

ERP software system comparison - Finding the Best ERP System for a Case Company

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Degree programme International Business	
Thesis title ERP software system comparison – Finding the best ERP system for a case company	Number of pages and appendix pages 49 + 2
<p>This thesis compares two ERP software solutions and aims to find out which one of the two suits best for the case company. The case company of the thesis is a Finnish small and medium-sized office furniture manufacturer, founded in 2015. The company has customers in Finland, Europe and North America. The company does not have an ERP system in use at the moment.</p> <p>ERP selection and implementation processes are resource intensive, time consuming and costly projects that companies need to be really well prepared for. The objective of this thesis was to compare the two pre-selected ERP software solutions, Odoo and NetSuite to the requirements specification provided by the case company. The aim is not to select either one of the software, but to recommend the system that answers better the company's requirements.</p> <p>This study applies a descriptive single case study method. The data is divided into primary and secondary data. The primary data consists of observations and personal experiences gathered during the author's internship period in the case company. In addition, the company's CEO provided a requirements specification that was used as a key document to compare and evaluate the suitability of each software solution. Another part of the primary data is the information provided by the representatives of vendors of each software system.</p> <p>A large amount of academic literature on ERP systems, the selection process and implementation were studied to get an overview on the whole process. Further, user reviews on both software systems were searched and studied. These two comprise the secondary data of the research. In addition, the cost structure of Odoo and NetSuite were tentatively studied.</p> <p>The findings of the data were analysed and compared to the requirements specification of the case company. The result is a recommendation of one software solution for which the company can request a quotation and a trial period with demo software.</p>	
Keywords ERP, Enterprise Resource Planning	

Table of contents

1	Introduction	1
1.1	Background	1
1.2	Research Question.....	2
1.3	Demarkation	3
1.4	Benefits of the research	3
1.5	Key Concepts	4
1.6	Risks of an ERP system.....	6
2	Case company.....	8
2.1	Overall introduction	8
2.2	Operations process in the case company	9
2.3	ERP requirements specification	11
3	Theoretical framework	14
3.1	Enterprise resource planning	14
3.1.1	Evolution of ERP	15
3.1.2	Structure of ERP	15
3.1.3	On-premise solutions	16
3.1.4	Cloud-based / SaaS - Software-as-a-Service solutions	16
3.1.5	Benefits of ERP	17
3.1.6	ERP in SMEs.....	18
3.1.7	ERP in operations	18
3.2	ERP selection process	19
3.2.1	ERP project procedure.....	19
3.2.2	ERP selection criteria.....	21
3.2.3	ERP implementation	22
3.2.4	Critical success factors (CSFs).....	24
4	Methodology	26
4.1	Research design	27
4.2	Data collection.....	27
4.2.1	Primary data.....	27
4.2.2	Secondary data	30
4.3	Data analysis.....	32
4.4	Risk management	33
5	Results.....	34
5.1	Key characteristics of ODOO software solution	34
5.2	Key characteristics of NetSuite software solution	35
5.3	Cost design	35
5.4	Comparison of the software solutions	37

5.5	Alignment with the case company's requirements	38
6	Conclusions	43
6.1	Recommendation of the best ERP system.....	43
6.2	Suggestions for the continuation of the ERP project.....	44
6.3	Personal learning	45
	References	46
	Appendices.....	50
	Appendix 1.....	50

1 Introduction

The purpose this chapter is to give an overall idea about the thesis topic and scope of it. The first chapter of the thesis plan gives a background information and introduces the reasons of the research and selection of the topic. The case company and the key concepts of the research are also described briefly.

1.1 Background

Enterprise resource planning (ERP) is a system that is used to collect and integrate real-time information and data from all the company's functions. An ERP system is a set of business applications or modules, which links various business units of an organization such as financial, accounting, manufacturing, and human resources into a tightly integrated single system with a common platform for flow of information across the entire business (Behishti 2015, 184).

ERP enables a company to integrate all the information from different stages and different sources to one software solution in easily manageable and sharable format. The up-to-date information can be managed and followed centrally within the company. ERP system supports the management to plan, make quick decisions and direct the operations more efficiently.

ERP systems are complex and the whole implementation process requires a great deal of time, money and effort from the company and its employees. Adopting a new ERP system is also a risk for the company. Selecting an ERP system is a huge project, and often requires re-engineering of the existing business processes. In most cases, employees are also forced to change their way of thinking and doing their work. Adopting an ERP system requires great commitment and involvement of the whole staff during the whole process cycle.

The case company in this research is an office furniture manufacturing SME (small or medium sized enterprise). It is established in 2015 and has its production facilities in Helsinki. The company does not have an ERP system installed. All information about production, orders, stock et cetera is based on excel-charts. Updating multiple excel-sheets and documents is time consuming and relies on memory of the employees at operations department. Human errors are more likely as the company and business are growing. The next step is to acquire an ERP system and implement it first to the operations department and later on incorporate other areas of the business to the system.

The objective of this thesis is to help the case company to choose between two different ERP systems and their providers. The two ERP systems, Odoo and NetSuite, are already given and selected by the company, thus the thesis will concentrate on studying and comparing those two preselected ERP systems.

ERP systems have become more and more important for any company in the accelerating competition of national and international markets. To succeed and be able to adapt to the constantly changing business environment and stand out from the competitors, companies need accurate and easily accessible data of their business processes. A personal knowledge about ERP systems, the selection process and the key critical issues within the implementation are valuable assets when applying post-graduate jobs from international companies.

1.2 Research Question

This thesis aims to help the case company to choose between the two possible ERP systems. This is done by studying the key characteristic of each system and comparing the two ERP systems against the requirement specification of the company.

The research question (RQ) is which ERP system serves the company's needs the best?

The research question is divided into investigative questions (IQ) as follows:

IQ 1. What are the specifications and needs of the company in relation to the functionalities and characteristics of an ERP system?

IQ 2. What is the cost design of the two ERP systems?

IQ 3. How do the two ERP systems meet the requirements of the company?

IQ 4. Which system is recommended to the company?

Table 1 below presents the theoretical framework, research methods and results chapters for each investigative question.

Table 1. Overlay matrix

Investigative question	Theoretical Framework*	Research Methods	Results (chapter)
IQ 1. What are the specifications and needs of the company in relation to the functionalities and characteristics of an ERP system?	Current business processes of the company, ERP system in operations, critical points in selecting ERP	Discussions with company management and staff, personal working experience and observation during internship	2.

IQ 2. What is the cost design of the two ERP systems?	Implementation process, service agreements, software costs	Interviews with ERP system providers, studying product materials, service agreements et cetera	5.
IQ 3. How do the two ERP systems meet the requirements of the company?	Functionalities, modules, customization of the ERP systems	Comparison of the two systems' characteristics and differences	5. and 6.
IQ 4. Which system is recommended to the company?	The results of the previous IQs	Make conclusions and recommendation based on other IQs	6.

1.3 Demarkation

The case study of comparing the two potential ERP systems focuses on the preliminary stage of the ERP selection process. The aim is not to choose one or the other of the two systems, but to give suggestions and recommendations that the company can utilize in the actual selection process. The final determination of the ERP system is done by the company solely.

The goal is to study the characteristics of each of the ERP systems and compare them to the requirements specification set by the company. Based on the functionalities and customization of the systems the most suitable is recommended to the company. The company has already narrowed the potential ERP suppliers to two, therefore this thesis concentrates on those and do not regard any other systems.

The company has already international customers and the product has had international visibility in Asia, USA and in Europe. The company is actively seeking to link with multiple international retailers for example in Europe and USA. Order volume and deliveries abroad are expected to grow rapidly. Thus, acquisition of an ERP system and being able to combine business processes together to one database is essential for the whole production and delivery capacity.

1.4 Benefits of the research

The thesis benefits the company directly by giving clear suggestions about the most suitable ERP system. This thesis will provide the company with specifications and characteristics, tentative cost structure and service information of the ERP system and its provider. With the information the company can go further in negotiating with the service provider. The research might also reveal some aspects of the company processes that need to be

re-thought and modified. On the other hand, the result can also be that neither of the explored systems is suitable for the company. This is one of the risks of the research, when the preselection of the software system has been made in advance.

ERP systems are designed to support the company in running the business more efficiently. They reduce the manual work thus decreasing the possibility of human errors. Supply chain management and procurement among other things, can be partly automated which decreases the manual work significantly. Customer relationship management is also more fluent and up-to-date since information about previous contacts and interactions are stored in the database.

ERP system does not only combine the internal business processes of the company, but it can also collect and send information to suppliers, customers and other business partners. Updates on the delivery process can be send to the customers through the system. Vice versa, service requests et cetera from customers can be send directly through ERP system to the company.

Suppliers can be connected to the ERP system so that the information of low stock of any product or component goes directly to the supplier. The system can also order stock refill automatically. At the moment purchase orders are filled up manually, stored to several place and send via e-mail to the suppliers. This process takes a lot of time but in ERP system all this automated. All in all, the research and its outcome will help the case company to take the next set forward in optimizing its business processes thus increasing its competitiveness.

The research on ERP systems will definitely broaden the knowledge of the author on the software solutions an SME can use to streamline its business processes. ERP systems have not been discussed in more detail during the specialization studies. Neither has the researcher had an opportunity to use an ERP software solution. Hopefully the knowledge about the ERP selection process will benefit the researcher at the post-graduate stage.

1.5 Key Concepts

Enterprise Resource Planning (ERP) is an integrated cross functional software system that re-engineers manufacturing, distribution, finance, human resources and other basic business processes of a company to improve its efficiency, agility and profitability. Sharing information across the functional units of an organization, is the main function of ERP. (Murthy 2008, 4.)

ERP system comprise of separate modules for each business process which are integrated to a joint database. The joint database makes it possible to share the information simultaneously to all the modules with one single entry. The data is also available to be used to draw specific reports and overviews at any point. (Umble et al. 2003, 242.)

Operations function or simply operations is the collection of people, technology, and systems within an organization that has primary responsibility for providing the organization's products or services. Operations can be seen as a transformation process where a set of inputs are transformed into outputs, either goods or services. (Bozarth & Handfield 2008, 4-5.)

Operations management is the planning, scheduling, and control of the activities that transform inputs into finished goods and services. Through good operations management the organization can make the best use of its resources and provide the best value to their customers. (Bozarth & Handfield 2008, 7.)

Supply chain encompasses the whole production process of any goods, starting from supplier processes, raw materials, manufacturing process to post production and distribution (Tarn, Yen & Beaumont 2002, 28). The manufacturers and service providers are linked together through physical flows, information flows, and monetary flows. These flows move in both directions in the chain.

The organizations' position in the supply chain can be divided further to upstream and downstream. Upstream organizations are usually raw material suppliers or firms that are positioned earlier in the supply chain relative to the firm of interest. Downstream organizations are for example retailers or carriers who move the finished products to the end customers. (Bozarth & Handfield 2008, 4-7.)

Supply Chain Management (SCM) is the active management of supply chain activities and relationships in order to maximize customer value and achieve a sustainable competitive advantage (Bozarth & Handfield 2008, 8). It functions as constant improvement of operations and interaction to develop supply chains in the most efficient ways. The philosophy of SCM is that a company has the right product in the right place, at the right price, at the right time, and in the right condition (Tarn et al. 28).

Requirements specification provide the basis for both the selection of the ERP system and the alignment process of the selected software package (Soffer, Golany & Dori 2005, 642). The ERP project must balance between the technical and business aspects of the

company requirements. It is important also to have a strong user involvement in determining the requirements specification for the ERP. ERP requirements rely heavily on business process modelling. Companies must score the selected requirements to must have, important and nice to have ones, based on the needs of the company.

ERP selection process is a crucial part of a successful ERP project. The importance of selecting an ERP software system and a co-operative vendor cannot be over-emphasized (Wei, Chien & Wang 2005, 47). There is no ERP system that would meet all the demands and functionalities of a company, thus companies must choose an adaptable ERP system that can be modified and scaled to the customer's needs.

Wei et al. (2005, 49) introduces a step-by-step procedure for selecting a suitable ERP system:

- Step 1. Form a project team and collect information on ERP systems
 - Step 2. Identify the ERP system characteristics
 - Step 3. Construct the structure of objectives
 - Step 4. Extract the attributes used for evaluation
 - Step 5. Screen the unqualified ERP systems
 - Step 6. Evaluate the ERP systems by using the AHP method
 - Step 7. Discuss the results and make the final decision
- (Wei & al. 2005, 49.)

1.6 Risks of an ERP system

An ERP project is not just an IT project. Nowadays, there is a huge contrast to the previous belief that it is a simple implementation of a new software system. Firms now realize that the ERP process is a cross functional process that must involve inputs from all functional business areas of the company (Muscatello & Chen 2008, 69). However, risk management process is often regarded as an extra work and expense and not properly addressed in ERP projects (Aloine, Dulmin & Mininno 2007, 548).

ERP projects are complex, they can be really costly and take a lot of time. Despite the many benefits that ERP software packages provide, they often cost millions of dollars to buy, several times that to install, and they often require disruptive organizational changes. ERP implementation involves a large number of stakeholders and the hidden costs during the ERP life cycle dramatically increase the total implementation costs. (Aloine et al. 2007, 548.)

The hidden costs that are not evident in the ERP procurement stage might come as a surprise to the company management if these additional costs are not assessed properly in the beginning of the ERP process. Special attention should be given to the costs related to the training, software solution integrations and add-ons and to the data transfer costs occurring as the current data is transferred to the new ERP system.

A few of the most important things related to ERP systems are flexibility, adaptability and scalability of the software solution. As the company grows and the business expands the ERP system must adapt and scale up accordingly. The integration of system features and scaling up means acquisition of new modules to the ERP system which in turn increases the monthly costs. (Profiz 2013, 11.)

The overall ERP project is a long-term process that can last months or even years in bigger corporations. Organizational processes might change during implementation process, thus also modifying the company's needs. This might result in the system being out of date and not appropriate already before the actual launching phase. (Kettunen & Simons 2001, 50.)

A successful ERP implementation project requires strong commitment from the whole staff of the company, including top management and end users. The employees of the company must be open to the changes that the new ERP system inevitably brings to everyday work. It is the duty of the project team and the top management to motivate the end users to the adoption of the new software solution to avoid employee related problems in the implementation process.

On the other hand, increased and centralized information management might appear as increased control over individual worker's work performance. This might result in decreased work motivation and a demonstration of mistrust from the management level towards the employees. (Kettunen & Simons 2001, 50.)

According to Aloini et al. (2007, 559) the top five risk factors in ERP implementation are: inadequate ERP selection, ineffective strategic thinking and planning, ineffective project management techniques, bad managerial conduction, and inadequate change management. Most of these factors are related to managerial aspects indicating the importance of top-quality ERP project management.

2 Case company

This chapter introduces the case company, its operations functions and the requirements specification for the ERP system. In addition, the current state of the company is analysed.

2.1 Overall introduction

The case company is a Finnish small and medium-sized office furniture manufacturer. The company was founded in 2015. The company manufactures all its products manually in its factory in Helsinki. The company sells products directly by own salespersons but also through retailers. The products are sold and delivered to Finland, Europe, North America and Asia. The company has showrooms in Helsinki and Oulu, but most of the staff is located in Helsinki. Last year 2017, the turnover was nearly two million euro (Kauppalehti 2018).

The company has five different products at the moment. All the products are handmade. The company has shelf stock of the most popular products and other products are manufactured by the order. A normal delivery time for a product is 8 weeks, but the lead time can also be much shorter if all the components are already in stock. The products are assembled of modules on site. The modules are packed and delivered separately to the assembly site. The company has its own installation staff but, in some cases, they use external service providers, especially in long distance deliveries.

The company staff comprises of production/manufacturing staff (carpenters and painters), assembly/installation staff, sales persons, production and sales managers, managing director and creative director. There are less than 20 persons altogether in the company.

The main business functions of the company are production, supply chain management, sales and marketing, product development and support services. Financial services, other than invoicing, are outsourced as well as some parts of logistics. The operative functions consist of supply chain management and production.

The company does not have an ERP system at the moment. The operations are controlled and guided through Google Drive based excel- and doc-sheets. Google Drive documents are filled in manually. The information about incoming orders, production and material requirements planning are all done with the help of the excel documents. There are several excel documents that all must be filled in separately and there are no links between different documents.

Material requirements management and the following procurement processes are a few of the most laborious processes in the current Google Drive based system. A material requirements plan is formed based on calculations of the stock and materials from different suppliers. The plan tells when an order should be put forward for different suppliers. In reality this is not functioning that smoothly. The stock has to be calculated manually before each purchase order because there is no automated system to keep the inventory status up-dated.

Besides the documents related to the supply chain management, there are dozens of other charts and documents that could be managed through appropriate ERP system. Thus, the research on the most suitable ERP system for the company is in really needed.

2.2 Operations process in the case company

Order-supply chain

Currently, the CEO is responsible of the order and supply chain management. New orders and signed order contracts are down loaded to Google Drive by the sales persons. The CEO/the operational director is also being informed of the new order. The information of the order is written down by the operations. At the same time the stock and warehouse shelves are checked, and purchase orders are submitted to suppliers if something needs to be ordered for the delivery.

The operations department will submit a form of subcomponents that are needed for the order to the production department. As the subcomponents are ready the operations department will order transportation and assembly service from a subcontractor. The operations or the subcontractor will then agree on the installation date and time with the customer. The installation date must be also forwarder to the packing site of the factory. All modules and components of the product must be packed for the delivery on time. If the delivery is close to the Helsinki Metropolitan Area, the inhouse mounting staff will deliver and install the product to the customer's premises.

Production

The production of the company consists of four different phases: timber production/carpentry, painting, assembly and packing. The basic forms of the product modules are produced in the timber production. Timber is sawed, glued, and honed. After wooden parts are ready they are painted and left to dry to be moved to the packing site. At the assembly the technical parts of the products are assembled. The wooden modules that have been dried are packed to cardboard boxes and shifted to the warehouse.

In the weekly production meeting the operative director briefs the production department with new incoming orders, delivery dates and product installations. The production manager is responsible for production planning and scheduling. Based on the information from the operations on the outstanding orders the production manager will plan and coordinate production schedule.

There are lists where to mark the finished subcomponents at each work station at the production department. When a product is finished for example in the grinding station it is forwarded to the painting. The production can produce a certain number of subcomponents in a day by following a time table of the production of subcomponents.

The employees at the production department are quite self-driven. They know what they need to do in the production line, in which order and how to check the quality of the modules produced. At the moment there are no guide lines to different phases of the production. Thus, there is no check list for the quality control either.

The production is followed by the lists of subcomponents. The stock is updated based on these subcomponent lists gathered from the production. In many cases the stock must still be calculated and checked again manually. At the warehouse each subcomponent has its own shelf location. As a new order must be delivered to the customer, the staff at the packing department will collect all the subcomponents and other parts to two platforms ready for transportation.

Logistics

The company has outsourced most of the logistics. Some of the transportations and installations are done by the own assembly team. Most of the transportations and installations are outsourced to a transport company whose staff has been trained to install the products of the company. The transport company collects the products from the warehouse, delivers and installs them to the customer's premises. In case of foreign deliveries, the company bids a few transportation companies and chooses the best offer.

After the delivery has been agreed with the customer, the time is marked on the assembly calendar. The calendar is also in Google Drive where each employee can select which calendars to follow. The delivery information, customer information and address et cetera is written down to a word-document which is attached to the outgoing product platforms. Foreign deliveries require different documentations which are done manually and attached to the platforms.

A transfer certificate must be signed by a representative of the customer as the product is delivered and installed to the customers premises. While this the company ensures that the customer has been given all the information about the product and its use. If there are any faults in the product, this information is written down to the transfer certificate. The products are also photographed from different sides and angles. This allows to go back and check the condition of the product directly after the installation. Transfer certificates are also downloaded to Google Drive.

2.3 ERP requirements specification

This section is trying to find an answer to the IQ 1, what are the specifications and needs of the company in relation to the functionalities and characteristics of an ERP system?

One of the most important things in the ERP selection process is the alignment of an off-the-shelf software package with the business processes of the enterprise implementing it (Soffer, Golany & Dori 2005, 639). The enterprise requirements provide the basis for both the selection of the ERP system and the alignment process.

The case company has compiled a requirements specification that was given to the author. The complete requirements specification is listed in Appendix 1. In the first phase of ERP implementation the operations functions are integrated to the ERP system. Later on, other business processes and functions are added on. The requirements have been divided into must have and nice to have components. Each must have component contains subcomponents which the ERP system must also include.

The company has already taken the first steps towards the ERP system project by going through the current operating model and its pitfalls. The biggest problems of the current system are listed below. Based on that assessment a new operating model has been formulated. The new process-driven model will be implemented along the implementation of the new ERP system.

The biggest problems in the current operating model are:

- A large amount of Google Drive charts and documents
- The huge amount of manual work
- Overall lack of automation in information flows
- Data not transferred automatically
- Individual responsibility of quality management of the workers
- Lack of real time data
- Lack of continuous development

By the adoption of an ERP system these problems are solved, and the way of operating is changed. Thus, the new operating model has been quidding the formulation of company's requirement specification (appendix 1).

The main requirements of the company are:

- Cloud-based interface
- Scalability
- Process driven platform
- Procurement planning and management
- Inventory management
- Supplier management
- Production planning
- Reporting & tracking
- Quality management
- Project management
- Assets management
- Product management
- Logistics management
- Basic CRM
- Vendor support

Soffer et al. (2005, 642) divides the company requirements into four different types of information:

- **Core system interfaces:** messages produced by the system as a result of messages received. There are two types of messages: requests for information (queries) and reports of tangible changes in the state of the environment served by the system (e.g. a change in the inventory level of an item), detailed inputs and outputs of processes performed by the system.
- **Core business processes:** processes which must not be changed through the alignment process. They generate the competitive advantage of the company, these may include logistics processes, or quality assurance processes (which ensure an exceptional quality level).
- **Business rules:** they express the enterprise goals and control the business processes. The company goals are operationalized by the business rules. In fact, they are constraints posed on the business processes.
- **Information objects:** are manipulated by the specified business processes, controlled by the business rules, and participate in the specific interfaces. They are entities that participate in and are affected by business processes.
(Soffer, Golany, Dori & Wand 2001, 187-188; Soffer et al. 2005, 644.)

The ERP system must be cloud based, which enables its use by everyone from everywhere. One of the key requirements is production planning and management. Production plan can be used to create weekly material and recourse plans. Weekly procurement and employees' work schedules and machinery utilization are also based on the production plan.

The system should also formulate work orders to the production department. These work orders can include also work and quality check instructions. As the work orders are marked as done the system will automatically reduce the used materials from the stock. The product will move along the production line automatically until a ready subcomponent of a finished product is registered to the warehouse. In addition, the finished subcomponent is registered automatically to the stock balance. As all the subcomponents of one product are recorded to the stock the system will inform that one product is ready.

Company's product development and support functions can be managed as separate project in the ERP system. Products that are finished in the product development project are added automatically to products that are sold. For the support functions the system must transfer customer's information to specific project (support request). It must also transfer the materials needed to the support project and reduce them accordingly from the stock.

Another requirement is separate portal for retailers. The portal will ease the information flow from the company towards the retailers. The information and content in the retailers' portal are decided by the company.

The new operating model of the company will be process-driven. In the ERP system this requires automated linkages between different functions. As one phase of the process is finished the order must move automatically to the next phase in the line.

3 Theoretical framework

3.1 Enterprise resource planning

This second chapter introduces the theoretical framework of the thesis. The theories and models related to ERP software system and different approaches on the selection process are discussed. Later on, the implementation and some of the critical success factors of implementation are discussed.

Figure 1 illustrates the theory framework and the connections between the theories. The requirement specification of the case company is the determining factor in the ERP selection process. Based on the requirements of a company the type of the ERP system for the case company is selected. The ERP in operations is in the core of the theory framework because the ERP system is going to be implemented first to the operations department of the case company.

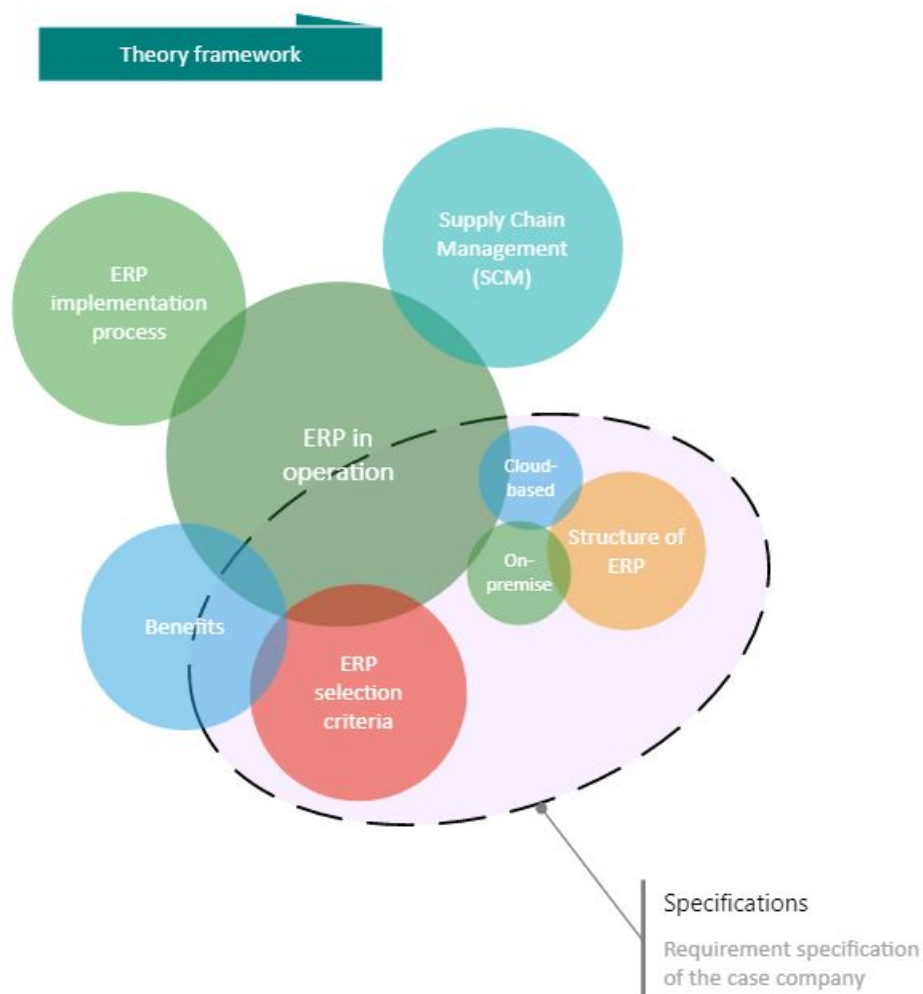


Figure 1. Theory framework

This section is divided into three sub-sections. First, the evolution of an ERP is discussed shortly. Then the structure of an ERP system is described and finally the two types of ERP systems; on-premise ERP and cloud-based software systems are introduced.

3.1.1 Evolution of ERP

The first form of enterprise resource planning software solution was called Material Requirements planning (MRP) system. The first forms of MRP were formed in the 1970s. The MRP is a production planning and inventory control system used to manage manufacturing processes. An MRP system was intended to ensure materials and products availability for production and delivery to customers, maintain the lowest possible level of inventory and plan manufacturing activities, delivery schedules and purchasing activities. (Parthasarathy 2017, 10.)

In the 1980s the MRP expanded to a company-wide system including virtually all the firm's resources. The new Manufacturing Resource Planning (MRP-II) addresses operational planning in units, financial planning in dollars and has a simultaneous capability to answer "what-if" questions. (Parthasarathy 2007, 12.)

During the next decade the MRP II was further developed into ERP, expanding the scope of planning to including more of the supply chain than MRP-II. Thus, the key difference between MRP-II and ERP is that while MPR-II has traditionally focused on the planning and scheduling of internal resources, ERP strives to plan and schedule supplier resources as well. (Parthasarathy 2007, 12.)

3.1.2 Structure of ERP

ERP systems consist of series of integrated modules. Instead of concentrating on specific functional areas, these modules focus on business processes. (Tarn et al. 2002, 26.) The primary advantage of ERP systems is that they pull together all of the classic business functions, such as accounting, finance, sales, and operations, into a single, tightly integrated package that uses a common database (Bozarth & Handfield 2008, 519). ERP can be customized to company's business processes. A typical ERP system covers key business processes and consists of the following modules:

- Financial management
- Customer Relationship Management (CRM)
- Sales & Marketing
- Human Resource management (HRM)
- Manufacturing
- Supply Chain Management (SCM)

- Inventory
- Purchasing
(Finances Online 2018.)

According to Davenport (1998, 124) an ERP system consist of applications or modules that serve four main stakeholder groups; management, employees, internal customers and external customers. The central database stores and streamlines all the information flow from all modules within the ERP system.

A company can select the modules they buy one by one according to its needs and structure of business processes. Additional modules can be joint later on to the system easily without reconfiguration of the existing database.

3.1.3 On-premise solutions

On-premise ERP solutions are installed locally on company's hardware and servers. The system can be used only in the company's premises. On-premise systems are "the traditional option" where the customer is responsible for the managing and updating of the system. (Profiz Business Solution Oyj 2013, 12.)

One of the benefits of on-premise systems is the customizability. The ERP system can be customized according to the needs of the company. Problems at vendor end do not affect the ERP system that operates at company's own server. (Profiz Business Solution Oyj 2013, 12.)

Acquiring on-premise system is usually require large initial and ongoing investments to purchase and manage the software system and the related hardware, servers, and facilities necessary to run it. The company must also have experienced and skilled IT-staff that is able to install, operate and maintain the system. Thus, on-premise systems require a significant amount of effort and time from the IT team of the company. (Oracle 2018.)

3.1.4 Cloud-based / SaaS - Software-as-a-Service solutions

Cloud based, also called SaaS systems are provided as a service. This type of ERP software system and its associated data are managed centrally by the ERP vendor and are accessed by customers using a web browser. Cloud-based ERP software system provides real-time data that can be accessed via the Internet anywhere at any time. (Oracle 2018.)

The initial costs of cloud-based ERP software systems are typically much lower than with on-premise systems. The software solution is simply implemented to company's requirements and accessed through internet connection on a computer. The cloud ERP provider hosts and maintains all of the IT infrastructure for the company, ensures the system is always running, that the data is secure, and that product enhancements are rolled out painlessly to the ERP solution without breaking the previously implemented customizations. (Oracle 2018.) The cloud-based system does not require any extra effort from the IT team of the company and the latest version of the software system is always at use.

Customization in cloud-based systems is limited and the integration to other software solutions that are used in the company must always be ensured. Cloud-based software system can also be accessed through mobile devices, thus on-premise ERP systems are more and more superseded by cloud-based solutions (Krutz & Vines 2010, 37-38).

3.1.5 Benefits of ERP

Companies can achieve many benefits with the acquisition and successful implementation of an ERP system. The benefits from ERP adoption varies from company to another. Nevertheless, the benefits should outweigh the costs of the system, and most probably they do as long as the correct system for the organization is chose and the implementation is done properly. (Beheshti 2006, 186.)

In global or multi-national organizations one common ERP system provides consistent operating practices throughout the enterprise. In case of company acquisitions, different legacy systems and formats make it hard and time consuming to collect information and present a coherent picture of that is happening in the business. ERP system can eliminate the redundancies that occur from outdated and separate systems. (Beheshti 2006, 186.)

One important benefit of ERP is its capability to improve internal processes of a company. ERP systems require companies to examine their internal processes in order to increase business efficiency and profitability. As Beheshti (2006, 187) concludes, a company is profitable when the product or service it provides can be sold for more than the production and delivery costs were.

3.1.6 ERP in SMEs

Organization-specific characteristics and context are important factors in ERP implementation process. Organization size and business complexity affects the ERP implementation, thus usually in SMEs the processes are shorter in duration and easier than in large enterprises.

Originally, ERP systems were mostly targeted to large companies and corporations. However, because of globalization, partnerships, value networks, and the huge information flow across and within SMEs nowadays, more and more SMEs are adopting ERP systems (Haddara & Zach 2011, 1). SMEs do not have as large financial and technological resources as larger companies do, thus solutions where SMEs can pay only for the services they use is optimal for them. With the cloud-based ERP solutions SMEs can now adopt close to a plug-and-play model of ERP (Gupta, Misra, Kock & Roubaud 2018, 84).

Agility, flexibility and quick introduction of ERP system is important for SMEs. It reduces the risks involved in ERP implementation. Successful adoption of an ERP software system improves company's competitiveness. The adaptability of business processes to the changing environment is in direct correlation to the competitiveness of a company. ERP system helps companies to make quick decisions which in turn makes a company more competitive.

Due to the limitations of resources in SMEs, companies usually have to make some compromises while selecting an ERP system. The modular structure of ERP systems makes it easier for SMEs to tailor the software system to answer the company's needs in the best possible way. In addition, scalability of ERP systems is crucial for SMEs. Often companies' business processes and structures must be adjusted or changed before the adoption of a new ERP software solution. Nevertheless, Liang & Xue (2004, 402) point out that ERP systems need also be localized according to the local management features.

3.1.7 ERP in operations

Supply chain management has been recognized as one of the key sources of competitive advantage. The ability to design, plan, and operate a progressively more complex global network of products, suppliers, facilities, and customers is often the backbone to successfully execute the corporate business strategy (Barros, Barbos-Pòvoa & Blanco 2013, 1040). Still, in many cases unfunctional or not optimal supply chain management (SCM) hinders the whole business performance of the company.

SCM practices include strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices and postponement (Barros et al. 2013, 1041). Li, Rao, Ragu-Nathan & Ragu-Nathan (2005, 620) define the SCM practices as “the set of activities undertaken by an organization to promote effective management of its supply chain”. These practices are aligned with the business structure of each company.

Barros et al. (2013, 1040) identifies the detrimental phenomena in the management of supply chains: waste, uncertainty, vulnerability, congestion, bullwhip, diseconomies of scale and self-interest. The knowledge of business hindering practices can be used in the selection of tailored practices for SCM.

ERP vendors are attempting to extend beyond the core functionality of their ERP products to include the SCM capabilities (Tarn et al. 2020, 27). Most ERP system providers have been enhancing their products to include sales-force automation, data warehousing, document management, and after-sales service and support all serving the SCM.

The ERP system has to be in line with the company’s strategy in manufacturing. There are two types of manufacturing strategies: imitation and innovation. The imitation strategy refers to a company that produces low cost products to existing markets. The production follows make-to-stock process and ERP requirements emphasize the cost control capacity. On the other hand, in the innovation strategy the products are made-to-order which requires more flexibility and ability to adapt to changing environment. The ERP system must be flexible and have a good quality control. (Gupta & Kohli 2004, 690-691.)

3.2 ERP selection process

3.2.1 ERP project procedure

The whole process of selecting an ERP system is a time-consuming task due to the limitations in available resources, the complexity of ERP software systems, and the diversity of alternatives (Lien & Chan 2007, 58). Ziaee, Fathian and Sadjadi (2006, 487) introduces a modular approach to ERP selection, more suitable for small manufacturing enterprises (SMEs).

Ziaee et al. (2006, 487) divides the process for selecting suitable ERP software solution to two phase procedure. The preliminary phase consists of two steps. In the first step a project team is formed. The team consists of top managers or decision makers, executive managers, stock holders, functional experts, users or their representatives. The project

team scrutinizes the business processes and reengineer them. During this process analysis stage, the functional characteristics of required ERP software solution are recognized. (Ziaee & al. 2006, 487.)

The second step consists of information gathering. As much information as possible about ERP vendors and systems is gathered and initial specification requirements of the company are submitted to the vendors' representatives. The vendors respond to the inquiries and based on the responses the unqualified vendors are ranked out. The following classified factors can be used in the selection of a few vendors:

1. Software system factors
 2. Vendor factors
 3. Project factors
- (Ziaee & al. 2006, 487-488.)

The second phase the best vendor from the vendors qualified in step 2 is selected. The required ERP modules are also considered and the decision which modules to purchase is made. The following aspects must be considered in determining which modules are purchased:

1. Processes: what types of processes there are in the organizational structure and do they need to be modified or changed completely?
 2. Organizational changes: the use of standard ERP modules may need to change the organizational units, the job descriptions et cetera.
 3. Data: data conversion from the old system might be difficult, costly and time-consuming.
 4. User interfaces: user interfaces required by the functions are another important factor.
 5. Upgrading: the use of customized modules may be risky because of the upgrading and integrating problems.
 6. Project team costs: in the customized modules, the duration of the ERP project and ERP experts' engagement may be increased.
- (Ziaee & al. 2006, 488-489.)

Ziaee et al. (2006, 489) uses 0-1 programming model to minimize the total costs associated with procurement and integration expenditures. They conclude (Ziaee & al. 2006, 493), based on a case study, that the model is useful and suitable for selecting a suitable ERP system.

The stages of the implementation project

After the system and vendor selection the actual project must be started. Mandal & Gunasekaran (2003, 281-282) divides the ERP implementation process into three stages: pre-implementation, implementation and post-implementation. In the pre-implementation

stage plans for the recruitment of the necessary personnel for the project team are prepared and the project is broken down into natural phases for gradual implementation. (Mandal & Gunasekaran 2003, 282.)

The implementation all the stakeholders are pro-actively kept informed about the progress of the project, user participation and communication are promoted, and functioning working environment is secured.

The post-implementation activities are important for the acceptance (adoption) of ERP systems. A company that has implemented a new ERP system should also create a post-project evaluation strategy to measure the effectiveness of an ERP system. The issues in post-project evaluation can include for example question about: are the objectives of the ERP system realized fully, was there enough options considered in the beginning and were the estimates and project information accurate. (Mandal & Gunasekaran 2003, 282.)

3.2.2 ERP selection criteria

Umble et al. (2003, 247) estimate based on their study with US companies, that 50-75% of US firms experience some degree of failure in implementing ERP systems. They continue by concluding that "The greatest enterprise system implementation failures seem to occur when the new technology's capabilities and needs are mismatched with the organization's existing business processes and procedures" (Umble et al. 2003, 247).

There is no unique or universal selection criteria that applies to all ERP selection processes. Nevertheless, some common criteria can be classified (Kumar, Maheshwari & Kumar 2002, 510). The target is that a company could find and select a system that underscores its unique competitive strengths, while helping to overcome competitive weaknesses. Thus, the ultimate goal should be to improve the business, not to implement a software system. (Umble et al 2003, 248.)

Ratkevicius, Ratkevicius and Skyrius (2012, 98) distinguished four groups of ERP selection criteria. The first group consists of ERP software-related criteria (functionality of the system, system reliability, fit with parent/allied organization system, cross-modular integration and best business practices available in the system). The second group relates to the implementation project manager (project management skills, functional experience and experience in IT management). The third group consists of criteria related to implementation partner and the last one is associated with implementation consultants' criteria (reputation, experience, et cetera).

On the other hand, Baki and Cakar (2005, 78) summarises the results of a literature review about the selection criteria to thirteen different factors. The most important factors according to them (Baki & Cakar 2005, 77) are functionality, technical criteria, cost and service and support.

Another set of factors to consider when choosing an ERP software solution is presented by Finance Online reviews for Businesses (Finances Online 2018). They highlight:

Upgrading (of existing ERP system) vs. replacement

Customization

Reporting and dashboards

Integration

Training and setup

(Finances Online 2018.)

Beheshti (2006, 190) recommends selecting a study team for the vendor selection process. He also states that there are various prospective approaches to vendor selection:

- Limit the study to one or two vendors and their products. This reduces the time required for the study but can leave out the best possible choice for the company.
- Make a detailed study of all vendors. This is the opposite for the first option, both in advantages and disadvantages.
- Make an overall survey and then limit the choice to one or two vendors. This is probably the best approach, a compromise on the first two approaches. (Beheshti 2006, 190.)

The selection process of ERP software system is always unique and case specific. The most important thing in selecting an ERP system is to compare the company's specifications to the functionalities of the potential ERP solution.

3.2.3 ERP implementation

ERP systems are extremely expensive to implement (Beheshti 2006, 188). Nevertheless, when implemented successfully, it can bestow great strategic, operational and information-related benefits to adopting firms (Muscatello, Small & Chen 2003, 850). The costs and benefits must be weighed carefully to make sure implementing an ERP system is worthwhile.

The cost of the actual ERP system is relatively small. The implementation of an ERP system is often accompanied by a Business Process Reengineering (BPR) that changes the way the enterprise operates (Soffer et al. 2005, 640). Process reengineering costs, support costs, training costs, data conversion costs, and the costs of changing information

technology architecture are a few of the many expenses a company has to consider when adopting an ERP system. (Beheshti 2006, 188.)

There are many ways how to implement an ERP system. Motwani, Subramanian & Gopalakrishna (2005, 541) propose a three phase ERP implementation framework. The framework illustrates the critical factors that need to be addressed in each of the three phases: the Pre-implementation (setting-up) phase, implementation and post-implementation or evaluation phase (Motwani et al 2005, 541).

One implementation approach is the one-time conversion from old to new system. This is risky and burdensome for the employees, since they need to start using totally new system without the backup of the old system. Another implementation method is the gradual replacement of legacy programs with ERP programs. This is an easier way especially in cases where the two systems differ a lot from each other. Small companies, like the case company, can implement an ERP system one module at a time and add more modules as the organization grows. (Beheshti 2006, 191.)

Muscatello et al. (2003, 854) in turn, presents a tripartite classification of the ERP implementation process. The three sections are planning activities, justification and selection activities, and installation activities. Under these headlines there are different factors relating for example to strategic objectives and top management involvement, costs and time consumption and overall project performance and training. (Muscatello et al. 2003, 854-868.)

Muscatello et al. (2003, 868) as well as other researchers (Motwani et al. 2005, 540; Jarjar, Al-Mudimigh & Zairi 2000, 123) have concluded that the main categories of critical success factors of successful ERP implementation are: top management commitment, change management, IT infrastructure and business process re-engineering.

Why do then ERP implementations fail? Umble et al. (2003, 250) mention the top three reasons for the failure of ERP projects: poor planning or poor management, change in business goals during the project and lack of business management support. Another important reason for failures is the lack of user involvement during the implementation process.

3.2.4 Critical success factors (CSFs)

As concluded already, ERP implementation requires considerable financial resources, while the whole implementation project is considered complex, lengthy, and quite challenging (Chatzoglou, Chatzoudes, Fragidis & Symeonidis 2016, 1243). Umble, Haft and Umble (2003, 244) argue that the success rate of ERP project is around 50% and about 75% of the projects are late, or over budget.

Critical Success factors (CSFs) are a concept that was developed to assist companies to achieve their goals and enhance their overall competitiveness. CSFs for a systematic way of identifying key business areas that require constant management attention. CSFs assist managers to directly affect a specific outcome, by proactively taking necessary actions in certain areas. (Chatzoglou et al. 2016, 1244.)

There are dozens of different studies and approaches to identify the most important CSFs. Nevertheless, the multitude of CSFs results in the fact that it is impossible to determine which are actually the most important ones. Chatzoglou et al. (2016, 1250) suggest six critical success factors companies should focus on: top management support, Organizational culture, Vendor support, Training, User involvement and Business process reengineering. In general, they conclude that ERP implementation success is a result of intangible factors (e.g. organizational culture), people-related factors e.g. training, user involvement) and proper leadership (top management support) (Chatzoglou et al. 2016, 1250).

Jarrar et al. (2000, 123) in turn, categorize the critical success factors under four main categories: top management commitment, IT capability level, change management and business reengineering. Change management is in a sense most critical one, as it affects the whole implementation process and other factors as well.

Top management commitment is critical when analysing and rethinking existing business processes, thus, the implementation should have an executive management planning committee that is fully committed and supports the ERP project (Umble et al. 2003, 245).

IT capability level in Schniederjans and Yadav (2011, 370) is considered as a construct that contains various CSFs. Further on, they propose that "IT capability level, constructed of IT capability, knowledge management system characteristics and CMM (capability maturity model) level, is positively associated with ERP implementation success". Therefore, IT capability and competence are a key driver of success and also to user satisfaction of an ERP system.

Change management refers to the ability to anticipate future changes, choose platforms that can accommodate change, and effectively manage change (Schniederjans & Yadav 2011, 372). It entails not only change in altering current business processes but also the overall culture of the organization. In addition, user education and training in the change process is critical for the success of ERP implementation project.

Business process reengineering (BPR) is almost inevitable in ERP projects. The existing organizational structure and processes in most companies are not compatible with the structure, tools, and types of information provided by ERP systems (Umble et al. 2003, 245). All the requirement of a company can't be fulfilled with the ERP system. Jarrar et al. (2000, 124) argue that even the best ERP systems can cover no more than 70% of the company's needs and processes. By reengineering its business processes the company can fulfil the missing 30% of the requirements as well as users' needs in ERP system (Jarrar et al. 2000, 124).

4 Methodology

In this chapter the research method, design and data collection are described. This study applies qualitative research methodology in a case study research. The purpose is to find out which ERP system will suit better for the case company. Qualitative research method is suitable in this research because the functions, qualities and special characteristics of both the case company and the two ERP systems must be assessed.

Both primary and secondary data collection methods aim to find answers to the RQ and IQs of the research. The data collection sources, analysis and relationship to the investigative questions are shown in figure 2. The IQs of the thesis are as follows:

IQ 1. What are the specifications and needs of the company in relation to the functionalities and characteristics of an ERP system?

IQ 2. What is the cost design of the two ERP systems?

IQ 3. How do the two ERP systems meet the requirements of the company?

IQ 4. Which system is recommended to the company?

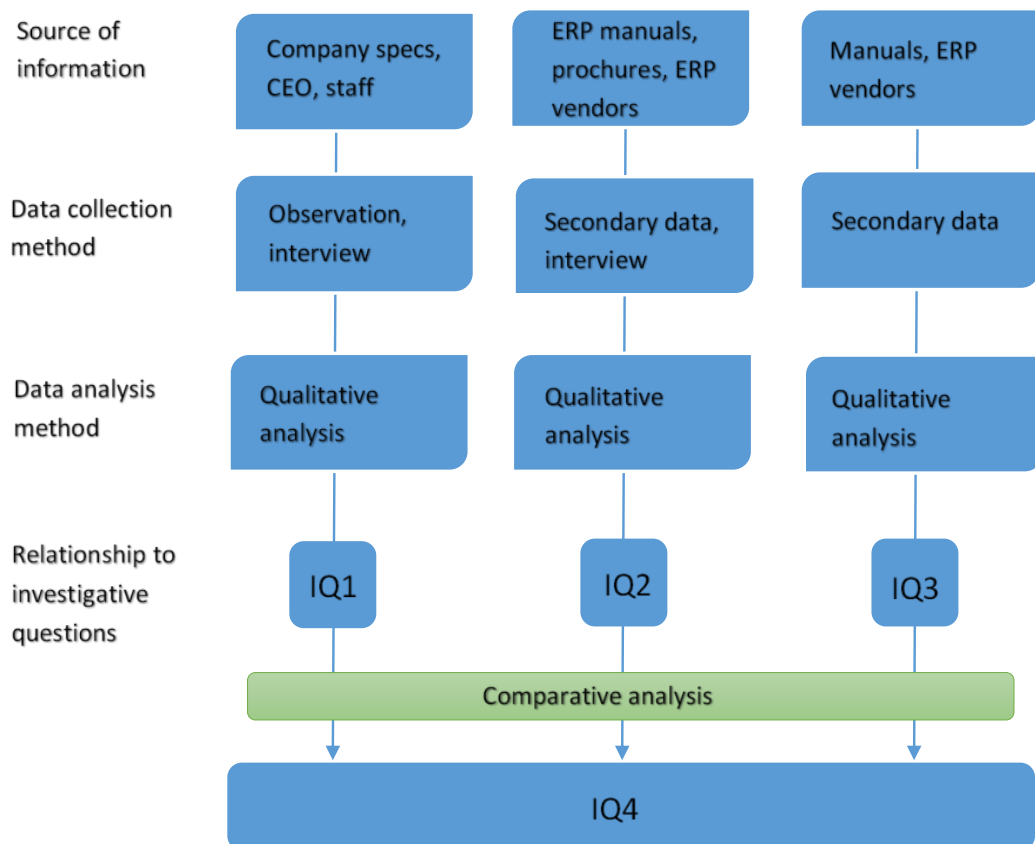


Figure 2. Research methods

4.1 Research design

The research design in this study is a descriptive single case study research. The thesis starts by defining the research question and the investigative questions.

In the first stage of the research process, data about the current state of the company was gathered by observing the company operations during an internship period in Spring 2018 (February – June 2018). Author's personal experience of using the current excel-based systems clearly pointed out the need for the ERP software system.

In the second stage a desktop study and literature review, discussions and conversations via e-mail with the ERP vendors and with the CEO of the case company was conducted. User reviews of the two ERP systems were also studied. The literature review gives tools for the research by describing the ERP selection process stages and help in finding the key phases and critical points to consider in the empirical research. Discussions with the case company and the vendors of the ERPs systems gave detailed information about the needs of the company and offerings of the systems.

The final phase of the thesis is the concluding part in which recommendations are given to the case company as a result of the thesis. By qualitative research methodology the best option for the case company was named.

4.2 Data collection

4.2.1 Primary data

The primary data consist of first-hand observations and discussions with the case company and of information provided by the ERP vendors. The requirements specification of the case company is also an important part of the primary data.

Most of the data about the current situation of the company was gathered before the actual thesis process had started. The author did her internship (five months between February - July 2018) in the company. By working in the operations, the actual work, daily use of the current systems and the amount of annual work came clear. Discussions with the operative manager, staff at the production and packing departments provided good first-hand data about the current situation and the pros and cons of it. These form the primary data of the research.

The operations manager named the two pre-selected ERP software solutions, their vendors and the specification requirements for the ERP. These data collecting methods provide information to the investigative question (IG) 1. (figure 2.)

The software vendor representatives provided some information about the matching functionalities of the systems against the company requirements specification. Vladi Parsonen from SprintIT (Odoo vendor) and Heikki Rakkolainen from Accountor (NetSuite vendor) was contacted via e-mail. They both got to see the requirements specification of the case company and estimated the functionalities of the systems against the requirements. The results of the comparison of the two software solutions' functionalities against the requirements of the company are shown in table 2.

Another part of the information of the ERP systems was gathered from the internet. Both ERP systems and their vendors have web-pages and there are also a lot of reviews written on the systems. These sources were all used to get an insight of the characteristics and functions of Odoo and NetSuite. The system specifications of the software solutions were studied and compared against the specification requirements set by the company. In addition, the cost structure of each software solution was clarified. In conclusion and as the result of this research the best option for the case company is recommended. (figure 2.)

Information gathered from the software vendors give insights and answers to the IQ 3.

Table 2. ERP requirements comparison

ODOO	Requirements specification of the case company	NetSuite
Great scalability Modular solution, based on apps	Scalability	Scales-up with the user amount
Yes	Cloud-based user interface	Yes
Depends on version: Community is license free, Enterprise is priced according to number of users and modules.	Cost / user (how the cost is determined?)	SaaS Service pricing is based on two factors; 1) Functionality (modules to be used) 2) number of named users
Enterprise is native-mobile, Community needs separate apps for mobile usage	Adaptability	Can be integrated through standard API interfaces
Possible, but requires knowledge of Odoop programming and Python, some changes might be made via GUI	Inhouse modification possible	Possible, NetSuite is highly modifiable, also "new code" (with NetSuite terminology "scripting") can be done by key users/administrator
Yes, the whole chain from sales to invoice is covered and all the process steps are aligned. Deliveries are also linked, and purchase orders can be linked too.	Process-driven platform	Yes, based on roles and workflows
Yes	Inventory management	Yes
Yes	Current assets management	Yes
Yes	Expenses recording simultaneously with delivery	Yes
Yes	Automated finished products storage tracking	Yes
Yes	Procurement planning & management	Yes
Yes	Automated procurement documentation	Yes
Yes	Systematic procurement	Yes
Yes	Accounts payable	Yes
Yes	Supplier management	Yes
Enterprise is strongly recommended	Production planning & control	Yes
Enterprise is strongly recommended	MPS-MRP-work order	Yes
Enterprise is strongly recommended	Production directed by production plan	Yes
Enterprise is strongly recommended	Procurement controlled by the material needs purchase plan	Yes
Enterprise is strongly recommended	Work- and quality control	Yes
Enterprise is strongly recommended	Work reportage through tablets (at work station)	Yes
Enterprise is strongly recommended	Simulation of Production	Yes
Enterprise is strongly recommended	Capacity counting and resourcing	Yes
Enterprise is strongly recommended	Reporting and tracking	Yes
Enterprise is strongly recommended	Easy to modify reports inhouse	Yes, with administrator's tools
Enterprise is strongly recommended	Cost estimation	Yes
Enterprise is strongly recommended	Quality management	?
Enterprise is strongly recommended	Systematic through production cycle	?
Enterprise is strongly recommended	Fault tracking	Yes
Yes	Project management	Yes
Yes	Delivery process tracking	?
Yes	Delivery /assembly calendar	Yes
Yes	Assets management	Yes
Yes	Machinery service management	Yes
Yes	Basic customer management	Yes
Enterprise is strongly recommended	Product Management	Yes
Enterprise is strongly recommended	Product lifecycle management	Yes
Enterprise is strongly recommended	BOM (Bill of materials) / product	Yes
Can be made by request	Linking with Netvisor	No Solution includes financials, which is recommended
Enterprise is strongly recommended	Support Desk	No
Enterprise is strongly recommended	Automated status updates towards customer end	Can be managed with e-mails
Enterprise is strongly recommended	Escalation	NetSuite Case management supports this
Enterprise is strongly recommended	Customer satisfaction inquiry	No
Yes	Logistics management	Yes
Depends on the quality of documentation	Automated transport documentation	Yes
Yes	Vendor system support	Yes, services are priced separately
Must be tested	Industry suitability	Strongest in the service-centric industries/ SuiteSuccess editions
Yes	Financial management	Yes
Yes	HR management	Partially supported
Yes	User-specific profiles	Yes, roles of different user groups
Yes	Retailer/logistics partners portal	Recommended to use O365/SharePoint or Teams sharing to externals
Yes	Future integration opportunities	Yes

	Must have
	Must have
	Nice to have
	? No information

4.2.2 Secondary data

The first part of the secondary data consists of literature review of ERP systems. There are a vast variety of academic articles and books written about ERP systems and their selection process. The literature about the overall ERP selection process, critical factors in the selection and implementation processes was studied to get comprehensive overview on the subject.

Another part of the secondary data are the user reviews of the two ERP systems. There are a lot of user reviews on the ERP software systems available online. G2 Crowd is a platform of real-time and unbiased user reviews on business technology. At G2 Crowd independent and authenticated users review different business solutions to provide transparency and insights to help decision making in selecting a software system. G2 Crowd collects also user reviews on ERP systems (G2 Crowd 2018a; G2 Crowd 2018b). The reviews of Odoo and Netsuite written in 2018 were studied and the pros and cons were collected from the reviews. These user experiences are visualized in table 3.

The reviews on business software solutions are based on individual perceptions and cannot be considered as one truth. Nevertheless, the reviews are based on actual user-experiences, thus the points can be considered indicative while forming an overall picture of the ERP systems.

Table 3. User reviews

	NetSuite	Odoo
PROS	- shaping the system according to your own needs - possibility to connect and integrate with other platforms	Customizable by developers and end users
	Information displayed and connected in logical manner	Flexibility - modifiable to suite industry needs
	Built to scale with company growth	Scalability
	Ease-of-use - nice user interface - strong search mechanism	Easy to use, instructions available - all departments can see/share information
	Consolidate all company operations and accounting information into one system	Users can eventually maintain the system by themselves (with some practice and training)
	Deep and strong reporting feature, custom reporting	Can do almost anything if one is trained to use the system
	Good admin controlling functions	Extendible to do what ever you want
	NetSuite implementation team knowledgeable	Thousands of modules & apps available
	Allowed developers able to develop APIs (application programming interface)	Free community version - Easy to start using the online service
	Robust software	Accounting is the core of the system
	Accounting rules specific to each country	Suitable for small companies
	Unifies order processing and fulfilment into one program	Quick customer support response rate
	Order management, inventory, financials work well and can be customized	Modules well adapted to each other
		Easy to understand and follow process flows
		Fast system, not lacking while in use
	Ability to foresee business processes	
	Covers MRP, multi-layer BOM and eSignature (which most ERPs do not)	
CONS	Customization can also be a weakness - can be complicated to have complete understanding of customization	Thorough Python knowledge required to customize or extend Odoo to make it unique to the company needs - complex to develop a new app
	User experience too complex, user friendliness cloud still be improved - most interfaces not intuitive, takes a long time to learn how to get where you want to go	Maintaining the system requires strong in-house IT skills or Odoo partner (which in turn is expensive)
	Not good in: - project management - timesheets - expenses reporting - HR	Bug fixing by Odoo team not that effective, may take long time to solve problems
	Lacking: - forecasting, modelling and prediction - dashboard capabilities	Really bad in reporting
	Linking with external platforms might not work as smoothly as predicted	Not much possibilities to integrate seamlessly with third party platform
	Support team not that high in technical knowledge	Lacking localizations
	High cost/user and limited users/user role	- hard to find info for developers how to modify the system
	Fixed assets management not part of the core NetSuite, might have inconsistencies with the rest of the system	Information within the system not well-organized
	Testing instances are expensive	Takes a lot of time and effort to get it configured
	Tax amount display not native in the system	Process flow documentation not straight forward
	Billing system not that good	Sometimes hard to understand the modules - module customization not easy
	User interface severely lacking	Limited documentation and instructions available
	Loading is really slow even with fast connection	Tough to create a mobile app
	System too complicated for some modules, for example CRM	Consultant implementation is recommended to avoid things to go wrong
	Setting up is a slow, long and really hard process - it is a must to hire a certified partner to install the system, otherwise impossible to make it work	Enterprise version is expensive
		Resource intensive - overkill for a business with a small set of requirements
	Not the best option for a small company	
	Expensive software	
	Customer support not effective and expensive	
	Pricing & account management at NetSuite	

4.3 Data analysis

The data for this research was analysed using qualitative analysis. Qualitative analysis seeks to find out the quality of phenomena and the subject matter studied, rather than measuring quantities (Tuomi & Sarajärvi 2009, 24).

The main sources of data to answer to the research question were the answers given by the software vendors representatives and the web-pages of the two software systems. In addition, the user reviews on G2 Crowd platform were used in assessing the suitability of the systems for the case company.

The functionalities of the systems were studied and compared to the main requirements of the company. In this research the analysis was not meant to take to the deepest characteristics of the systems, but to analyse the functionalities on the surface, since the requirement specifications of the company were also on the general level. To be able to do more thorough and in-depth analysis on the suitability of the ERP systems more detailed requirements specification would also have been required.

Due to the complexity of ERP systems, analysis on the surface does not give the final answer and result of the absolute best choice for the company. The target of the research, which was to be able to recommend one software solution, was met however.

The data was analysed by following the framework of functionality criterion. Illa, Franch & Pastor (2000, 3) looks at ERP systems in relation to three main aspects of functionality: which functional areas are covered by the product and how flexible the product is with respect to adaptability and openness (table 4). The findings of the data analysis are described in the next chapter.

Table 4. Functionality criteria (adapted from Illa et al. 2000, 3)

Criteria	Definition
Included functionality	Areas or functions of the company that the ERP has to serve. It is described how the ERP covers each function.
Main target	Functional area or areas for which the ERP is specially oriented or strong.
Adaptability	Possible level of customisation in general and for the specific company.
Openness for - custom development - working with other systems	Level of openness to additional bespoke development (internal or external) and to other existing applications (for example, vertical applications, API, CRM, SCM, etc.).

4.4 Risk management

One of the risks in this research is the possible result that neither of the pre-selected potential ERP systems is suitable for the case company. This would lead to the situation where the company must do the whole data collection and analysis part again. This risk cannot be avoided.

Another risk is that the requirement specification provided by the company is not accurate enough to make valid comparison of the two system functions. This risk is mitigated by interviewing the company's operations department and CEO to get more detailed information about the requirements of the company.

On major risk is that the thesis is not ready by the dead line. The time to conduct the whole thesis process is altogether only 8 weeks. Time management and prioritization are crucial during this research period.

5 Results

5.1 Key characteristics of ODOO software solution

Odoo is an open source cloud-based management software solution. It was developed by Fabien Pinckaers in 2005 and called OpenERP. In 2014 the company changed name to Odoo.

The three major features of Odoo are Business management, CRM and ERP. All these main categories include several sub components. Each feature is implemented through various Odoo applications. Odoo has diversified applications from sales, operations, productivity tools, website tools, Odoo Studio and many third-party applications. (Zhao 26 January 2018.)

In addition to ERP, it includes CRM (customer relations management), eCommerce and CMS (content management) and HR (human resources). Odoo is highly modular and suitable for all kinds of business needs. There are 30 core modules and over 3000 community apps that make it easy for a company to adjust and customize the software solution to answer its business needs. (Zhao 26 January 2018.)

Odoo's advantage is that it is an all-in-one business software solution including CRM, website/eCommerce, billing, accounting, manufacturing, warehouse and project management, and inventory (Zhao 26 January 2018). It is also considered as user-friendly, customizable, cheap, license free and it has a big partner network. Odoo is customizable to each user's needs. The user can start with basic implementation and add applications along the way. Odoo's scalability supports the growth of businesses.

There are two different versions available: a community version and a commercial version. (Zhao 26 January 2018). The community version is free version while the commercial or enterprise version is charged and provides more features and services. The enterprise version of Odoo available as a Software-as-a-Service and accessing the source code is restricted to enterprise customers and partners.

Odoo has 160 000 customer companies and 3.7 million users world wide, which is a clear indication about the suitability and customizability for a wide variety of businesses.

5.2 Key characteristics of NetSuite software solution

NetSuite is cloud-based integrated ERP solution for small-, mid- and large enterprise-sized businesses. It was founded in 1998 and was the first fully cloud-native ERP solution to come to the market. More than 40,000 organizations are using NetSuite in more than 160 countries. It serves organizations from all business sectors, but its particular strength is in service-centric industries.

NetSuite has always run on the Oracle technology stack. In fact, it was acquired by Oracle in 2016 and is now a separate global business unit (GBU) within the Oracle business. NetSuite offers a common unified cloud-native platform with a single code base. NetSuite is focused on delivering industry-specific solutions, for sectors including software, services, media, not-for-profit, manufacturing, distribution, and retail. Its strategy includes providing deep industry processes for micro-verticals within these sectors. (Jennings 2018, 2.)

NetSuite separates its business management software solution into six different product categories: NetSuite ERP for inventory, supply chain, and financials; NetSuite CRM for sales and marketing; NetSuite Commerce for both web and on-site sales; NetSuite PSA (professional services automation) for project management, OneWorld for multinational organizations and SuitePeople for HR (human resources management).

In addition, there are several additional NetSuite editions with different configurations targeted for example to serve the needs of manufacturing, retail, e-commerce and non-profit organizations. There are also several add-on modules available that can be incorporated to the software package with separate monthly fees.

NetSuite ERP is a fully integrated ERP targeted at fast-growing companies that require high scalability of the ERP system.

5.3 Cost design

The cost of an ERP system can be divided into two: implementation costs and maintenance costs. The implementation costs include the ERP project, installation consultants, configurations et cetera that occur when the actual system is installed for the first time. The cost varies according to the size of the company and the need and level of customization.

The maintenance cost consists of monthly user fees and module/application fees that are also charged monthly. The amount depends obviously on the number of users and the number of applications/modules in use by the company and by each user.

Some of the ERP software systems have also separate license fees, but most of the cloud-based software does not include license fees.

Odoo

The community version is free to download with limited functionalities and support. The users install, configure, customize, update and manage the platform by themselves. The enterprise version offers different level of pricing plan. It has also 15 days free trial after which there is a monthly subscription fee per user per app. The first app is free for the customer. Different apps have different prices. The costs can grow quite high in large companies as the number of applications increases.

Odoo provides also implementation services for the customer with four levels of implementation packages. The price of the implementation package varies also according to the complexity of the system, time and customization level. The Success pack by Odoo is recommended for companies less than 50 users. The Success pack by Odoo include 100 hours for the set up. This implementation service provides an expert to give personalized assistance to help customize the software solution and optimize company's workflows as part of initial implementation. The 100 hours are available to use anytime, if the implementation does not require all the hours.

The cost estimation of Odoo per month for 10 users with 16 apps (indicated by the CEO of the case company) that would be selected to the software solution in the beginning is 444 euro per month (5328 euro/year). In addition, the implementation service, The Success pack by Odoo with 100 hours of assistance costs 7425 euro.

Odoo is suitable for smaller businesses since the user number is not that high keeping the monthly cost of the system also lower.

NetSuite

NetSuite ERP is quote-priced, which means that each client gets a price tailored exactly to their needs. The SaaS service pricing is based on two factors: functionality (modules to be used) and the number of users.

Usually the hosted software system pricing falls in the range of 99 euro to 129 euro per user per month based on annual contract. Additional fees apply to various add-on products and add-on services. Help desk support is priced separately and may range from 22.5% to 37.5% of the software subscription. (Finances Online 2018b.)

Heikki Rakkolainen from Accountor gave a rough estimation of the work load and cost of ERP implementation project (table 5). Even with minimum work load estimation the cost of the project will rise above 100.000 euro, which is quite a substantial investment for a small company. On top of that there is the monthly fee /user, so the overall costs can rise pretty high.

Table 5. Implementation project cost estimation of NetSuite

Task	Estimation of hours re-quired (min)	Estimation of hours re-quired (max)
Project management	13	26
Analysis/specification	22	40
Implementation (tools, parameters, modifications)	40	80
Testing and iterations to implementation	15	30
Introduction, introduction support	10	20
Total (man-day)	100	196
Total (EUR VAT 0%)	100 050	195 500

Unfortunately, it was not possible to get an estimation of the monthly maintenance fee of NetSuite without conducting a proper quotation of the software solution. Nevertheless, the monthly fee of basic ERP package starts from 999\$ per month. On top of that may come additional fees of add-ons most probably needed in the customization process.

5.4 Comparison of the software solutions

Both of the software solutions are cloud-based, which is one of the main criteria for the ERP system. The main difference between Odoo and NetSuite is that the other is an open source software system developed by a community of developers/users, whereas NetSuite is closed and developed by an IT company.

Open source model enables individual developers to build, develop and modify the apps. It provides usability that scales across all apps (Zhao 26 January 2018). In open source system the post implementation support is not depended on the vendor. In closed model the modifications and model revisions are done by the developing company. New versions of the software system must be installed separately to the user interface. The company

relies to the service provider in case of problems and there is of course a price tag for the support and post services.

Odoo's core function is accounting and it is built up around financials. Odoo can be customized and extended through acquisition of new applications, whereas NetSuite consists of different modules and module packages for different business purposes. The systems have a lot in common and they are comparable to each other in terms of functionalities. The usability, cost structure and features of functions differ somewhat from each other.

In the next section the differences in functions, pros and cons of the systems and the alignment to the case company's needs is discussed in more detail.

5.5 Alignment with the case company's requirements

The business areas of the company that the ERP system has to serve are distinguished by using the functionality criteria model (Illa et al. 2000, 3; table 4). The main target areas are;

- Production and product development
- Procurement
- Product delivery and installation process
- Post services

The four of the areas are part of the SCM to which, according to the CEO of the case company is the first part of the business the new ERP system is going to be adopted. Sales and marketing, CRM (customer relations management) and financial management (e.g. accounting) modules are going to be included also to the ERP system later on.

The must functionalities according to the company's business needs are project driven platform and process orientation. Also, the ease of using the system from the user perspective is essential. The system interface must be simple so that the ERP system can be used from tablet and phone screen without disrupting the content and usability. One key selection criterion is the depth of the functions within the basic models of the modules and apps, in other words how deep to the functions a company can go with the basic model. (Annex 1; Table 2.)

Adaptability and openness criteria in this case includes scalability and customization. As the company grows and business processes scales up the changes that are needed in the system must be easily executed, preferably inhouse by the company. Inhouse develop-

ment and system modification is really important feature. At the moment, the case company uses NetVisor for financial management, thus the systems should be open to link with NetVisor at least in the beginning.

In terms of openness neither of the systems has native linking possibility with Netvisor. Odoo can be linked with Netvisor, but this requires additional configuration and consultation which might be costly. Both software solutions include financials functions which are highly recommended over continuation of using Netvisor.

Project management and process orientation

The user reviews criticize heavily the project management feature of NetSuite. Odoo's project management feature is reviewed better since it is fully customisable and easy to use.

Odoo's process flows are also easy to follow but project flow documentation in turn is not clear enough. Odoo has also business process prediction and modelling function which are lacking in NetSuite.

Reporting

One of the strongest features of NetSuite is deep and strong reporting function. The user can create informative and custom reports of different data. This is a clear advantage for NetSuite in comparison to Odoo. Odoo's reviews are really negative in terms of reporting; many users deem the reporting function of Odoo as being really bad.

Production and product development

Production planning and control can be automated with NetSuite. MRP (Materials requirements planning) calculation is included and work orders, scheduling, inventory transfers, purchase orders et cetera can be managed through the system. There is also work order queue which enables production plan to direct production. Procurement can be controlled by material needs plan and purchase requisitions are included in the system. Work quality control can be managed with the system since it registers good and damaged items manufactured.

Odoo has a Manufacturing app which includes also maintenance, PLM (Product lifecycle management) and quality management. According to the user reviews Odoo is strong in material resource planning and includes also BOM (bill of materials), which is one of the must have requirements of the case company. This same functionality is also included on NetSuite. Odoo supports also product versioning.

Procurement

Both software solutions have procurement planning and management included as standard functionalities. Purchase orders and order confirmations are automated and standard features in each system. NetSuite also supports systematic procurement; purchase requisites can be originated by sales order, production work order or lack of stock balances.

NetSuite does not include prediction or forecasting, which in turn is strong in Odoo. Predictability and systematic procurement are both must feature for the case company.

Product delivery, installation and post services

These functions must be considered as processes thus process flows, process automation, documentation and reporting functions within the processes are important. NetSuite is based on roles and workflows thus, it is process-driven as wished. Delivery process tracking and attached calendar are included in Odoo, which can support the assembly process of the company.

NetSuite does not support shipping automatically. There is a third-party NetSuite shipping integration app that allow the customer to stay on the NetSuite platform (Hirsch 28 September 2017).

Easy to use

Odoo and NetSuite both have easy user interfaces which get positive feedback from the users. On the other hand, the speed of the connection and lack of the user interface differ between the two. In user reviews Odoo is thanked for being really fast whereas NetSuite's interface is slow and lacking severely even with fast network.

NetSuite has strong search mechanism and information is displayed in a logical manner. Odoo's users are criticizing the information within the software solution as not well organized and there is a lack of instructions for example for app developing.

Odoo might be a bit tricky in the beginning since information is not organized that intuitively but as one gets used to it all gets easier as all the apps are built in similar way.

General features

In Odoo most of the features that support the requirements of the case company are included only in the enterprise version. Thus, the costs of all the required features might rise

quite high per user. In this case the enterprise version seems to be the only option for the case company, if Odoo would be the choice for the ERP system adopted.

Odoo is perceived as suitable for small companies. On the other hand, it was mentioned in the user reviews that Odoo might be “an overkill for a business with a small set of requirements”. This is a valuable point, but the actual suitability must be tested in each case separately. User reviews also pointed out that NetSuite might not be the best option for small companies. This is one big factor in determining the better choice for the case company.

Both of the systems have great scalability. They are built to scale up with the company growth and the functionalities within the systems support the business growth. Both can be adapted to the specific needs of each user and the whole company.

Odoo apps are developed by developers from all over the world. This is a small disadvantage in the sense that Odoo is lacking localisations on some of the features and functionalities of the apps. NetSuite on turn has for example country specific accounting options for different countries.

Inhouse development and modification is important for the case company. Both systems can be modified and “scripted” inhouse. In case of Odoo the inhouse modification requires a lot of IT skills, knowledge of Odoo programming and Python. Smaller companies might not have this kind of inhouse IT resources so app development and inhouse modifications are not easy to conduct. NetSuite is also modifiable, and scripting can be done by key users or administrator.

Odoo releases new versions of the system from time to time. Users say it can be really difficult and painful process to shift to new versions. There are cases when the information between versions have not been easily linkable and the installation costs have escalated.

NetSuite releases scheduled updates to its entire customer base twice a year. Every customer receives a preview account where you can test each transaction and process to make sure everything run as wanted also in the new update. If the customer has a lot of customizations in the solution it might be wise to have help and support with the update from the implementing partner or software vendor.

Also setting up the system in the first place is time consuming and requires IT knowledge. Thus, in both cases, it is recommended that companies hire implementation consultant to install the software system.

6 Conclusions

6.1 Recommendation of the best ERP system

The goal of this research was to find out which ERP system of the two pre-named software solutions would be the better choice for the case company. The selection of an ERP for any business is quite a complicated decision to make. This research is trying to ease the first stages of the selection process by pointing out pros and cons of each of the pre-selected software systems and by giving recommendations on what to concentrate for example in the demo and trial phase. The answer and final recommendation to this question was investigated through four investigative questions (figure 2).

A huge part and a determining factor in this research are the requirements specification compiled by the case company. Another demarcation factor was the two pre-selected software solutions; NetSuite and Odoo. The recommendation of the best software solution is based on the answers given by the software vendors, the sum-up of user reviews and analysis of the functionality criteria in relation to the company's requirements.

Based on the data analysis, cost structure estimations and user review the more suitable software solution in this case for the case company is Odoo. Odoo does not require as big initial investment to the implementation project as NetSuite does. In addition, the overall cost of Odoo for the case company (with only 10 users) is much more reasonable. The user reviews also pointed out that NetSuite might not be the best option for a small company.

The inhouse IT skills and Python knowledge required for the customization and development of Odoo put the system at a modest disadvantage. On the other hand, this can also be seen as an advantage. After acquiring the knowledge of how to create apps and how to modify the software system, one can do basically anything with Odoo.

In the beginning the road with Odoo can be hard and complicated, but as the system gets familiar the options are countless. As inhouse IT skills are required from the beginning of ERP process, in the long run the modifications and inhouse development does not require that much external support or consultation which means less additional expenses.

Nevertheless, in the end the final selection of the ERP system for the case company has to be done after detailed evaluation and testing. The system needs to be tested thoroughly and the company must evaluate well, how much they need to customize it.

6.2 Suggestions for the continuation of the ERP project

As the research progressed it came clear that both of the software solutions would fit relatively good to the company's needs. There were some major differences, like Odoo being open source model and NetSuite a closed system. Otherwise, the functionalities of any of the systems would answer the requirements of the company.

The requirements specification used in this research was a bit too general in nature to be used for quotation. As the requirements were not stated in detail the vendors could only look at the requirements specification on the surface. This has a significant effect on the results. On the surface, both systems might have the functionalities required but how deep the functionalities go is another thing, which can only be investigated with much more detailed requirements specification.

As mentioned earlier the cost of an ERP system can be divided into two: the implementation costs and maintenance costs. The cost depends on the need for customization and configuration which depend on the specific needs of the company. As the modules or apps to be selected cannot be stated in this stage of the research the vendors are not able to estimate the real implementation costs either. Similarly, due to the inability to determine the modules it is also impossible to determine the maintenance costs of the software solutions at this point of research.

Thus, the IQ 2. What is the cost design of the two ERP systems? cannot be stated precisely without determining exactly the modules to be selected to the software solutions. The cost structure described in the previous chapter gives a rough estimation of the costs of each software system. The ERP vendors need more accurate requirements specification and detailed ERP system implementation plan to be able to estimate the costs of the process in more detail.

During the data analysis the author found contradictions between the answers given from the software vendors and user reviews of the two software systems. The vendors answered "yes" to nearly all of the requirements specification features but did not specify the actual usability and utility of the features. From the user reviews it came clear that for example reporting and project management might not function as smooth as might be anticipated from the software brochures. In case on NetSuite, for example fixed assets management was said to be included in the system from the vendors side but the user reviews mentioned that fixed assets management is not part of the core functions.

This is a strong indication of the need to have a demo version and a trial period of each of the solutions before making the final decision of purchase either one of the ERP systems.

More detailed requirements specification could have been designed also during the thesis process, but that would have gone out of the scope of this thesis. The purpose was to make a preliminary study on the two software solutions, not to decide on the acquisition of one or the other. A more detailed requirements specification and a try-out of a demo software solution to find the real depth of the functions is the next step for the company. The company can start with the recommended software system but still keep the table open for other choices.

6.3 Personal learning

The thesis writing process was really intense and instructive. The author finds that the short time period turned out to be an advantage; writing, collecting data and analysis were far more effective than usually is the case when there is a lot of time to conduct a research.

The author did not have previous experience on ERP software systems. Thus, writing this thesis was a true learning experience. Most of the literature used in this research was new for the author. Finding good academic and reasoned literature required excellent information searching skills, which the author got to practice a lot during the thesis process.

This thesis is closely tied to the author's internship period in the case company. Personal experience working in the case company together with the thesis research taught a lot about the processes and challenges of an SME manufacturing company. Besides conducting this research and writing the thesis, the author had to step out of her comfort zone and self-study a whole new topic and build connections between the theory of supply chain management and empirical research.

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Appendices

Appendix 1.

Requirements specification of the case company

Must have:

Scalability

- Cloud-based user interface
- Cost / user (how the cost is determined?)
- Adaptability
- Inhouse modification possible

Process-driven platform

Inventory management

- Current assets
- Expenses recording simultaneously with delivery
- Automated finished products storage tracking

Procurement planning & management

- Automated procurement documentation
- Systematic procurement
- Accounts payable

Supplier management

Production planning & control

- MPS-MRP-work order
- Production directed by production plan
- Procurement controlled by the material needs purchase plan
- Work- and quality control
- Work reportage through tablets (at work station)

Simulation of Production

- Capacity counting and resourcing

Reporting and tracking

- Easy to modify reports inhouse
- Cost estimation

Quality management

- Systematic through production cycle
- Fault tracking

Project management

- Delivery process tracking
- Delivery /assembly calendar

Asset management

- Machinery service management

Basic customer management

Product Management

- Product lifecycle management
- BOM (Bill of materials) / product

Linking with Netvisor

Support Desk

- Automated status updates towards customer end

- Escalation
- Customer satisfaction inquiry

Logistics management

- Automated transport documentation

Vendor system support

Industry suitability

Nice to have:

Financial management

HR management

User-specific profiles

Retailer/logistics partners portal

Future integration opportunities