria.

3.1   Analysis

The analysis section is divided by software categories. Under each software category section its applicability for all three industries in the framework is analyzed separately.

3.1.1   Business Intelligence

Banking

BI system acquisitions for the banking industry are typically considered in situations where the company possesses a considerable amount of stored customer data and struggles to capitalize on it in an efficient way.

During acquisition considerations the evaluation of functionalities should receive the most amount of attention. The benefit of a BI system, especially in banking, greatly depends on the features of the software and user-friendliness. The total success of the acquisition is highly impacted by the features matching the company's needs.

The technical perspective and evaluation of any EAS is quite a straight forward pro-cess, though the evaluation will review many important functions of the software. Nothing should be taken lightly when evaluating systems architecture, integration, per-formance and security. The evaluation of these functions should lead into *reject* or *pass* result and if software passes the requirements it should receive a grade e.g. for performance and security which allows better comparison with alternative software options.

Customizability for BI systems in banking is not a top prioritization, but is still some-thing to be considered. Customizability of functionalities is essential to be able to best

utilize the system. BI systems usually are not to receive huge modifications later on in future. Therefore, if needed, customizability can be bargained.

With well utilized data, companies are able to cost efficiently determine their target audience and better serve them by more needed and accurate services.

Manufacturing

The motivation behind BI system acquisition consideration for the manufacturing industry lies in the hope of achieving better performance. BI in manufacturing can greatly assist in inventory management, reporting and allow quicker responding to changing markets.

The evaluation of a BI system for a company in the manufacturing industry should concentrate on the functionalities of the system. The desired benefit is found when the functionalities are similar to the needs of the company. Therefore a lot of different software options should be tested and the functionalities perspective weighted among the overall comparison of them.

On the technical aspect of the evaluation the company should pay attention to the integration point of view. The BI system should painlessly integrate to the existing systems and preferably even to forthcoming systems in future. Additionally the system should perform efficiently and therefore performance has to reach good levels to be considered as a candidate for acquisition.

It is not common practice to perform large customizations to BI systems later in future. Though taking in account that the environment of other company's systems could face developments or upgrades in future, customizable integration of BI would be beneficial.

Good acquisition for a manufacturing company would be software that effortlessly integrates to existing systems and possesses the level of customizability to allow integrations to next generation systems. Well executed acquisition process and followed implementation can bring the company major efficiency and performance to their processes.

Telecommunications

A telecommunications company working as a service provider considers a BI system in situation where they already possess a somewhat significant client pool and related client data. To capture the total value of the already obtained information, the company desperately needs assistance with utilizing it. The BI system which is well suitable to the company's needs will be the answer to this need. The evaluation of the acquisition options does, however, play a major role in determining the best candidate.

The evaluation should prioritize functionalities. The features and user-friendliness are essential and must strictly match the company's needs. BI software should include the features the company considers to get their value from.

The technical evaluation will determine the software's level of performance and security and should rank the acquisition candidates by the grade received. This will ease comparing the acquisition options against each other. Additionally the integration aspect of the technical evaluation does play a role, but depends on the company's existing systems. A company in an acquisition planning process should pre-determine the integration requirements to be able to perform technical testing as straight forward as possible.

Customizability of BI in this scenario does not weigh a huge amount. Though, as always is positive, if the used code language in software is well-known, it is easier and cheaper to modify it later if necessary.

By performing a well planned and executed software acquisition process and implementation, telecommunications companies can achieve not only a system, but a great tool they can utilize to enhance their processes and improve customer satisfaction and retention in the long run.

3.1.2   Customer Relationship Management

Banking

When evaluating the functionalities perspective during acquisition consideration the focus should be on the features and user-friendliness. Many functions and features are necessary for a company working in the banking industry. These should be pre-determined during the planning process to avoid resource waste during the evaluation.

The technical aspect of CRM acquisition consideration will focus highly on security. Customer critical data is stored all around the CRM system. In addition to security CRM has to function and perform efficiently. Thus the performance must meet high standards.

Customizability should be a priority in the evaluation for a banking company as the industry is under a vast transformation process and it's very likely that the companies business operations will develop in near future and therefore customization is required.

Manufacturing

Manufacturing companies consider CRM in the hope of boosting their sales. When evaluating functionalities during acquisition considerations it is essential to focus on user-friendliness. Feature comparison and evaluation should also receive somewhat same prioritization.

The technical aspect should take in account integration, performance and security. Integration may be essential if the company already possesses systems which need to be integrated into CRM. Security is always critical, especially when customers and their information are managed. Therefore the CRM vendor should be considered as reliable when their information security background is inspected.

Customizability should be slightly weighed in the evaluation, but for a manufacturing company it isn't a key aspect in acquisition.

Telecommunications

The requirements about the features of CRM should be pre-determined during the planning phase. During acquisitions evaluation for a telecommunications service provider company the required features should all exist before even allowing the candi-

date to pass for further testing. The benefits of CRM are difficult to unleash if features are negotiated. In Addition to this the user-friendliness of the system is essential and should receive attention during the evaluation.

The technical aspect should evaluate performance and security as priorities. It is unconditional for a security evaluation to meet the required standards as CRM in telecommunications will be managing an enormous amount of customer critical data.

Customizability in telecommunications CRM acquisitions is to be taken in account. Services offered by telecommunication service providers are ever developing and therefore it would be beneficial to preserve the possibility to modify the CRM system in future if needed.

3.1.3   Database

Banking

The evaluation of the functionalities should weigh the user-friendliness aspect. The features should allow the company to easily and precisely manage the database. The features should additionally enable strict and secure user management as success in banking is highly dependent on security.

The technical evaluation is highly focused on the security aspect of the acquisition candidates. Banking databases will include all client information e.g. balances and therefore a high level of security is an absolute requirement for the system. In addition to this the performance has to meet sufficient levels as a banking database will most likely experience high traffic.

Overall customizability of the system doesn't play a big role in the database evaluation process.

Manufacturing

During the database acquisition consideration for manufacturing company the evaluation of functionalities should concentrate on user-friendliness. The features should

meet the requirements that the company has determined during planning process. In addition to this the features should receive tests on how they perform, but besides that they shouldn't be receiving more evaluation attention.

For a manufacturing company the requirements on the technical aspect focus highly on performance. The manufacturing companies may seek e.g. better inventory management and this is only achievable with a database which performs efficiently. Basic security is always essential in databases which include customer specific data, though its evaluation for the manufacturing industry is less critical compared to banking.

Customizability is left under lesser attention as it is rather an insignificant aspect of a database.

Telecommunications

The evaluation of functionalities for a company working as a telecommunication service provider should be a somewhat simple comparison between pre-planned requirements and the features the acquisition candidates possess.

A telecommunications service provider does manage customer specific data and therefore evaluation of security is prioritized first. Immediately after security follows performance which should receive a considerable amount of attention in the evaluation.

Customizability should receive the least attention during the evaluation process as core database modifications later on are very rare.

3.1.4   Enterprise Resource Planning

Banking

When any company starts to consider ERP software acquisition it should plan the process early on and thoroughly. Too many ERP acquisitions or implementations tend to fail and the only way to improve this rating is to learn from other's mistakes. This should show especially in the planning efforts. A company competing in the banking

industry should direct a significant amount of their resources during planning to the determination of the required modules and features of ERP.

As the required features and functionalities were more or less pre-determined during planning, the functionalities evaluation of the acquisition candidates concentrates on finding the software which matches with that need. Additional testing and efforts should go to the user-friendliness aspect.

From the technical perspective the most essential concern for banking is security. Security must meet specific standards and even company certificates may require a certain level of security. In addition to this the software's level of performance is important. Even slightly slow ERP would cause dissatisfaction among users.

Customizability is something that needs to be considered as ERP acquisition is a very large and long term business decision and it is probable that new modules and modifications are needed in future. It is therefore essential to notify the customization possibilities of ERP as well as the code language the software is written with. It will greatly smooth the future developments to the ERP if software with easy customizability is chosen.

ERP can bring much needed consistency between all company functions and departments. This is especially true in very large banking organizations which are struggling to integrate working methods and information sharing.

Manufacturing

A manufacturing company aims to streamline their information flow within their organization as they consider ERP system acquisition. For the acquisition to succeed, it is essential to be able to integrate all company's key functions under ERP.

The functionalities ERP is expected to offer should be pre-determined in the planning phase. The manufacturing functions are expected to. This will allow the evaluating group of testers to concentrate on how the different functions perform and weigh the user-friendliness aspect of them. The functionalities of ERP acquisition are essential,

but should not require a deep analysis in the testing phase as the requirements were chosen early on during planning.

The technical side of ERP should concentrate somewhat equally on all the applicabilities. The specifics of systems architecture, integration, performance and security all reflect the potential of ERP. In a good ERP system they all combine to form a solid package that the manufacturing company can gladly select to run in their environment.

Customization is to be taken in account. Regardless of the fact that the manufacturing company most likely won't be changing the way it functions in future in any major way, it should preserve the option to easily add modules and modifications later. A good option would therefore be to acquire an ERP system from a vendor that produces high-quality modules and allows easy addition and modifications later.

ERP acquisition can benefit a manufacturing company regardless of its size. The company can gain a competitive advantage by utilizing ERP better than competitors.

Telecommunications

In the telecommunications industry companies require ERP to automate their processes to be able to serve more customers with less resources.

From the functionalities perspective the features are the most essential to a company functioning by offering telecommunication services. The requirements need to be determined early on and the possible acquisitions evaluated by weighing the features aspect of them. User-friendliness is important as well, but shouldn't receive nearly the same amount of testing time than features.

The technical evaluation should concentrate mostly on the evaluation of performance. The ERP system in telecommunications needs to withstand high volumes and continue to perform. Security is something that definitely cannot be disregarded, but its evaluation is prioritized second behind performance. The specifics of systems architecture and integration are not to be ignored, but should be treated as suitable or non-suitable categorization.

The acquired software should have the possibility for later modifications as the company may require more from ERP in future, e.g. due to growth. Outside of that, customizability shouldn't receive much more evaluation attention.

ERP can help companies working in telecommunication services by many ways, but especially by automating otherwise resource greedy functions. ERP acquisition is to be recommended for larger companies rather than small ones. This recommendation isn't unconditional, but is based on the amount of gains that a company with larger processes can receive compared to smaller ones.

3.2   Results and Recommendations

An applicability analysis was performed for all four EAS with a framework that included industry categories and applicability criteria. The applicability analysis resulted with ideas to consider before and during software acquisition process. The results also included suggestions on how to weigh different applicabilities during the evaluation and therefore also on how to divide the resources between them.

Applicability was analyzed for three different industries. These industries were banking, manufacturing and telecommunications (services). These industries possess similarities when it comes to EAS, but good differentials were also discovered to separate them as analysis objects. These differences were a big part of the goal of the analysis.

The results for the applicability analysis for banking indicated the importance of emphasizing the functionalities. The features of the software are an essential aspect of the potential of the software. The technical evaluation for banking was also important, but more precisely it was security that separated banking from the other industries. Even though security was valued for all industries, for banking it was an absolute priority number one. By taking customizability in account banking companies would ensure that even with future developments their software acquisition would be able to be customized to their needs. Additional ones deserving to be mentioned in the evaluation context are technical performance and user-friendliness.

The applicability analysis for manufacturing revealed the significance of integration and performance. Integration is essential for manufacturing especially when the company which is considering an acquisition already does possess systems that are required to be integrated with a new one. Manufacturing compared to banking and telecommunications industries, differentiated as being one that will mostly benefit from a balanced solution. A balanced solution means that all three main applicability criteria are valued at more or less the same level. Though there were exceptions, the balanced solution was ideal in several situations.

The results for the applicability analysis for telecommunications showed the importance of features. To discover the best candidate with suitable features for a particular telecommunication company the required features of the software must be precisely determined in the planning phase. By doing this the company enables the evaluation group to concentrate on what they need to do, evaluate the candidates, and not partly participate on determining tasks. From the technical point of view it's also recommended to value performance and security. As companies IT systems in the telecommunications industry do store customer critical data the security is a true concern that needs to be taken in account in every scenario. Additionally the amount of data in IT systems in telecommunications is often substantial. The performance – even with high usage situations – has to be sufficient to withstand the traffic.

The results concerning all the industries were in connection to the acquisition planning. Especially with ERP it is a mandatory procedure to invest time and efforts on the quality of the planning phase before the acquisition evaluations are started. By taking care of the planning, the companies secure the best possible foundation for the acquisition and therefore improve the chances of successful acquisition and implementation.

It is highly recommended to have competent people performing the acquisition process and particularly the evaluation between acquisition candidates. A well planned acquisition and careful evaluation of software candidates will most likely lead to impressive results.

4 Conclusions

4.1 Summary

The thesis started by determining the goal. The goal then turned out to be to create a framework that can be utilized to analyze Enterprise Application Software applicability for different industries. This led to the choosing process of software categories. The software that were chosen included Business Intelligence, Customer Relationship Management, Database and Enterprise Resource Planning as they are all under heavy utilization in business markets and additionally interest the author greatly. After this the industry categories were chosen. The industries to be used in the framework ended up being banking, manufacturing and telecommunications (services). The reason for the selection was that these were all very technical industries, but still possessed some differentiating factors. Now that the software and industry categories were decided it was time to determine the applicability criteria which would form the third corner of the framework. After thorough research, functionality, technical and customizability were selected as the applicability criteria. These were selected for the reason that their importance was highly valued by professionals.

When the framework was finished it was utilized to perform an applicability analysis with it. The applicability analysis was focused on every software category at a time. Every software category was analyzed for every industry by the chosen applicability criteria. The analysis led to conclusions on how to weigh different evaluation factors during an acquisition process.

4.2 Personal Evaluation

Personally my goal with this thesis was to increase my knowledge about Enterprise Application Software (EAS). I feel I have achieved that goal and additionally feel more comfortable about the idea to be working with this kind of software in future. I believe that the completion of this thesis will give me an advantage if I ever end up working with EAS e.g. in service management, sales or consultation.

In my opinion the goal set at the beginning of the thesis was met. The framework was created and it was successfully used to analyze the software in question. The results of the applicability analysis also led into recommendations that will hopefully be helpful if taken in account before and during a software acquisition process.

I personally feel like everyone should pick their thesis subject in a way that professionally best serves them in future. In my opinion that is the most important object of a thesis. I learned beneficial theory and gained important knowledge about EAS which I most probably will somehow work with in future during my professional career and therefore I am honestly satisfied.

In addition to theory about EAS I have significantly developed my English vocabulary during the time I was writing this thesis, even though I considered myself more or less fluent in English before starting. This outcome has been one positive surprise of this project as I do recognize the fact that almost all ICT companies require fluent language skills.

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