Vaasan yliopisto
UNIVERSITY OF VAASA

Sagar Shah

Analyzing and Benchmarking of 5 potential Software of new ERP for better Inventory Management System for case company

School of Technology
Master's thesis in Industrial
Management

Vaasa 2021

ACKNOWLEDGMENTS

Working on this project of master thesis is a great achievement for me. A special thanks to University of Vaasa which allowed me to pursue my master study in this widely recognized University. This is my thesis for master's programme in Industrial Management.

I would like to express my gratitude to my supervisor, Prof. Ville Tuomi, who guided me throughout this master's thesis. It is an honour to be associated with him in this project where his guidance, advice and support made this thesis possible.

I would also like to thank the CEO of the case company, Mr. Jose Ayala who gave me this opportunity to pursue this thesis for his company and showing that trust. He was always there to support and has always responded to my queries throughout this project.

Finally, I would like to thank my father, mother, sister, brothers, and my friends without whom my studies would not have been possible.

UNIVERSITY OF VAASA
School of Technology

Author:	Sagar Shah
Title of the Thesis:	Analyzing and benchmarking of 5 potential software of new ERP for better inventory management for case company
Degree:	Master of science in economics and business administration
Programme:	Industrial Management
Supervisor:	Ville Tuomi
Year:	2021 **Page:** 78

ABSTRACT:

This Thesis is commissioned by Stafix Oy Finland. The case company was interested in finding out new ERP tool for their inventory management. The research questions were formulated as follow: How can the company receive inventory recording and calculation automatically with traceability of produced goods as well? And what are the major pros and cons of the suggest 5 potential software solution (easy to use and affordability)? Addition to providing solution to the above question, the cost comparison of those suggested ERP tools was also important. The thesis presents the theoretical background related to the software and its quality and functionality, ERP tools, benchmarking of suggested tools, Inventory management etc.

The methodology applied is qualitative approach in which primary data were collected through semi-structured interviews and questionnaire. The two interviews were carried out with the managers of different companies which are using the ERP software in their companies and the software which are being analyzed by the researcher in this thesis are used by these companies. The secondary data were collected through different journals, publications, books related to the topic and basis of the topic to provide the overview of the related subject under which the thesis is being commissioned. An interview was also held with the CEO of the case company to the current issue that are being faced by the company and the expectation related to the new potential software. The questionnaire was answered by the employees of the case company. The aim of the questionnaire was to know the current status of the software that is being used by the case company and the problems that are being faced by the employees as well as the decision makers related to the software.

The researcher analyzed the interviews and questionnaire to provide the final outcome to the case company which would help the case company to choose one of the 5 suggested ERP tools for them. The researcher was able to handover the detail analysis and results related to the use, cost, efficiency etc. related to the potential software based on the theoretical research as well as empirical data collection, out of which company can choose which suits best for them.

KEYWORDS: Software quality, Functionality, Usability, Benchmarking, ERP, Inventory management

Contents

Figures

Abbreviations

ERP	Enterprise Resource Planning
SAP	System Applications and Products in Data Processing
HRM	Human Resource Management
CRM	Customer Relationship Management
CSF	Critical Success Factor
ROI	Return on Investment
WIP	Work in Progress
R&D	Research and Development
SME	Small and Medium Enterprises
ISO	International Organization for Standardization

1 Introduction

The current business world is completely based on the digitalized strategy and methods which enables them to achieve better transparency and profitability. Every business has certain strategic planning and management which helps them to achieve their goal and if they failed to do so then, it's like that though the driver has participated in the car race, but his eyes are still stuck to the rear mirror (Analoui and Karami (2003). To achieve its goal, the business must be well balanced from both the side i.e., internally as well as externally. The first that comes as priority is selection of the software for the business which keeps transparency from accounting, inventory, warehouse etc.

The selection of software depends on various factor such as software quality, affordability, data accuracy etc. These are the major components in business to achieve its goal and success in the market. It is all about the company which tends to switch their current business strategy with the future and focus on the need accordingly. The company also developing their absorptive capacity for the better outcome. (Beheregarai E&A 2014). The company selects the software and digital platforms for obtaining secure and transparent data as per their size.

There are much software's existed in the market required for every department in the business such as designing, documentation, accounting, finance, inventory management etc. These software companies provide the solution to every companies as per their requirements irrespective of their size(Kurnia 2017). In today's competitive world, every business should be competitive enough to survive and secure their position in the market. Currently there are many software companies existed in the market and some of them are SAP, Net suite, Microsoft, SAGE intact, Syspro, Orion, X-tuple, Opti pro, Epicor, Plex etc.

1.1 Background

The case company is middle scale company currently using open source for data management system. This data management system involves human intervention and requires manual calculation for data accuracy which takes more time with possibility of errors. This manual intervention prevents from data transparency and the person from one department do not have access for another department. This situation will not only hamper the production process but also that sales as the decision makers are not confident about the quantity of raw materials available and quantity of order can be completed with it considering the scrap which is also relatively high while manufacturing products.

This thesis is done on behalf of Stafix Oy company which is more interested in implementing new ERP software for the company since current software is not reliable and effective enough which helps the company to achieve its goal what they expect from it. The motivation of writing thesis on this topic started when author and company CEO met and discussed the current situation of the company and some brainstorming related to the issue leads to the conclusion that the author would research on the current leading ERP software in the market and select the five-potential software among which company can one to fulfil their need and utilize it for their company.

 The current situation requires better information flow between aspects of production and inventory management so that the product availability becomes more visible and reliable to warehouse manager and decision makers. The manager does not get enough and reliable information from open-source data which leads delay or inaccuracy while making decision related to the availability of raw materials, production, inventory etc. this ultimately delays the purchasing, production process which is not good for such emerging company.

1.2   Research questions and objectives

The research question for this thesis includes better inventory recording solution as well as detail related to the suggested potential software's. They are as below:

How can the company receive inventory recording and calculation automatically with traceability of produced goods as well?

What are the major pros and cons of the suggested 5 potential software solution (easy to use and affordable)?

The objective of the thesis is to provide the list of 5 potential software's for the company which includes its pros and cons and benchmark all that related software to provide wide range of information of that software so that the company can use them. The objective is not limited to select any random ERP inventory software and benchmark them but select the best 5 in terms of affordability and uncomplicated and adaptable out of all the major ERP software existed in the market and perform research and analyze them.

1.3   Limitation

The thesis is limited to evaluate and suggest the best suitable software for the case company. This research will not include finance of the company however; it will be limited to the pricing of every possible software which will be suggested to the case company. The research will not include any improvement methods for production or warehouse management or developing any business strategy but could suggest the modification of certain operational process while adopting new ERP software if required.

2   Software Quality

It is not easy to measure the quality of software and it depends upon the assessment quality how it is accessed. Sometimes, even an expensive software can have small issue during its process but the outcome might not be wrong which means that the process might be confusing and difficult to do or understand. (Walkinshaw 2013)There are much software's existed in the market which are being used in different sector of the business to provide best possible support for business and help to achieve its goal in easier and affordable way. (Atoum 2020) Every department of business is currently handled through software support since it gives better accuracy with minimum effort and in short period of time.

It is never easy for any company to replace their existing software with the new one. It is very important that the software they switch to are better and fulfill all the loopholes of their company which they came across while using the older one. It really takes lots of time, effort, and capital of the company to switch to new ERP software.(Mishra and Otaiwi 2020) Though there are hundreds of software for every department in the market, but the main issue is to find out the correct and perfect software for the company which would meet the requirement as per company and help the business to grow and balance internally as well as externally. The company tries to improve their business with the help of latest software which provide better transparency with their business and this process continues. (Anna & Philipp 2016)

The requirements of the quality and requirement of the customer may not be similar which might cause some conflicts, but it is always the best way that the customers understand the long-term vision for using the software and see the possible solutions that it could offer to them.(Le Gall 1995) The expectation of the quality of software will be achieved only when the customer has clear and appropriate quality requirements for software for their company. (Kocak, Alptekin & Bener 2014)

There are different quality models existed which are based on different criteria such as affordability, accuracy, easier access, flexibility, testability, maintainability, functionality etc. The quality model of the software is nothing but a set of possible requirements that are needed to provide the best possible outcome and stand different in the market and then meet the customer satisfaction. The information related to the quality model is useful for making decision while selecting the qualitative software based on the requirement for their business. The various existed quality model falls under one category among the listed ones.

2.1   Software quality Model

There is various software quality model existed and the software company adopt certain quality model under which that particular software is developed based on their requirement.

2.1.1   Software process quality model

It includes the improvement of the software for better quality and works on removals of unnecessary characteristics and improving up the software continuously. This models always works on the problem that arise while using certain software and the measures are taken to provide effective and comprehensive solution.

2.1.2   Software product quality model

It includes comparison of the quality with one another and combine them for development process on different matrices such as removal of defects. This models mainly works benchmarking different software and does not limit with excluding defect but also adding certain features based on the requirement and adding value on it.

2.1.3 Hybrid software quality model

This quality model combines both the approaches and analyze and finally picks the best qualities from both and utilize it. This model is the composition of both the models in which the customizations are done based on the need so that the improvements are done continuously. Basically, this model works on slight variation of the existed model and find the better solution to prevent from the future failure of the software. (Ference, Hegedus &Gyimothy 2013)
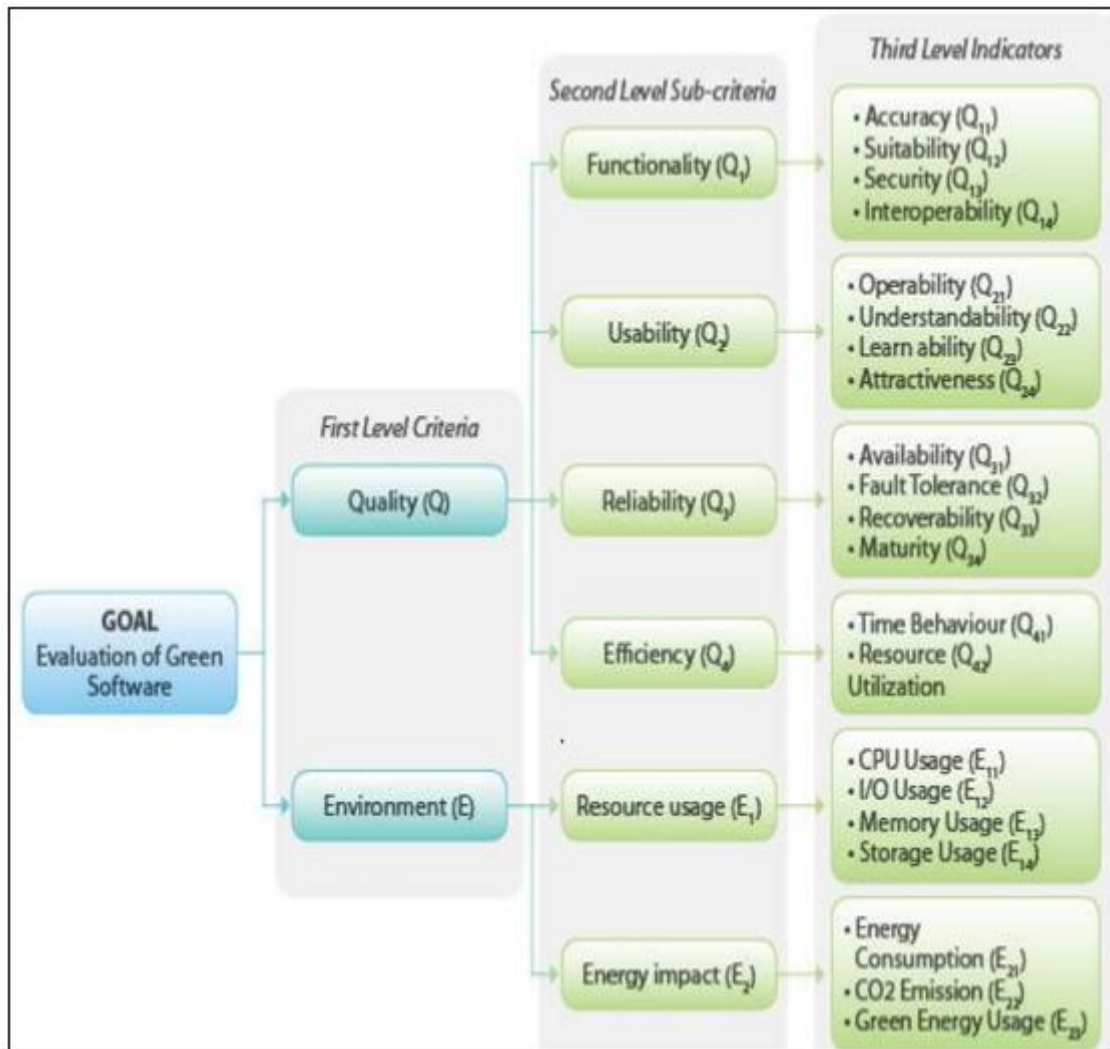

Fig 1: ISO/EC 9126-1 Quality Model (Kocak, Alptekin & Bener 2014)

The above table illustrates the ISO/EC 9126-1 quality model which not only focus quality but also on the environment. This quality model has three level division in which both quality and environment are taken into consideration. In the first level, Quality and environment are considered which means that for every software focus should not be limited to quality but also environment. This further move to second level in which quality is split into three subdivisions and so does the environment. The sub-division of quality includes followings:

- Functionality

It includes the functions and features which needs to be considered for software. Much software mainly works on the characteristics which needs to be included/excluded to compete with others in the market.

- Usability

It includes the factors which makes the software convenient to use for its end user. Sometimes though the software is good, but the user finds its complicated to learn and use it which might annoy them and compel them to switch.

- Reliability

This includes the factor which makes the software reliable and accurate enough for its user. The user can trust the software for their company and trust it considering that there won't be any system failure and in case occur will be rectified quickly and conveniently.

- Efficiency

This model evaluates the efficiency which means if the software is fast enough to satisfy the user. There are much software's existed in the market but if the software is not faster

and consume some time to operate and process any sorts of operation then it really becomes annoying for the users, so efficiency matters the most in this case.

Another aspect for this model is environment in which further two sub-divisions are made, and these are resource usage and energy impact.

- Resource usage

This means that the model user knows about its storage and in this process the storage does not degrade or destroy environment by any mean or in other word, environment is taken into consideration while using the software.

- Energy impact

This quality model does not have any negative impact on environment during its energy consumption or emission. ISO/EC 9126-1 Quality Model is fully responsible and concerned towards the environment and its safety.

2.2 Software functionality

The necessity of software has increased in current days as most of the manufacturing, service company need it to carry out their daily work properly and it is not possible without good quality software. It has played an important role in worldwide economy, environment, and society to improve and upgrade the productivity and knowledge. (Akatsu et al. 2020)The software is equally important as the computer hardware, machine, or any kind of electronic devices as such devices success or failure is decided based on its software quality and its functionality. The software quality and functionality success are determined as how well it is coordinated with the design of the hardware and give the

possible outcome as expected to sustain its reliability and accuracy. Software function-ality is the objective and purpose of any software in which any software perform for its user for their satisfaction and possible outcome.(Salleh, Bahari, and Zakaria 2017)

2.2.1 Characteristics of software functionality

There are many sub characteristics for the software functionality which are being ad-dressed by many manufacturing and service companies. The failure in this system may lead to dissatisfaction among customer, loss in revenue, data reliability issue, losing com-pany reputation in the market etc. The cost and time for maintenance of software issue will hamper the productivity as well as the create security issue of the system.

Functionality service sub-characteristics	Wireless net-work (3G,4G,5G)	Software ap-plication (EPR,EHR)	Approach for evolution	Quality of service	Software functionality develop-ment
Suitability	-	√	√	√	√
Accuracy	-	√	√	√	√
Interoperability	√	√	-	√	√
Compliance	√	-	-	-	-
Security	√	√	√	√	√

Fig 2: Characteristics of software functionality

The below are the sub- characteristics of the software functionality which the companies test before implementing in their business.

- Suitability

It is the category in which the related software function is identified and checked whether basic functions are done or not. Sometimes users experience short term col-lapse of software, confusing or tough process to carry out simple tasks etc. which are

draw back for any software and ultimately loss for the company. Any software that companies uses and rely on it, should be suitable to its function which means that the user should not feel that they give huge effort for minor outcome. It is also important that the software is suitable for the tasks that it is supposed to handle in quick time and give better and reliable result. (Lindström 2017) Functional suitability mainly concerns in three degrees, firstly completeness which mainly means that the software should cover all the aspects of tasks and its purpose. Secondly, correctness to which it is expected to give correct result and thirdly, appropriateness which means that the software should functions based on the need and requirement of the user and should be flexible enough to perform any special task if required. (Cortellessa et al. 2005)

- Accuracy

Functional accuracy is the term in which result is expected with least error or very marginal error. Considering the current business world where software requires to evaluate and analyze big data, in such cases data accuracy becomes one of the major issues with the software functionality. Inaccuracy with the data by any software occur when the system does not perform quickly and accurately every time data is analyzed and result is expected with 100% accuracy.

- Interoperability

Functional interoperability is the ability of the software to merge with another system without requesting any manual intervention from user. Sometimes, system generate the outcome in simpler form which is easier to understand by interacting with other system and make the complex data to simpler form and provide it to the user. There are many software's which are not easy to integrate with other system but the customers are unpredictable and expects the outcome as per their convenience.(Butler et al. 2020) It is challenging for the service provider to perform as per their customer satisfaction because every system is developed independently with different design and technology to

perform certain task. There are very less software's that can integrate with one another for customer satisfaction.

- Compliance

This term is defined as the capability of the software to maintain certain standard and regulation as per law. This function is very critical and hence not much upgrades has been done in the past.(Nguyen-Duc et al. 2021) There are many companies and enterprises that struggle to maintain this requirement as many issues arise due to older compliance which are not designed to update based on latest changes.

- Security

It is the ability of the software to prevent the unauthorized accesses.(Rindell et al. 2021) The software should be ideally designed in such a way that any unauthorized intrusions are reported immediately and no harm cause to the stored data, information, or service hindrance. It is the common issues with some existing software whose technical operational requirement are not enough protective which may cause security lapse and ultimately loss to the company. (Ren et al. 2011)

2.3 Software Usability

The demand of usable software has increased exponentially from past decades as the consumers are demanding while choosing the software and they want that every needs should be fulfilled by it.(Muqtadiroh et al. 2017). The evolution of software has made the consumer unadaptable, and they want their minor issue to be fixed through the software without hampering their day-to-day life. This also becomes the challenge for the software company to develop and upgrade their software based on the user demand. Usability is the term in which the user wants to use the software with ease and without any sorts of hindrance.(Dubey, Gulati, and Rana 2012) In another word, it can also be

explained as easy procedure in which consumer can learn to execute the system as per their requirement and get the result as desired.

There are different factors that are considered when the software is recognized as the usable software. The factors below are considered as the important factors for determining the usability of any kind of software.
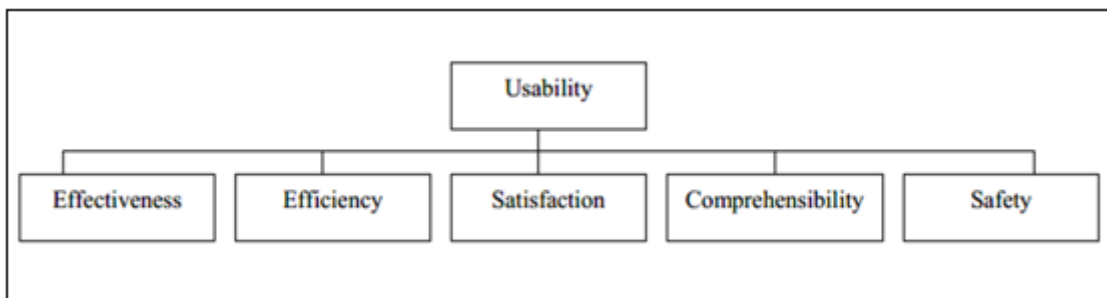
Fig 3: Characteristics for software usability

- Effectiveness

It is the characteristics of the software which makes the task accomplished for its user based on the requirement without any sorts of mistakes or with marginal error. This helps to achieve the goal without hindering the content or any error. One of the major characteristics of the software should be that it can perform the task in a correct way and provide the complete result with all necessary requirements for user satisfaction. The output of the software should be user friendly that the user understands it without any issue so that the decision making becomes easier for them as well. Below is the chart which illustrates the factors which makes the software effective and user friendly and these factors are interconnected with each other.
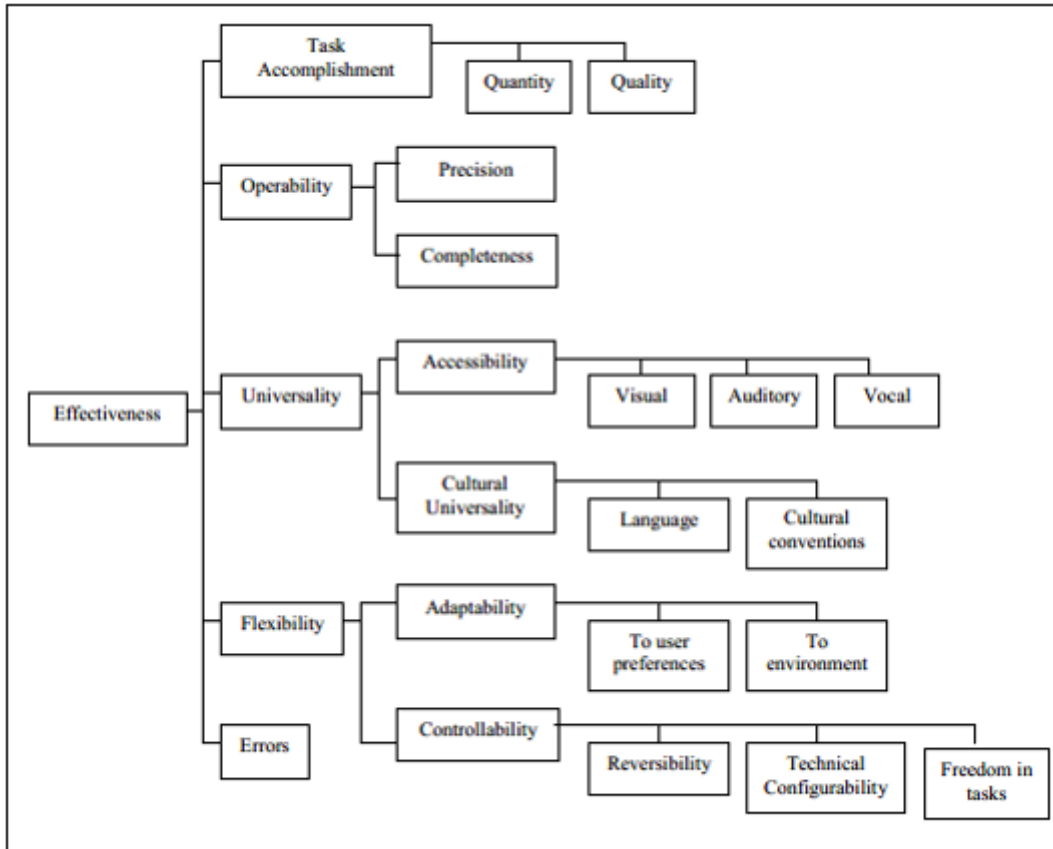
Fig 4: Software Effectiveness

- Efficiency

This factor of software makes sure that the outcome delivered by the software is accurate and no mistakes are displayed with the effort made by the user by investing its time and money. The efficiency of any software is determined by several factors such as effort from its user, cost, time consumption by the tool etc. When these several factors are checked and compared which gives the outcome that the investing certain resource, time, and cost if the results are appropriate and correct then the software are recognized as the efficient software. To make or tag a particular software as the efficient one, multiple factors need to be analyzed and made sure that there is proper balance between all these factors such as high cost and time-consuming software cannot be considered as the efficient one.
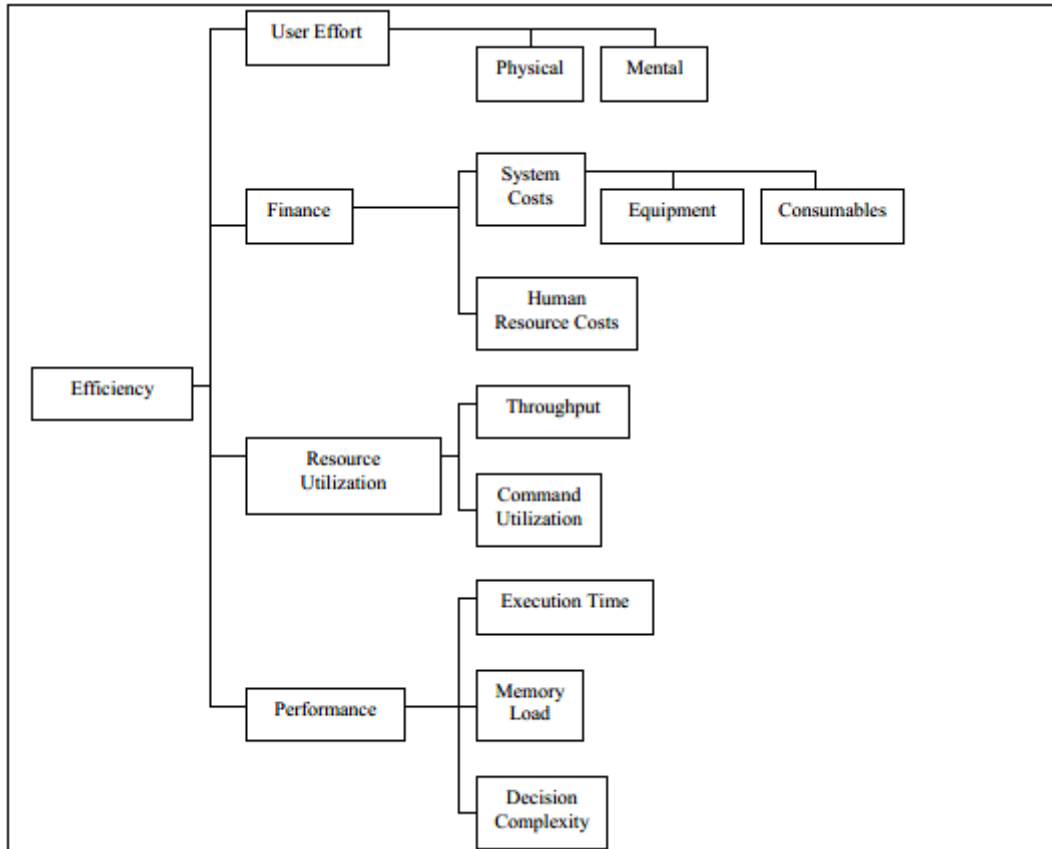
Fig 5: Software Efficiency

- Satisfaction

This is the degree of user adoption with the software where the user feels more comfortable, without any complain, trustworthy with the outcome and thus refer such software as the user satisfaction. This factor might be the challenging among all other factors to consider as this is purely from user point of view thus the more user friendly the software is developed the more satisfied as its users. The factors which make any software as user satisfied are that it should be likeable which means the user must like it and it is followed by other characteristics such as comfortable, attractive enough, trustful with its results and outcome so that decision maker uses it without any hesitation.
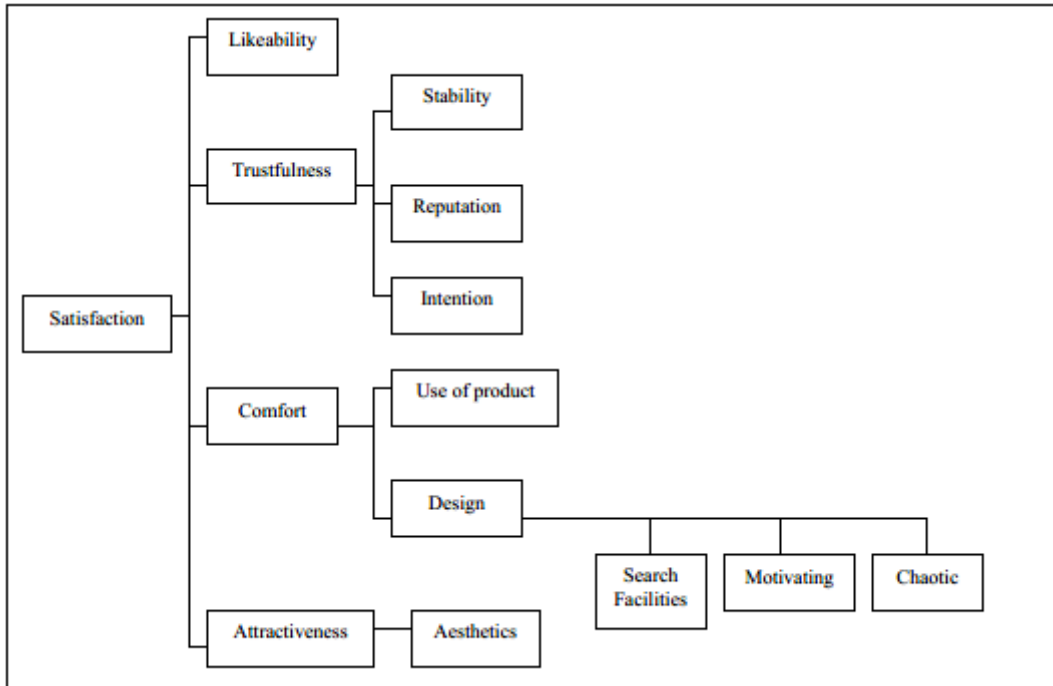
Fig 6: Software Satisfaction

- Comprehensibility

The software is recognized as the comprehensive enough when it has the clarity, easier operability and support when required. Is using any software takes long time to learn and use it and if its system is not user friendly and really a complex one, then it cannot be called as the comprehensive one. The software should be easy to learn and quick enough to give the outcome with least manual intervention as the user might find the software annoying if it takes long time to learn and handling of it is complex with lots of manual intervention to finally give outcome and these types of software cannot be claimed as the comprehensive one. Any user purchase or invest in any kind software so that they can enjoy its use and trust on its result with less time consumption and less time to learn it but instead if it goes other way, then the software might not find the market and fail to achieve its goal of success.
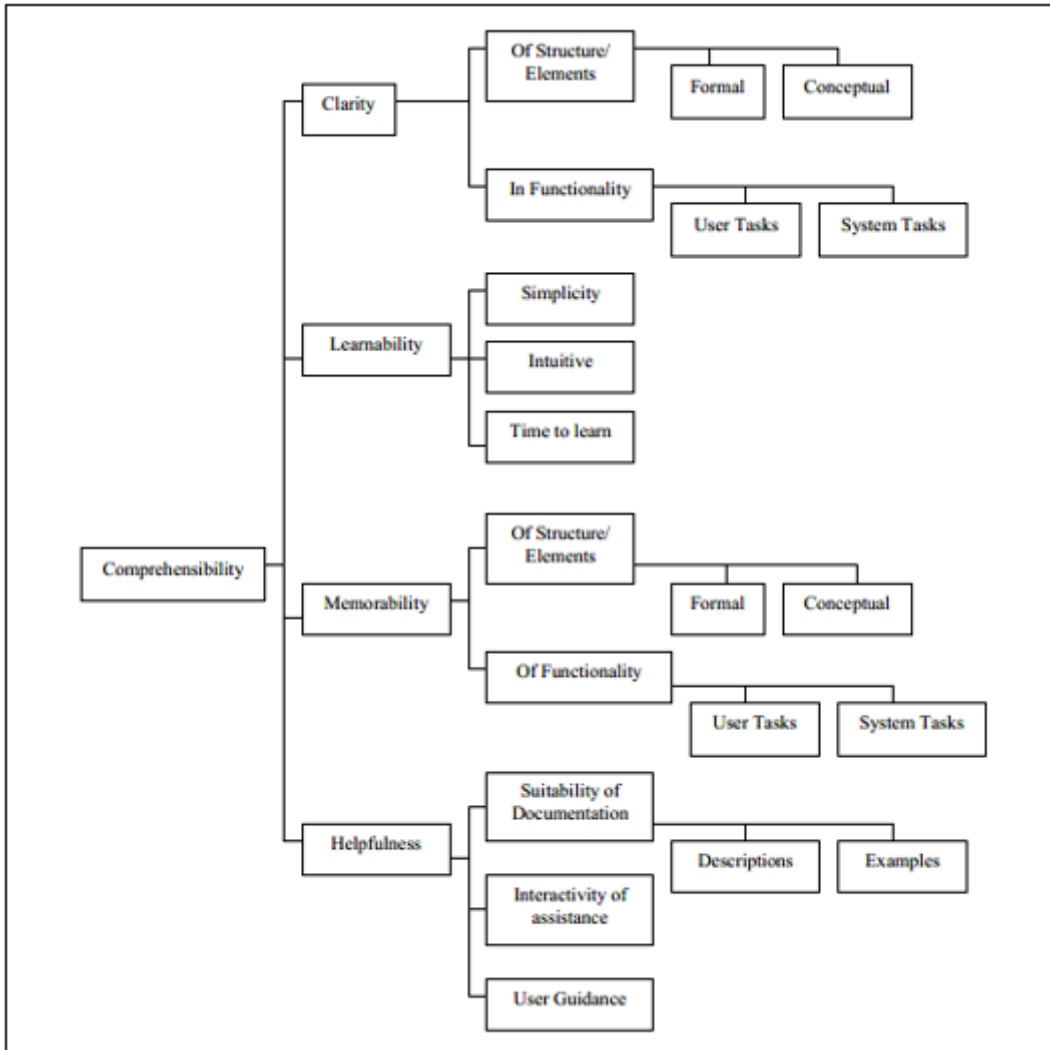
Fig 7: Software comprehensibility

- Safety

The software can be recognized as the safe if the risk or damage or loss of any data is avoided. There might be the risk that software used by any company is hacked by other and its data are in other hand, and this may create huge loss of the company/user, so it is very important for the software company to minimize these risks and make sure that even the system is in danger of misuse by other unauthorized user, its data are not shared, corrupted or damaged. (Hawedi, Talhi, and Boucheneb 2018) Safety does not only include the safety of its own data but also the safety of the environment which means that software is not hazardous to the environment, but it is environment friendly.
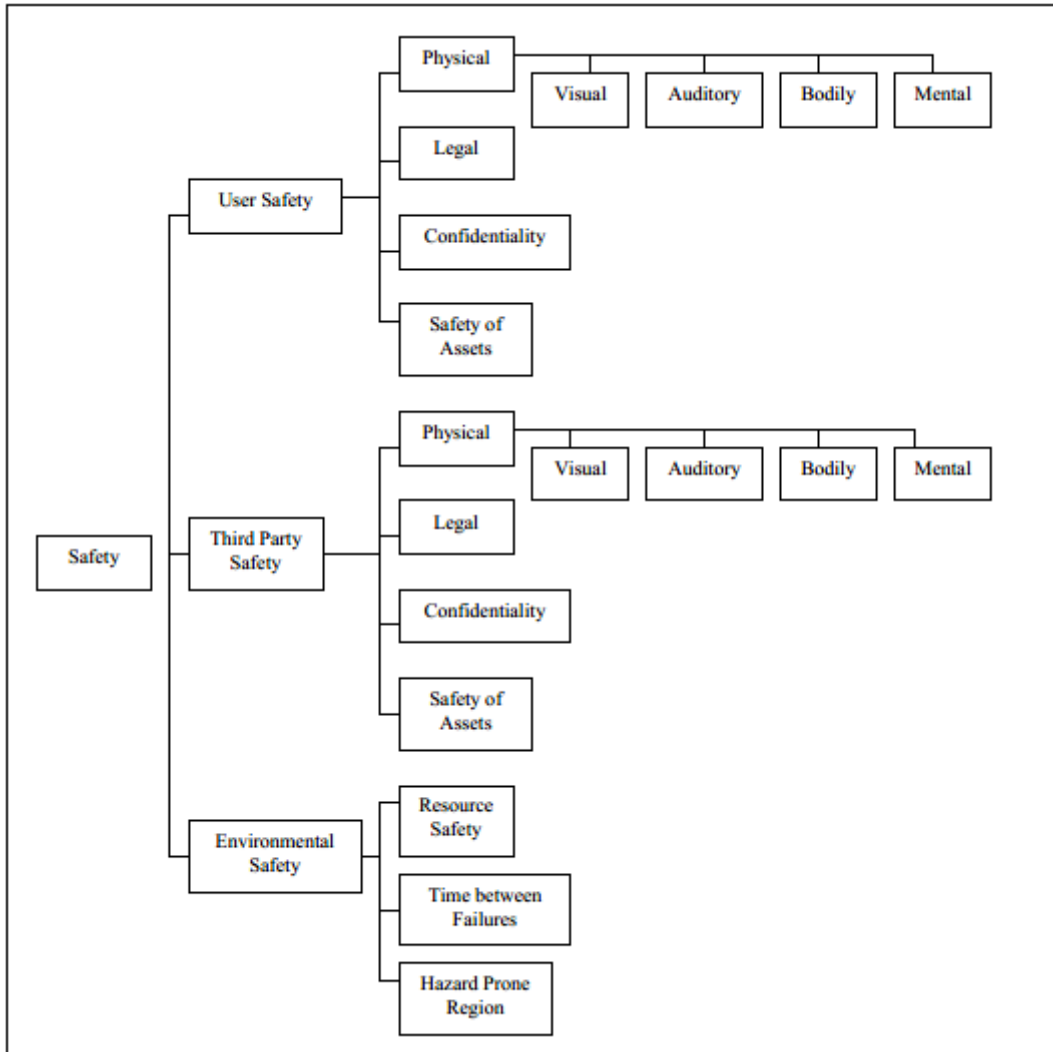
Fig 8: Software Safety

3 Economic prospective for software evaluation

Mainly cost of the software are additive which means that the number of additional functions in the software makes any software expensive or cheap. However, there are other charges as well such as training, integration etc. which are excluded from its price.(Boehm 2016) It is very important for the company to look for the software in which the price of the software won't be issue for them. On the other hand, finding a cheap software is not the solution but finding the software with low cost and having all the function that the company expects should be ideal for the company (Sommerville, 2013). However, it all depends upon the size of the company and turnover they make in order to select the right software for them.

Due to quality issue of any software, company do not recognize it during early integration phase but once it is integrated then, the bug shows up which is huge trouble for any company. Sometimes, it is very important to check its quality as it is not only delaying the work for the company but also a huge capital loss for the company which starts from software cost, production delay and customer dissatisfaction.(Walkinshaw 2013)

Below chart illustrates the co-relation between software quality, architecture, and process. All these three categories have their own role for the model of information system quality. Software quality aspects and the architecture are interrelated with each other as they relate with the organizational culture and its impacts. Software quality is all about the function, reliability, data security etc. any software existed in the market can only be recognized based on the quality listed below in the charts. Software architecture relates with the model of the software which the company/customers are attracted. It is all about the preference of the customer that they like to see their software presents. It is often the case with may software companies that the customization would be possible, but the question raises is to what extent. Software process mainly dealt with maintenance, bug rectification, proper training, integration of data etc. It is only the win-win situation if this process gets short and implementation starts quickly.

Product Quality

- Functional Suitability
- Performance Efficiency
- Compatibility
- Usability
- Reliability
- Security
- Maintainability
- Portability

Quality in Use

- Effectiveness
- Efficiency
- Satisfaction
- Freedom from risk
- Context coverage

Quality
ISO/IEC 25010:2011

Architecture
ISO/IEC 42010:2011

Objective Characteristics

- Model Kind
- Architecture Model
- Architecture View
- System-of-Interest
- Architecture Rational
- Correspondence
- Correspondence Rules
- Architecture Framework

Subjective Characteristics

- Concern
- Stakeholder
- Architecture Viewpoint
- Architecture Description
- Environment

Process
ISO/IEC 12207:2008

Primary

- Maintenance
- Operations
- Development
- Supply
- Acquisition

Supporting

- Documentation
- Configuration Management
- Quality Assurance
- Verification
- Validation
- Joint Review
- Audit
- Problem Resolution

Organizational

- Management
- Infrastructure
- Improvement
- Training

Fig. 9: SQuAP(Software-Quality-Architecture-Process) Meta-Model.(Russo et al. 2018)

3.1 Cost Evaluation Matric

One of the important perspectives for software evaluation is the cost as company needs to understand this theory of their investment and facilities they get in return. Since purchasing of any new software for the company, it is important to calculate the total investment for the company and receiving financial profit in return for a period of time.(Marvel et al. 2020) If accompany is spending in certain cost, they must understand that how long it takes company to balance this expanse with the profit they make over period of time. It does not mean that the company gain profit by further selling it to customer but using the particular software and helping the organization with production management, financial management and reducing lead time to deliver finished products to their customers. This phenomenon is known as return on investment(ROI).

It is calculated with formula below:

$$ROI = gain_{term} - cost/cost$$

In this, $gain_{term}$ is the profit and cost are the overall cost software including training, integration, maintenance, license fee etc. In some cases, it can also be considered that ROI is fully dependent on investment and profit made after certain investment.

$$ROI = gain_{total} - cost.$$

Any organization do not run with individual thought or plan, but it has certain policy in which they operate which means that for every expense they make proposal how those expenses will be covered in the coming future. Introducing and implementing any new software in the company will obviously make life of every employee easier but it costs also needs to be considered that how long will it take the company to return their investment. Though measuring the return of such investment is difficult but, this would give the clear picture for any company who wants to upgrade their facilities based on their size and capital of the company.(Grudin 2004)

4 ERP System

Enterprise Resource Planning (ERP) system is the integrated system that includes multi-modal software packages which integrates all the departments of any businesses. Including all the related department of the business in a single frame and making a compact toll which enables to process fast as well as reliable operation. (ERP Implementation 2007). This system provides better visibility and transparency with every business and helps to improve the planning and achieve the goal.

This software may include several department queries such as purchasing, planning, decision making, communication, customer service, inventories, tracking, finance, controlling, Human resource, warehouse management etc. When these all aspects of business are balanced and transparent, this leads any company to achieve its goal and lead the market (Almajali, Dmaithan 2016). It Is designed to have better transparency and improve productivity by generating updated and accurate information across the supply chain. The successful implementations of this software will enhance the enterprise with less inventories, improved productivity and profitability, customer satisfaction. (Abugabah 2018)

4.1 Importance of ERP system in company

ERP is an integrated system mainly used for data processing which connects business management with production processes. All the departments are inter linked with each other in this system which enables better visibility of the product and information from its availability to its lead time. In this fast moving world, every customer wants to know about their required products details from the supplier in quick time and with the help of ERP system, enterprise can be that quick enough to provide necessary information about product production, availability etc. as whole supply chain is connected with it.(Maditinos, Chatzoudes, and Tsairidis 2011) ERP system has currently dominated the business world as most of the companies irrespective of their size has implemented ERP

system which enables them with better information flow, higher productivity, less operational cost and higher customer satisfaction.(Lečić and Kupusinac 2013)

4.2 Impact of ERP system on decision making

The integration of ERP with all the elements of business makes it important and collecting data from every element helps the decision makers for their business. ERP system use, distribute and present the current time data which enables to find the present situation of organization from production to finance and due to this data, it helps to predicts the future needs and estimations. It can be helpful to perform re-engineering and reduce the border between the departments within the business and create flexible and less time-consuming monitoring process. (Lutovac & Manojlov, 2012)

The ERP success in not just limited to certain area, structure, field of business but it has impacted in every business across the globe and not just limited to the researchers but for the decision makers as well(Maguire, Ojiako, and Said 2010). It improves business process by modifying the company performance and taking the business to new height in long term. This enables every member of the company to think and improve the performance based on historical data which enforces the long-term improvement and development of the business. (Langer, 2012)

4.3 Effect of ERP implementation on CSFs on business performance

CSFs are key areas of activity that are necessary for every decision maker of the company. There are several factors that are considered to decide the success for failure of ERP implementation. It is necessary to understand the parties involved for ERP implementation to avoid the failure. The effective and successive ERP implementation leads to reduction in the cost, higher productivity, effective communication, and improved customer satisfaction. These factors are necessary for every company to stand in the market

and compete with its competitors. Every business CSFs should be well considered, and efficient and effective implementation of such factors decides the future of the company. Implementing ERP software of the companies is also one of the major CSF in today's businesses as its gives the transparency and clarity between several departments within the company which enable the managers, decision makers to see where they are lagging behind and where they are up to the mark.
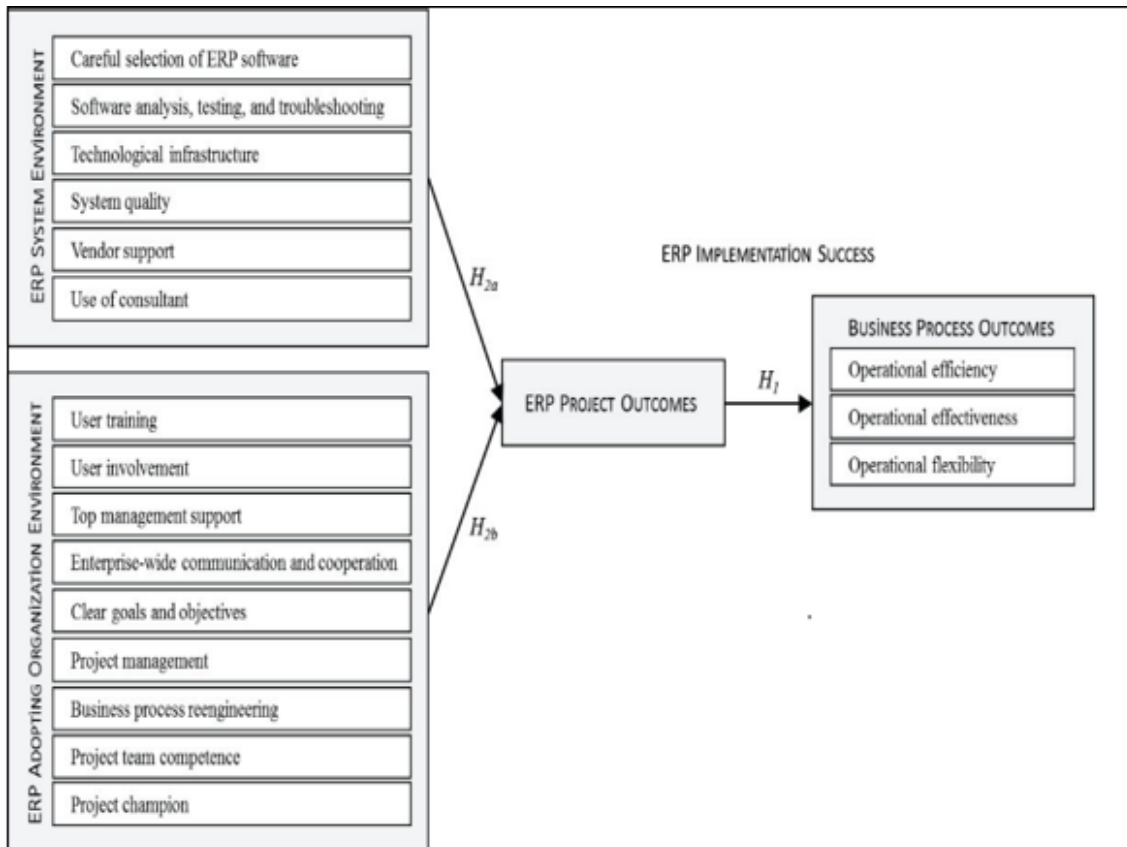
Fig 10: ERP system and adoption environment(Ağaoğlu, Yurtkoru, and Ekmekçi 2015)

The chart above illustrates the adoption of ERP system environment and adoption of organization environment that has positive influence on the outcome of the project. When these two hypothesis features merge, it gives the better outcomes which is beneficial for the company and decides the success of it. Adoption of only one of them might push the project towards failure because vision and objective will not be clear enough.

4.4   Potential ERP software's existing in the market

Out of several software exiting in the market, 5 of the software's are chosen based on characteristics that the case company has requested for. This five software's were selected out of 14 popular and advanced software's which were tasted through several modes such as visiting official web page and its characteristics, opening trial account, and checking its reliability, affordability etc.

These are the ERP software which are selected for further research and provide the concrete benchmarking and suggests the case company the best possible software solution that the company can consider in their operation.

4.4.1   NetSuite ERP

This ERP software is currently well renowned in the market and many big corporations are under this system. It is a license-based software which charge based on number of users every month and the contract for this can be renewed every year or every five years. The price for every user includes maintenance as well as any system update or upgrade but the installation at very first time incurs the additional cost which excludes the monthly charge. This software is quite popular due to its approach to whole supply chain which covers from production to finance department. It is very easy for any company to either add or reduce the number of users based on their necessity. It is very easy to customize the system as per requirement, however extra charge is added once it is customized. (Webpage of select hub)

Migration of the data is possible, and which is pretty much easier to do however, cost is charged for it and regarding time consumption which depends upon the amount of data that are to be migrated. Since this software would be new to the company, training would be required for company's representatives which is possible, and cost of the training would vary upon the type of training chosen as well as some webinars and training

videos also available which is free of cost. (Webpage of NetSuite) The company claims that it is one of the easiest software to use without any complications.

Since there are many advantages of this software, few limitations are noted for it as well. Online help or assistant is quite complex compared to other software's existing in the market. It has certain language complication as well which means that some southeast Asian languages are not supported by it. there are few countries whose accounting rules are not complied with this software so the users must have to purchase the package from other agency/company for it. there are many competitors existing in the market for this software in terms of cost, accuracy, and reliability.

4.4.2 Syspro ERP

Every software existing in the market tends to reduce the cost and increase productivity as well as efficiency but only few successes to offer these to their customer and make an impact in the business and Syspro is considered as one of them. This software provides wide range of customization as per requirement and designed to simplify the complexity and provide simple and concrete data solution to the manufacturers as well as distributers. It has latest features that are developed and updates as per the requirement which provides greater control in the supply chain and better transparency in the business. This helps to provide better accuracy to the business with less manual intervention and in affordable price and save extra time and effort. (Webpage of Syspro)

This software provides solution as per the need which means that the use and updates can be generated when required and this helps the company to pay for only those updates that they require. This enables one to perform their work from any device and through any platform by just browsing it through its webpage. This can be customized as per need even individually without any external effort that gives chance to every workforce to manage their space accordingly. The developed artificial intelligence and ma-

chine learning directly enabled in the system which enables the personnel to take immediate action for the improvement. The company is 40 years developing experience in the software field and currently one of the most reliable software in the market.

There are different things that are considered before implementing this software in any company which includes cost, data migration, training, customization etc. This software has trail available for the new user to verify if software is reliable enough for their company. It requires minimum of 1-year commitment from the user to use it once it has installed and adopted. (Webpage of select hub)

4.4.3   Infor Syteline ERP

Infor Syteline ERP is cloud based as well as on-premises ERP software which is ideal for small as well as medium sized companies. The software company guarantees the security of data which are secured through Amazon Web Services. (Webpage of Infor) This software is also a license-based software in which cost determined by the number of user and license. Like other multiple software existed in the market, its price also dependent on the functionality that a company require for their operation which means that the increment in the number of functions leads to the increment in the price. (Micheni 2019)

Other additional cost such as maintenance, integration, training etc. will be added to the normal license cost. The software has a systematic assistant tool that helps the user to solve their issues. Cloud based data storage is also possible in this software. Cost of the maintenance, training, integration depends upon the party providing such services such as Infor, in-house or any third party. Customization is possible in this software and is very easy to do so however, additional charges are included based on the application and function added. Data migration from older tool to new is also possible which can be either cloud based or not.

Training facility is also possible for this software which can be either virtual class or proper classroom session. Software renewal is possible however, renewal cost is different for cloud based and on-premises and on-premises renewal charges extra that normal subscription, but cloud-based renewal is already included in subscription cost. It has also certain limitation such as the software does not include the function of HRM (Human Resource management) and CRM (Customer Relationship Management). It is quite usual for the software that its user must wait for 3-6 months for upgrading new version which is worst parts for it, and it is also the reason for customer dissatisfaction. The software also lacks the function of well managed warehouse module.

4.4.4 Epicor

This software is considered as the modern-day software solution which integrate with other software's existed in the company to provide better data accuracy and increased productivity. (Web page of Epicor) The software offers business-to-business as well as business-to-customer solution that helps to creates customer relationship management. The software provides the work in progress and real time with quality data which enables the decision makers to make decision which is profitable for the company. It is also a license-based software in which license cannot be shared with another user. Cost of maintenance and training is not included in the license fee and are charged separately however, on premise maintenance cost is comparatively higher that cloud-based maintenance.

Additional cost of installation and implementation is added above the subscription cost which varies as per number of users, scope, and its complexity however, it can be done through third party as well. The company has some partner which implement the services and are authorized such as clear business outcome and detox. Customization of different application is also possible in this software which depends upon the size of the company. If the company is large, customization cost is higher to implement. There are multiple platforms for training which includes on-site and virtual session, conferences,

eLearning materials etc. License renewal is easy in this tool which is 10-15% of the software cost. Renewal for on premise is additional cost than normal subscription costs whereas cloud-based renewal cost is included in the subscription fee.

This software has certain limitation that it does not have effective BI tools. Comprehensive finance module is missing from it which is not good for any company. The software also does not support the backlogs automatically meaning the company won't be able to recognize if the system is functioning in systematic way or not. The other important aspect of this software is that many users have complained about the complexity of it which means that the tool is not easier to handle and requires certain level of expertise.

4.4.5   SAP Business One

It is a single integrated software which has over millions of installations worldwide and widely accepted and acknowledged in order to provide transparency and in their business and helps to achieve the goal. Over 80% of its customers are small and medium size company.(Rolia et al. 2012) This software is ideal for the companies whose manpower is between 5-75. It integrates all the departs of a company such as sales, inventory, supply chain, CRM, Production, Financial, purchasing etc. and provides the best possible support for the business. Cost of the software is based on the number of subscription/licenses. All types of maintenance services are provided by the company which includes 24/7 support, upgrades, recovery etc., which are included in the monthly cost as per subscription.

Services of installation and implementation are provided by the company either directly through them or their authorized partners however, the costs are additional and not included in the subscription fee. Customization is also possible in most of the applications such as project management, supply chain, finance, human resource but the cost varies from one module to other. Basic integration such as MS office and excel are al-

ready included in the monthly fee. Data migration, trainings are provided by the company in which data migration cost is charged separately but the training cost is free of charge which is done through online. The existing customers are satisfied with the training and claims that the software is easy to operate and learn.

The software has issue with data migration as the earlier user has claimed that accuracy of data migration is not 100%. One special feature is missing in this application, which is drag and drop feature for the attachments, so the user has to attach the attachments manually. Updates are quite frequent in this software which might be annoying for some user. Training might need some special expertise to understand, and implementation time might take some time and comparatively lengthy than others existed. The software also might be bit expensive comparatively.

4.5   Benchmarking

Benchmarking is the process of evaluation in which different product/service are compared with many others based on different category of comparison.(Sammut-bonnici 2017) Benchmarking can be done with different service/products of a single firm or a product/services produced by different organization that are carried out in a similar category.(Freytag and Hollensen 2001) Sometimes even inside a company, managers want to know their best department or any other service/product, so in this case they benchmark it and find out so that they can follow which is their best/worst product or service(Emmanuel and Inikpi 2014). This benchmarking is not always done for comparing quality but also the cost, flexibility, acceptance, reliability and so on and it is also the way to measure the strategy and performance.

There are different types of benchmarking existed in the market depending upon the product/service that a company wants to benchmark.

4.5.1 Internal benchmarking

This benchmarking process is the common form of benchmarking in which many companies measure different internal procedure to identify the best among the categories. Sometimes company execute similar procedure for their operation for long time and do not recognize that the existing might not be efficient enough and can be replaced. In this situation, internal benchmarking plays vital role for measuring and selecting the best out of many operations based on time efficiency, accuracy, acceptance etc.(Amaral and Sousa 2009)

It is very important for any company to recognize and measure the operation time to time so that they do not fall behind in the market. There are many benefits of internal benchmarking of the company that company can easily adopt the best procedure once they are done with the process by passing similar procedure to other departments of the organization.

4.5.2 Industry(functional) benchmarking

It is the measuring process of the operation of the company with different companies in the market with similar group. For instance, different technology companies try to benchmark their processing of application and its features with other companies and try to find the best and well acceptance one so that they can present something similar or even better feature to their customers(Customer 2010). This kind of benchmarking is either privately or publicly to measure the better operation/feature/process of different company within similar industry.

Since there is not the competition involved directly in such activities, many companies do not want to exercise this sort of benchmarking due to the fact that this is time con-

suming and not surely the beneficial.(Freytag and Hollensen 2001) These sorts of benchmarking process are existed in the market because though it is not directly beneficial for the company, but customer/end user find it quite beneficial while choosing their products/services.

4.5.3 Process(generic) benchmarking

This process of benchmarking is measuring of procedure of the company irrespective of the industry. Though this is really very difficult to execute, but it is really useful for any type of company as it helps to improve its own process and also to adopt new procedure of operation. (Fridley, Jorgensen, and Lamancusa 1997)Though this process of benchmarking is tough to perform, many companies work on it and spend its resources to execute it to gather the best possible solution and implement in their company. It is equally beneficial for existed companies as well as the startups.

There are many companies which try to switch some operation for instance, logistics process and so they start to benchmark there with many other companies but not necessarily of similar industries. This benchmarking process might include the time efficiency, quality of products while receiving it, cost of the logistics etc. This process requires the broad understanding of the whole procedure of measuring as the benchmarking is not necessarily done within similar industry so it important to gather more information and dig deep into the data and analyses it so that if the company plans to adopt such procedure, they make sure that they have full information to execute such in their company as well.

4.5.4 Competitive benchmarking

It is conducted with the company's competitors of similar industry, and these are performed to directly compare the services or products. This kind of benchmarking is not

easy to perform because it is not always easy to gather the data from different companies which related to their products/services. It always depends upon the company that what kind of information they want to share and what kind of information to be put confidential. Many tech companies try to advertise their product stating that the feature or certain quality that their product or service includes are completely unique.(Fridley et al. 1997)

Competitive benchmarking is the common procedure of benchmarking and many companies practice this process more often when they plan to purchase or replace their products or services. These kinds of benchmarking are equally important and beneficial for the company as well as the customer/end user because it compares all the aspects of any particular products or services that are existed in the market. In this thesis, researcher has used the competitive benchmarking approach to compare all the suggested potential ERP software.

5   Inventory management system

Inventory is simply a term that describes of the goods and material that are kept as stored for the purpose to sale. It can be raw materials, processed products which are stored with the intention to sale based on need of the company and market. (Shenoy etal. 2018). Inventory is also an asset for the business which can be turn into cash when required. Inventory is very important for the company as help the company to operate systematically with the raw materials which are needed for production even though the ordered materials do net get delivered in time. It is also an extra cost that is tied up and holds certain capital for the company. But this certainly makes the company stronger in the market and among their competitors.

Inventory management is also linked with material requirement planning which helps to constantly reduce the inventory cost and provide better visibility in the whole supply chain. (Caplice 2006). There are different kinds of inventory that company keeps for their future need which can be either raw or finished materials that they sale or the machinery spare parts that they use for the maintenance of the machines. Inventory is equally important for the company to make the decision either to order raw materials or selling their ready products to their customers. Inventory is equally important for any company for competing in the market. (Priniotakis and Argyropoulos 2018)During the crisis period in which the raw materials are not available for short period, at that time such inventory of raw materials becomes saver for the company and their customers.

5.1   Inventory management

Inventory management helps to determine and balance the whole supply chain and pro vide the clear and transparent financial status of the company. But it is also the responsibility of every company to maintain optimum inventory so that inventory cost is not high and company capital is tied up on it. (Shenoy et al. 2018)

It requires very care full analysis to keep inventory constant and low cost. There are various costs that incurred while managing inventory which includes costs for space, labor cost, packing and shipping, damage cost and other uncertainty such as thefts etc. (Muller Max. 2002)

There are different categories of products which are kept in inventory which are listed below:

- Raw materials

Materials which are used to manufacture final products which are sent to the market/customer. These materials are directly kept in the inventory purchased from the supplier after inspecting that the order quantity and quality of the material is as per the quotation.

- Work in Process

These items are considered WIP in which raw materials are not converted to finished products due to delays, queuing and bottleneck and are stored. These materials are partially finished products which are kept on hold and also asset of the company but cannot be sold immediately.

- Finished products

The products which are ready to ship to their customer but are also kept in inventory just in case of market uncertainty for tis demand. This is quite for many companies in which they store their finished products during their off season and sell it when their product's demand is higher.

- Spare parts and consumables

There are many spare parts which the company store in order to use them for the maintenance of their machinery. These spare parts can be either small parts or big. These materials also hold some costs for the company.

5.2 Importance of inventory management

In every company inventory is considered as one of the important parts of it. It helps the business to fight against the uncertainty as well as keep the balance between planning and demand.(Oluwaseyi, Onifade, and Odeyinka 2017) There are multiple benefits of inventory for any business in which few are listed below:

- Demand Fluctuation

With the help of inventory, any company can reduce these fluctuation issue which means that when company faces low demand of their products and at that time, they can simply store their finished products and sell when their demand is higher in the market.

- Predictability

It is often difficult to predict the quantity of raw materials required to continue products for certain time period. In this case, inventory plays a huge role to assure that the quantity of raw materials gets enough for their production.

- Unreliable supply of material

Sometimes it becomes the issue for the company that the material which they order do not get delivered in time and because of this whole production chain is blocked and so inventory helps to store some extra materials which can be used during such adverse situation.

- Price inconsistency

Due to higher demand of the raw materials, sometime supplier raises the price for raw materials which leads to cost extra money for the company. Inventory helps the company to store the materials when it is cheap and use during such monopoly states.

- Bulk discount

It is pretty much easier strategy for every company that if the materials are purchased in bulk, they the supplier offer it in discounted price. if any company can store their raw materials in huge quantity, then they receive such discount which is of course a good saving for the company.(Du.Donglei 2000)

Inventory management helps to minimize the risk of failing and provide the solution to the company with less costs when managed perfectly and precisely. It leads to maximize the customer service by providing customer satisfaction, improve the efficiency of production with any disruption due to raw materials shortage, reducing inventory cost and improving profitability. (Vaile J. David 1996)

6 Conclusion of the theories of the study

The theoretical part of the thesis includes the factors that are needed to be considered for every company to make decision to select ERP tool for them which would cover their whole supply chain and add value to their company. The first thing that comes to the mind while making such decision is the quality of the tool. Quality of any tool is decided when it perform the tasks with less manual intervention and provide the reliable result. (Bouwers and Vis 2009). The functionality and usability of the software are important to figure out so that the companies know if the tool which they are planning to purchase fulfill their need or not. Functionality and usability refer to the actions that the tools perform during its operation. If the tool is time consuming, difficult to use and extracted data are not easy to understand then such tool is not good enough to use. Budget of the tool is equally important while selecting the ERP tool as the tools are not cheap, so company needs to understand the importance of the tool and purchase based on their need.

ERP tools are considered most reliable and transparent tools which enables the company to know status of every department within the company. Any company comprise of several department and effective collaboration within the departs only leads the company to achieve its goal and compete in the market (Amado and Belfo 2021). ERP tools helps the company to link the information of several departments such as production, finance, human resource etc. and handover to decision makers of the company (Alaskari, Pinedo-Cuenca, and Ahmad 2021). This also eliminates the use of several less productive tools that company uses and spends without much of its contribution. There are several ERP tools existed in the market. Based on the company need, researcher has selected five potential ERP tools which are widely recognized and accepted in the business world.

Benchmarking of suggested potential ERP tools are carried out based on the features, advantages, disadvantages, customization possibility, maintenance, technical support, down time, adaptability, cost etc. All the suggested tools are easier to use and there are limited cons to those tools as well. Benchmarking is performed to compare different

products/services which carry out similar function and are used for similar kind of activity. Thus, benchmarking of tool is important so that best tool is selected out of many similar tools which is explained in this chapter.

The last theoretical chapter includes the inventory management system and its importance to every companies. Any company cannot achieve its goal until there inventory is well managed and transparent. The managers and decision makers should be well aware about the status of their inventory which could be either raw materials, finished products, machinery equipment etc. (Nemtajela and Mbohwa 2017). It is important part of SMEs which not only provide overall status of the inventory but also make the companies compete in the market (Muchaendepi et al. 2019).

The theoretical analysis done under several listed topics helped the researcher to achieve the goal of the thesis. These topics were important to highlight and describe so that the concept related to the research questions are clear and objectives are achieved. It is important to make the reader understand about the concept of the terms and all the terms are explained and its necessity for the company are elaborated as well. Selection of any software by a company is not easy because if wrong software is selected then, the company lose time, effort, cost invested in that tool thus it important to know what kind of tool they are planning to purchase, how that tool can help to solve their problems, compare the different similar tool, if company can afford it for long term or not.

7 Methodology

This research will be operated in two parts which includes theoretical as well as empirical. The theoretical framework includes literature review in which the probable sources would be Books, Literature, Journals, published articles etc. The empirical part includes qualitative methods with focused semi-structures interviews with key personnel from case company as well as some decision makers from other company which has been using the ERP software tools.

The qualitative method is the term that explains the behavior, experience, activities, and its context (Pathak, Jena, & Kalra 2013). This method includes several designs such as explanatory, exploratory, descriptive, multiple case study etc. (Baxter & Jack 2008). This approach is considered as the important component of any research which provide the evidence and integrate those evidence for the favorable outcome (Hamilton and Finley 2020). The data collection done through interviews are widely practiced (Robinson 2014). Data collection through interview is done by asking the questions with the interviews and getting response from them which are noted during the interview and analyzed for the results.

There will also become open ended questions with some of the members of the case company. This open-ended question includes the current situation of the tool that are being used as well as the problem that are being faced by them while using the current open-source tool. The data gathered from interviews and questionnaire will be analyzed as per the research methodology explained in the research process. The reason of choosing this qualitative approach is that the company is expecting to choose the best ERP software which will be suitable for them and doing research for primary as well as secondary data will only help to achieve the goal of the thesis.

7.1   Description of research process

Once the topic of the thesis was finalized, thesis was officially started on 15th May 2019. Researcher had an opportunity to visit the case company and have a half daylong meeting with the CEO and introduction with other employees of the company. The meeting with the CEO was not just limited to the software requirement for the company but the criteria that the potential software must fulfill to be chosen was discussed. Different ideas and procedures were discussed during meeting for the research process.

The case company is looking to upgrade their inventory management system as currently they are using open-source inventory management system which do not provide correct, reliable, and latest data/information. This makes the decision makers difficult to know the status of their inventory and whole supply chain is puzzled with it. Company is unaware of their raw material availability, production ratio and ready products status. This forbid them to decide the quality of raw material as they are not aware of quantity of correct products produced from previous lot of raw material and damaged quantity. The lack transparency in the inventory puts the decision makers in lot of trouble.

7.2   Initial stages

The researcher was not familiar with the type of industry that the case company belongs to as well as the topic of the thesis. Once the thesis was finalized, researcher was more focused on the current situation of the case company. The researcher had opportunity to use the case company's current software and see the complications that are faced by its user and most of data required manual interventions and also lacking the transparency. It was also big challenge for the researcher to choose the 5 potential ERP software as every software existed the market present themselves as the best for any type of company. The first thing that the researcher worked on was study of secondary data i.e., mainly the literature which were relevant to the research and context of the thesis. As

per the request from the case company, researcher was also focused on features of the existing of potential software's in the market. Since the case company is medium sized company, it was very important to take it into consideration while choosing the potential software.

7.3   Empirical data collection

When the relevant theories were researched and gained as per the planning, then empirical part was planned. The empirical part included interview with manager of two company which are using different software that are among that 5 software on which research was done and questionnaire in which a list of questions was sent to the employees of the case company to know the current status of the software used by the company and the expectation from the new software which will be implemented in the future.

The interview was done first with the supply chain manager of the Areva NP which is the main contractor of building the Olkiluoto Nuclear Power plant 3. Currently, the Areva NP has been using the SAP business one software. This interview was also possible as the researcher has been working in this project from past one year. Second interview was done branch manager of Dabur India which are using Syspro ERP tool, and the company is situated in the capital city of India.

Both the interview was held online through Skype and first interview was done for 1 hour and 25 minutes on 9th November 2020 and second interview was done for 1 hour on 26th November 2020. First interview was held in English language and second interview was held in both English and Hindi language as researcher and interviewee speak in Hindi language so for better understanding of the context.

The interview was semi structured and mainly focused on three topics which were overall efficiency of the ERP software used, advantages and disadvantages of the software.

The detail of the interview was sent to the interviewee through email. The interviewee from India demonstrated the use of software through skype sharing the screen with researcher. It was request from the researcher to see the demonstration of the software due to the fact that the free trail for this particular software is not available. Since the researcher has been working as a cost controller in Areva NP, interview with the Supply chain manager was easy and due to current COVID-19 crisis interview was held through skype though interviewee and researcher have been working in same project.

Regarding the questionnaire, it was sent to the all the employees including the decision makers of the case company. Questionnaire was mainly the open-ended question based on the current situation the software that is being used by the case company and the common issue that their employees are facing due to it. In the questionnaire, one question was mentioned as additional comment in case anyone would like to write more detail or any specific topic which they think should be included or considered for the case company. overall, the questionnaire includes the issue that are being faced by the employees as well as the decision makers. Most of the questions are mainly considered for the employees so that factual feedback/results are obtained.

7.4   Analysis of data collected from interview/questionnaire

Both the interviews were carried out smoothly though there were some technical issues for few minutes with the interviewee from India. When the technical issues were solved, general ideas and thought were shared. The researcher has already known the interviewer from past few years. The good thing about the first interview was that the supply chain manager from Areva has more than 20 years of experience in the related field and he has worked earlier worked in KSB SAS company in France for 8 years where the company have used NetSuite ERP. He has joined the Areva project in the year 2016. The researcher was fortunate that the first interviewee shared his thought and experience related to the NetSuite software as well and short session of comparing the user experience between NetSuite and SAP was done as well.

Second interview was carried with the branch manager of the Dabur India who has been working in the company for 8 years. The company has been using the same software from past 5 years and before it they had their own local software. Usually, the medium sized Asian company do not spend much on the R&D and so do not used expensive ERP tools and mostly dependent on the local software. The researcher is bi-lingual, so the second interview was carried out in both English and Hindi and the first one in only English language. While noting down the bullet points from second interview, Conversation shifted to English language as it was quite tough to understand in Hindi and write in English due to different culturally specific expression.

The objective of the analysis of the interview was to find out the concrete evaluation of the software that are being used by both of the interviewee's company and their effectiveness. These analyses will be then used when writing the results and suggestion for the case company.

Software's Efficiency	Merits	Demerits
• Communication • Time to time review • Assistant support • Training • Improvement • Time effective • Process • Maintenance	• Time effective • Transparent • Customization • Smart tool • Upgrades • Strong security • Inventory status	• Requires expertise • Long training • Expensive • Complicated initially

Fig. 11: Interview questions overview

Regarding the questionnaire, altogether 9 members were able to reply to it and the analysis was done based on it. The main objectives of the questionnaire were to know the status of current software related to the employee satisfaction and possible issue behind it. The survey results are analyzed based on the answer provided by all 9 participants. Online tool has been used to carry out this questionnaire process which was easier and less time consuming. This process was quick and done through tool called "Jot form". The questionnaire was conducted in English language even though many employees were native Finnish, the research was carried out in English and also researcher was not to understand the Finnish language to professional level. The recipients of questionnaire were bilingual, so they were able to understand English thus, they were able to answer the questionnaire accordingly. The questionnaire was also sent to CEO and CFO of the company considering that it is also important to understand if the issue faced by the employees are known to their decision makers or not as well as to know the hidden issues if any through additional comment. Online questionnaire was carried out smoothly in second week of February 2021 and result were received within a week.

8 Case description

The case company is European based company situated in Vaajakoski, Jyvaskyla and specialized in printing material manufacturer which are glue free and easy to use materials. It was established on 23rd February 2007. The company has 12 employees with the probability to increase the employee in the coming year. The company is well established and successfully maintained in the European market. The company has strong market policy and planning for extending their market other than Europe as well. There are very limited competitors of the case company in Europe. The company target market is European countries. Since the demand of the product is very high, company wanted to increase its production and widen its market to other continents as well.

Currently most of the companies invest a lot in promotion and advertisement to attract their customers and those advertisement banners, posters are manufactured with products made by the case company. The main issue with the advertisement banners and posters is that they cannot easily detached from the walls and doors but the products from the case company are glue free and can be easily attached and detached without leaving any marks on the walls and doors.

There are mainly two types of products of case company namely which are Stafix static and Stafix grip. Stafix static is an adhesive label material that can be attached on all the surfaces and can be easily removed from it without leaving any marks on the surface. These adhesive materials last for almost 3 months. Stafix grip is a silicon-based adhesive which can be easily attached to any surface and can be removed without leaving any marks. These types of materials can last up-to 12 months.

The case company is currently using the open-source data management system for their inventory records. This system requires maximum human intervention and manual inputs which increases the risk of giving wrong data and ultimately it affects the decision makers while taking certain decisions. The case company is currently planning to replace

their current open-source inventory software with most reliable and cost-effective ERP software.

In current business world, every decision and operation have to be fast otherwise competitors will not let them to survive. Customers are getting many options to choose based on their preference so every business must take it into consideration that they have to be the best and readily available to their customer as well as take care of their satisfaction. No one can claim that they are market leader and have loyal customer due to the fact that now the customers have variety of option to choose so they do not want to compromise on any of their demand. In such competitive market, the company should be ready and assured with their products' quality, and availability. The manager or decision maker must know their inventory clearly so that they can inform their customers accordingly. This confirmation is generated by different software's available in the market as company cannot trust the traditional way of inventory management anymore.

9 Results of the study

In this chapter, results obtained through benchmarking of the potential ERP tools and through interviews and questionnaire are analyzed.

9.1 Results from the benchmarking of ERP tools

Altogether five potential ERP software's were benchmarked which are suitable for SMEs and widely recognized. All the five ERP tools are mostly used in Europe and North America. The latest technology, time efficient, security, reliable data and lowest down time makes these tools popular and highly recognized in current business world. All the tools mentioned below are licensed based which means that purchasing of tool is done based on the number of user of the tool in the company. Minimum commitment of the tools is one year, company cannot purchase it less than that and trail version is only available for Sap business one however, minimum features are available in the trail version.

Description	NetSuite ERP	Syspro ERP	Infor Syteline	Epicor	SAP Business
License/Subscription	*Licensing model: per-user/month*	*Subscript based user/month*	*Licensing model: per-user/month*	*Licensing/subscription model: per-user/month*	*Licensing/subscription model: per-user/month*
Maintenance	*24x7 online free maintenance/support*	*Support assistance available*	*Support assistance available*	*24x7 online free maintenance/support*	*24x7 online free maintenance/support*

Installation	*Provided through part-ner/re-seller channel*	*Provided through part-ner/reseller channel*	*Provided through third party/author-ized partner*	*Provided through third party/au-thorized partner*	*Provided through Authorized 50+ partners*
Customization	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Training	*Available*	*Available*	*Available*	*Available*	*Available*
Renewal	*Possible*	*Possible*	*Possible*	*Possible*	*Possible*
Pricing	*$999/month for base access $99/user/month*	*$14400/5 user 16800/10 user 25000/25 user/year*	*$42000/10 user/year*	*License: $4000-$500000. License cost for 10 users: $40000/year*	*$199/user/months. *Minimum 10 users*
Deployment	*Cloud based/SaaS*	*On premise/cloud-based*	*On premise/cloud-based*	*On premise/cloud-based*	*Cloud based/SaaS*
Pricing Model	*Subscrip-tion-based licensing*	*Subscription based*	*Subscrip-tion/License-based*	*Subscrip-tion/Li-cense-based*	*Subscrip-tion/License-based*
Minimum Commitment	*1 year*	*1 year*	*1 year*	*1 year*	*1 year*
Free Trail	*Not avail-able*	*Not available*	*Not available*	*Not availa-ble*	*Available*
User Satisfaction	*V. Good*	*Good*	*Satisfactory*	*Good*	*V. Good*

Rating	4.5/5	4/5	3.5/5	4/5	4.5/5

Fig. 12: Benchmarking of potential ERP software

Training, customization and renewal of the subscription is possible based on the request from the client company however, these services are subject to additional cost. All the above mentioned ERP tools have received good review from its existing customers but NetSuite and SAP business one have better review compared to other three tools. Installation, maintenance and technical support are provided by all the above mentioned tools through authorized partners who either visit the premises of the customer or assist virtually. Overall, all the above mentioned tools are widely recognized and used my multi companies all around the world. There are few features in which one is slightly better than others but all the tools are equally competitive and successful in the market.

9.2   Results from the interviews and questionnaire

Since the primary data was collected through two ways i.e., through interviews and questionnaire, interview was carried out first with supply chain manager of Areva NP and then with the Branch manager of Dabur India, Delhi branch. Both the interviewees were the decision makers of their departments and well experienced in using such ERP tools.

The first interview was mainly focused on the factors such as software use, its transparency related to the data/information, accessibility of the tool, merit/demerit, possibility of customization and so on. Areva NP has been using the ERP tool since 2010 and they have been using it since then as they are satisfied with it. the tool is easy to operate and easy to learn as well. The newcomers who have not used such ERP tools before finding it bit complex while using it for the first time but the training from the SAP support is very effective that few hours of coaching make the newcomers more confident with the

tool. The tool gets upgraded at least 5-7 times every year without disturbance in its service or minor disturbance as upgrades takes place usually during Sat-Sun nights however, the users are informed at least 24 hours earlier about the action which will be taken with exact date and time. The tools give the better dashboard view which is very helpful for the decision makers as its information is transparent (accessibility can be customized) so the decision makers know the status of their inventory, flow of outgoing goods, past activities, trends based on the activities etc.

Usually, the training for newcomers depends on if he/she has already used such tools before or not. If the user has used it before then, it just takes few hours but if they are new with the tool then, it takes around a day which starts from the very beginning from its basic information, importance, pros, and cons etc. and then only the demonstration and use. Such trainings are done by the SAP support however, if the newcomer has already used such kind of ERP tool before then, a basic training from the team member is enough. The service guides are also available for this tool and easy to understand. It usually takes a week for new people to learn the tool and use it fluently without any external support however, there is 24/7 service support by the software company.

The tool is fast and rarely gets crashed (1-2 times/month) however, the downtime is short (10-20 minutes) and instantly gets help from its IT support. Customization is possible and access can be provided to only those who needs it as the cost of the tools is user based which means that if the tool is used by 10 members of the company with tool 50 employees, then, company pays for only 10 persons. Obtaining the results is sometimes time taking depending of the size of the data. Extraction of the results or extraction of the data from the tool is also time consuming sometimes depending upon the size of extraction.

The tool does not require much maintenance as minor updates occur in the background without disturbing the daily task of the user. Such messages related to the maintenance are popped-up in the screen before the actions are taken. The employees are mainly

satisfied with the tool and synchronizing the tool with other it tools such as Microsoft office is partially possible and currently the upgrades are being planned for this smooth operation of synchronization with other existed it tools. This tool is comparatively bit slower than the NetSuite ERP tool but there are many necessary characteristics in this tool which are missing in NetSuite such as detailed customization or as per requirement, more cost efficient that NetSuite, bit complex to learn etc.

The second interview was also focused on the similar factors as it was focused in the first one such as use of current software, its transparency related to the data/information, accessibility of the tool, advantages and disadvantages, possibility of customization, comparison with the earlier software if any and so on. Dabur India has been using this Syspro ERP tool since 2015 and they have been using it since then as they are comparatively very satisfied with the current tool as they were using a local software which has some issue and the tendency of occurring such issue were bit high on it thus, they replaced it with Syspro ERP which is internationally recognized tool for many companies across the globe. This tools also gives the dashboard view in which all the information related to the inventory is transparent (accessibility can be customized) however, decision makers do not always prefer only this tool as their reference on this topic.

 The tool is easy to operate and easy to learn as the software company sends several guides and videos for basic understanding and information related to the tools and its importance before their training session with the users. The software company sends their representatives in the beginning for training to all the members of the company. the trainings are usually held for 1-3 days depending upon the number of user and level of training they need for their work. This training in the beginning while implementing the tool in the company is free of charge (usually comes as a package) but if any additional trainings are required for example for newcomers, they are charged separately. The newcomers who have not used such ERP tools before finding it bit complex while using it for the first time but the training from the support is very effective that a day or two of training after watching the user manual and videos make the newcomers more

confident with the tool. The tool gets upgraded at least once a month without disturbance in its service or minor disturbance as upgrades takes place usually during nights however, the users are informed at least one week earlier about the action which will be taken with exact date and time and notifications are sent on daily basis until the upgrades are fully done.

The training for newcomers depends on if he/she has already used such tools before or not. If the user has used such ERP tools before then, it just takes half day of training from the support after the basic information from its user manual and videos are watched and read by the newcomer but if they are new with the tool then, it takes around 1-2 days which starts from the very beginning from its basic information, videos related to it, short presentation from software support team etc. and then only the demonstration and use. But if the newcomer has used such tools earlier then, basic training after watching videos and manual is enough to handle the tool independently. It usually takes 1-2 weeks for new people to learn the tool and use it fluently without any external support.

The tool is much faster and rarely gets crashed (1-2 times/month) however, the downtime is short (about an hour) and instantly gets help from its IT support. Customization is possible and access can be provided to only those who needs it as the cost of the tools is user based which means that if the tool is used by 10 members of the company with tool 50 employees, then, company pays for only 10 persons. Obtaining the results is bit fast compared to the earlier software but the extraction of the results or extraction of the data from the tool is bit time consuming sometimes depending upon the size of extraction.

The tool does not require much maintenance as updates occur in the background without disturbing the daily task of the user. Messages related to the maintenance are popped-up in the screen before the actions are taken. The employees are mainly satisfied with the tool, and they are happy with the tool. Synchronizing the tool with other it tools such as Microsoft office is partially possible and currently the upgrades are being

planned for this smooth operation of synchronization with other existed IT tools. Even though customization is possible but still there are areas of improvement in this related to customization such as time-consuming customization, additional cost based on added characteristics/function on the tool etc.

The questionnaire was sent to the all the members of the case company and the results were obtained within a week. The results were analyzed based on the thoughts of the employees of the case company related to the issue of their current open database that is being used and the expectation with the new software. The questionnaire was created with the main topic of concerned under which the analysis was done. These major topics are illustrated below in the graph. The graph represents that majority of the believes that the current tools is time consuming which is hampering their productivity as well. The current tool has also the issue with its data accuracy and data transparency thus the decision maker, employees are not fully aware of the situation of their inventory.

Most of the respondents also believes that the current tools give mental stress to its users as well. Though the tool does not require the expertise for its maintenance, but the down time is still high. The maintenance can be done easily by most of the employees, but the tendency is high. The current tool used by the case company create communication issue as well. The tool does not show result automatically and requires manual intervention and the outcome is also not fully trustworthy. Though the respondents do not fully agree that their daily work is hampered due the issues in the tool, but the productivity is affected due to this for sure. Few comments were received which was mainly related with manual intervention for the input of the data to get the result and the outcome is not reliable enough for decision makers.
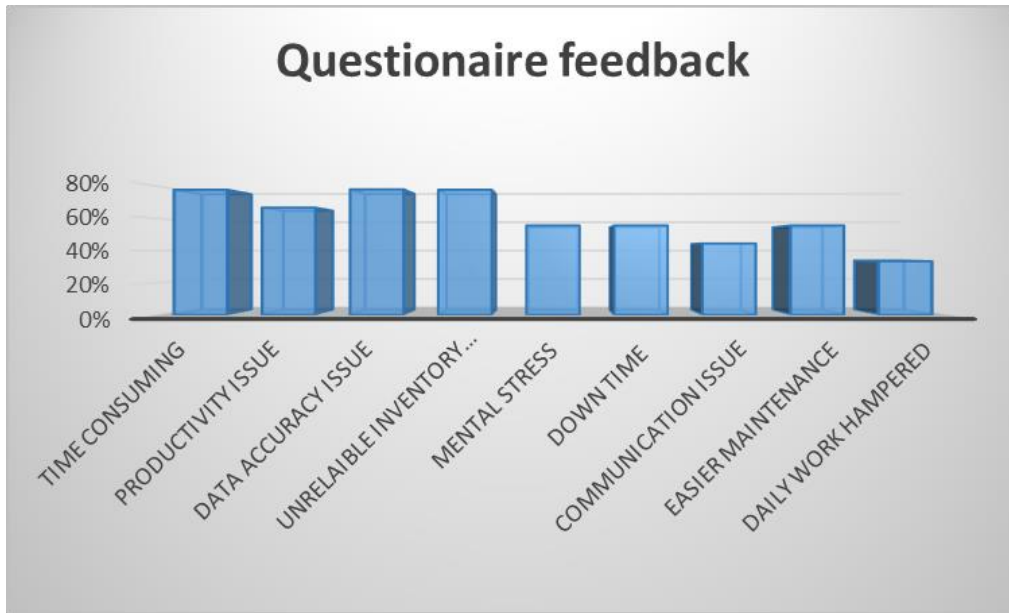
Fig. 13: Questionnaire results

10 Conclusion of the results

The research problems were addressed based on the discussion with the CEO of the case company in which the CEO was more interested in replacing of their current open data source tool with the new ERP tool which would help the company to know the actual status of their inventory, current activity ongoing, financial status, production transparency etc. or in other word it can be said that the case company was looking for a tool which provides the overview of the company status starting from inventory to its finance. The primary as well as secondary data collected by the researcher helped to analyze the research questions to fulfill the objective of the thesis. the two research questions were answered based on the data collected with the help of theoretical materials as well as the analysis of the interviews and questionnaire. These materials were summarized and analyzed to answer the following research questions.

1st research question: *How can the company receive inventory recording and calculation automatically with traceability of produced goods as well?*

The theoretical analysis done in the chapters 2,3 and which is related to the software quality, functionality, and usability, 7 and 8 which are related to ERP system and Inventory management system are major topic of this first research question. The case company was interested to know how the company can solve the current problem which is that the inventory recording is missing and the data that are collected manually, are not reliable enough. Thus, the theoretical summary done of above topics gives the correct answer to the research question. Nowadays, every company uses the software which helps them to provide the correct, reliable, and transparent result with manual intervention thus the case company need to look for the software solution for their problem. Secondly, the question arises that what type of software does the case company needs to solve their current issue so the answer would be ERP software which Enterprise Resource Software. There is many ERP software existed in the market and most of the companies are using such ERP software tools based on the size of the companies. ERP tools

are very important in the current world as this not only enables to provide the overall solution starting from inventory, production, finance to human resource but also are cost effective as well. With the help of ERP tool, a company can plan their resource either its manpower or the goods, services based on the requirement as they will have transparency on their inventory, resource, warehouse situation etc.

The last topic related to the research question is inventory management system and its importance. This chapter gives the overview of inventory management system and its importance in the company. any company regardless of its size requires to manage their inventory and transparency in the inventory or perfect management of the inventory means the decision makers have the clear understanding about their product status either it is raw materials, finished products, half processed products, equipment etc. any company whose inventory status are not transparent of its decision makers won't be able to survive and compete in the market.

The primary data collected through interviews helped to answer the research question as well. The companies whose managers were interviewed by the researcher have been using the ERP tools from long time. The tool helped the company to know their inventory status. All their activities have transparency among the decision makers and decision makers find the ERP tool very helpful which not only provide the accurate the data but also saving the costs. The interviewers shared their experience regarding the benefits of the tool which helps them to know the status of their inventory. The data delivered by the software are reliable and accurate and very rare the false data are displayed by the tool. The ERP tool has provided many benefits to their company and the decision makers find the tool very helpful as well as reliable. They believe that the effective and reliable inventory management is achieved only through the help of such reliable ERP tool.

2nd research question: *What are the major pros and cons of the suggested 5 potential software solution (easy to use and affordable)?*

The theoretical analysis done in the chapters 5 and 6 which is related to the potential software existed in the market and economic prospective for software evaluation and in chapter 9 which is related to the benchmarking of those potential software listed by the researcher are major topic of this second research question. The CEO of case company and researcher came up with this second research question which would help the company to select the best software among the potential software suggested by the researcher. The selection can be based upon different factors such as data accuracy, cost effective, service support, subscription ways etc. thus, the theoretical analysis done on above listed chapters covers the whole summary of second research question.

The analysis done in the chapters 5 and 6 are mainly related to the software that are being compared and from cost perspective as well. All that potential software's are analyzed based on their market status. This software's are highly accepted in most of the manufacturing companies regardless of its size. Many small and medium sized companies fall in the trap thinking that spending a limited budget on software might lead the company to bankruptcy but what they forgot is that the company whose productivity, inventory status, warehouse status is unknown for its decision makers will lead to bankruptcy as well. Spending on one software tool if it gives all the necessary results that the company expects is always a winning situation. These chapter elaborates on such factors which a company can adopt and improve their existing situation.

The analysis done in the chapter 9 is related to the benchmarking of those listed potential software. The benchmarking is done based on several factors such as subscription, installation, training, renewal, pricing, deployment etc. Comparison of these factors would help the case to select based on their requirement. It is also important for any company to benchmark the product or service before adopting it as there are several models, types of products or services existed on the market and it takes time and effort to install or adopt new product or service and if such adoption is not carefully and with full analysis then, the company may face the loss of their time, effort, and finance as well. Adoption or installation of one product in a company means the company needs to

change its organizational structure either partially or fully so this step needs to consider in such a manner that all the boxes of the required characteristics are ticked by that product.

The primary data collected through interviews also gives the overview of the potential software suggested by the researcher and used by the company of the interviewees. The interviewees shared their experience regarding the current software SAP Business One and Syspro. Both the software's are easy to use and so not require long training sessions as many users' manual as well as videos are provided to its new user by the company and are easier to follow them. The tools are not much expensive compared to other similar tools existed in the market. Customization is possible and tendency of crashing of the software is relatively low. Even a bigger company can purchase a small package as its purchasing is based on number or subscription a company needs. Both the software's are reliable and gives accurate data however, there are few cons for these software's as well. Though the software gives the real time results, but the extraction of those results is time consuming especially when the raw data is large. Importing of data from existing tools are not always possible and the software companies are still working on these upgrades.

10.1 Discussion

The first phase of the research mainly includes the theoretical data collected through various related books, journals, published articles etc. In this phase, it was important for researcher to understand the concept of the topic which needs to be presented to reach the objective of the thesis. While writing theoretical part, it was important to include the factors which needs to be considered while selecting an ERP software for a company. The first thing that needs to understand while selecting any kind of software is the quality of software. There are several characteristics of the software which makes it with better quality. The software which are fast, less manual intervention required, data accuracy, less maintenance and down time, technical support when required, importing

and exporting of data is easier, security of the data, etc. Another topic which was explained is that why ERP software but not others and why this is considered as the better tool in current business world. ERP tools are considered more reliable and cost efficient as company do not need to install and use multiple analytical tools once ERP tool is used. This tool helps to integrate the information from different departments such as finance, production, warehouse, human resource etc. and present it to the top management so decision making becomes easier and reliable.

The other concept was important highlight was benchmarking of the potential ERP tool and its importance. Benchmarking is required while selecting while selecting a tool out of many having similar functionality. Five potential software were compared so that it would be easier for the case company to make decision and choose one based on their need. Furthermore, another aspect which was needed to clarify was the budget of the tools because while the company plans to purchase a tool, they should also have considered the budget as these tools are not cheap and investing in those tools should be justified so that it adds value to the company. Another aspect which was necessary to highlight was the inventory management and its importance in the company as it was one of the objective of thesis to know if the ERP tool which will be implemented, will be able to provide transparency of inventory management or not. Company can only compete and survive in the market when they know the correct status of their inventory. Many aspects are linked to the status of inventory, such if raw materials which are store will be enough to product the goods as demand or not, finish products are enough to supply as per customer order or not, activity related to WIP ongoing as per planning or not and so on. All the above topics were important to highlight to make sure that the concept of the thesis is clear and so does the objectives.

The results from the primary as well as secondary data collection suggests that it is recommendable to implement any one of the tools suggested by the researcher. Now when the research has been finalized, researcher is more confident that implementation of

anyone of the suggested tool will be beneficial for the case company. However, this assurance was not believed during the early phase of the research. There were few obstacles where researcher felt that the objectives of the thesis might not the fully achieved.

At the initial phase of the research, it was important for the researcher to understand the detail information related to all the potential software's that are being suggested to the case company. The researcher has not much knowledge of programming so he was not able to evaluate the algorithm and compare between them however, as a user there were many things which can be compared and analyzed. Different materials published by the software company as well as many benchmarking platforms available online were referred to understand and compared those suggested tools. Another challenge for the researcher was managing the time as he is working fulltime, and it was bit tough for him to manage time and complete the thesis.

The trial version of all the software's is not available, and the trail version does not include all of its feature which are implemented in the paid version as well. All the suggested tools are widely accepted by many companies across the globe. Implementation of any one of the suggested tools would not be easier for the case company initially as the case company has not used any ERP tool before so adoption might be difficult as it is initial phase. However, the software company provide support during its implementation. As mentioned before, training might not be tough even though all the employees will be new to the tool.

The case company has not yet finalized if they will be implementing the new tool instantly or not however, they are planning it to be implemented next year. There are many contacts that the researcher used for communicating with the software companies' representatives during his research which would be shared with the case company. Most of the software companies' representatives are not available physically but those companies hire the employees through third party who would go to the venue of their customer during the implementation and installation phase of their service. Training can be held

either physically at the customer's venue or virtually however, it does not affect the training process as claimed by most of the software companies.

This research was intended for the case company to provide the solution related to suggesting potential ERP tool which can be replaced by their current open data source tool. The case company business focuses on producing glue free adhesive posters, advertising banners etc. Their products are new in the market and their main target has been Europe. The company wants to enlarge their market and penetrate in the Asian as well as North American market as well. The company has been constantly working on finding new customers in the new market but because of their limited production and inventory capacity, they have not yet managed to do so. The case company has planned to first improve their inventory recording and then improve their production. The company has heard of many ERP tool existed in the market but unable to select one because of limited knowledge regarding the tools and thus the researcher was approached to do research on this topic.

The draft copy of the research is handover to the client company. The data collected through theoretical as well as empirical approach provides the strong evidence to the case regarding the suggested potential software. The results from the research suggest that any one of the ERP tools can be implemented by the case. All the tools suggested by the researcher are not equal, but some are best in factor which other might not be but implementation of anyone out of five would the decision of the company. The researcher believes that the suggested 5 potential ERP tools are the best suitable tool for the case company considering the business area, size and budget allocated for implementing new tool.

References

Abugabah, Ahed. (2018). "Enterprise Resource Planning Systems (ERP) and User Performance: A Critical Review." 4-11.

Ağaoğlu, Mustafa, E. Serra Yurtkoru, and Aslı Küçükaslan Ekmekçi. (2015). "The Effect of ERP Implementation CSFs on Business Performance: An Empirical Study on Users' Perception." *Procedia - Social and Behavioral Sciences* 210:35–42.

Akatsu, Shinji, Ayako Masuda, Tsuyoshi Shida, and Kazuhiko Tsuda. (2020). "A Study of Quality Indicator Model of Large-Scale Open-Source Software Projects for Adoption Decision-Making." *Procedia Computer Science* 176:3665–72.

Alaskari, O., R. Pinedo-Cuenca, and M. M. Ahmad. (2021). "Framework for Implementation of Enterprise Resource Planning (ERP) Systems in Small and Medium Enterprises (SMEs): A Case Study." *Procedia Manufacturing* 55:424–430.

Almajali, Dmaithan (2016). "Antecedents of ERP systems implementation success: a study on Jordanian healthcare sector". Journal of Enterprise Information Management. 29(4): 549–565.

Amado, António, and Fernando Paulo Belfo. (2021). "Maintenance and Support Model within the ERP Systems Lifecycle: Action Research in an Implementer Company." *Procedia Computer Science* 181(2019):580–588.

Amaral, Paulo, and Rui Sousa. (2009). "Barriers to Internal Benchmarking Initiatives: An Empirical Investigation." *Benchmarking* 16(4):523–542.

Anna Schmitt, Philipp Diebold (2016) Product-Focused Software Process Improvement: Why do we do software process improvement? Springer-Verlag Berlin Heidelberg

2014: 359-367.

Atoum, Issa. (2020). "A Novel Framework for Measuring Software Quality-in-Use Based on Semantic Similarity and Sentiment Analysis of Software Reviews." *Journal of King Saud University - Computer and Information Sciences* 32(1):113–25.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report, 13(4), 544-559

Beheregarai Finger, A., Flynn, B., B., & Laureanos Paiva, E. (2014). Anticipation of new technologies: Supply chain antecedents and competitive performance. International Journal of Operations & Production Management, 34(6):807-828.

Boehm, Barry. (2016). "Improving and Balancing Software Qualities." *Proceedings - International Conference on Software Engineering* 890–891.

Bouwers, Eric, and Reinier Vis. (2009). "Multidimensional Software Monitoring Applied to ERP." *Electronic Notes in Theoretical Computer Science* 233(C):161–73.

Butler, Simon, Jonas Gamalielsson, Björn Lundell, Christoffer Brax, Anders Mattsson, Tomas Gustavsson, Jonas Feist, and Erik Lönroth. (2020). "Maintaining Interoperability in Open-Source Software: A Case Study of the Apache PDFBox Project." *Journal of Systems and Software* 159:110452.

Caplice, Chris. (2006). "Inventory Management Material Requirements Planning Assumptions : Basic MRP Model." *Transportation*. 27-31.

Cortellessa, V., A. Di Marco, P. Inverardi, F. Mancinelli, and P. Pelliccione. (2005). "A Framework for the Integration of Functional and Non-Functional Analysis of Software Architectures." *Electronic Notes in Theoretical Computer Science*

116(SPEC.ISS.):31–44.

Customer, The. (2010). "The Role of Benchmarking in Outsourcing." *Business Credit* 112(December):50–52.

Dubey, SK, A. Gulati, and A. Rana. (2012). "Integrated Model for Software Usability." *International Journal on Computer Science and Engineering* 4(03):429–437.

Du. Donglei. (2000). "Supply Chain Management: Inventory Management." *ARPN Journal of Engineering and Applied Sciences* 2(3):2–77.

Emmanuel, Armstrong, and Odiba Rita Inikpi. (2014). "Benchmarking as a Tool of TQM in the Delivery of Quality Services / Products." *Journal of Business and Entrepreneurship* 1(3):52–63.

Epicor(2020). Official web page. Retrieved 2020-07-25 from https://www.epicor.com/en-us/erp-systems/epicor-erp/

ERP Implementation (2007). ERP Systems Definition. Retrieved 2020-03-12 http://www.implement-erp.com/erp-systems-definition.html

Farhad Analoui and Azhdar Karami (2003). Strategic management in small and medium Enterprises. Thomson Learning 2003: 3-9.

Freytag, P. V., and S. Hollensen. (2001). "The Process of Benchmarking, Benchlearning and Benchaction." *TQM Magazine* 13(1):25–33.

Fridley, J. L., J. E. Jorgensen, and J. S. Lamancusa. (1997). "Benchmarking: A Process Basis for Teaching Design." *Proceedings - Frontiers in Education Conference* 2(December):960–967.

Grudin, Jonathan. (2004). "Return on Investment and Organizational Adoption." Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW 324–27.

Hamilton, Alison B., and Erin P. Finley. 2020. "Reprint of: Qualitative Methods in Implementation Research: An Introduction." *Psychiatry Research* 283(November 2019):112629.

Hawedi, Mohamed, Chamseddine Talhi, and Hanifa Boucheneb. (2018). "Security as a Service for Public Cloud Tenants(SaaS)." Procedia Computer Science 130:1025–30.

Ian Sommerville (2013). Requirements engineering challenges: 3-22.

Infor.com (2020). Official web page. Retrieved 2020-07-12: https://www.infor.com/products/erp

Lečić, Dušanka, and Aleksandar Kupusinac. (2013). "The Impact of ERP Systems on Business Decision-Making." TEM Journal 2(4):323–326.

Le Gall, G. (1995). "Software Quality Control." Commutation and Transmission English Ed. 17(3):91–101.

Lindström, John. (2017). "Improving Functional Product Availability: Software-Related Measures Planned and Taken." Procedia CIRP 59(TESConf 2016) :202–207.

Maditinos, Dimitrios, Dimitrios Chatzoudes, and Charalampos Tsairidis. (2011). "Factors Affecting ERP System Implementation Effectiveness." Journal of Enterprise Information Management.

Maguire, Stuart, Udechukwu Ojiako, and Al Said. (2010). "ERP Implementation in Omantel: A Case Study." Industrial Management and Data Systems 110(1):78–92.

Marvel, Jeremy A., Shelly Bagchi, Megan Zimmerman, and Brian Antonishek. (2020). "Towards Effective Interface Designs for Collaborative HRI in Manufacturing." ACM Transactions on Human-Robot Interaction 9(4):48–55.

Micheni, Elyjoy Muthoni. (2019). "ERP Software Maintenance." pp. 307–329.

Mishra, Alok, and Ziadoon Otaiwi. (2020). "DevOps and Software Quality: A Systematic Mapping." Computer Science Review 38:100308.

Muchaendepi, W., C. Mbohwa, T. Hamandishe, and J. Kanyepe. (2019). "Inventory Management and Performance of SMEs in the Manufacturing Sector of Harare." *Procedia Manufacturing* 33:454–61.

Muller, Max. Essentials of Inventory Management, Amacom, (2002). ProQuest Ebook Central,https://ebookcentral-proquest-com.proxy.uwasa.fi/lib/tritonia-ebooks/detail.action?docID=3001813.

Muqtadiroh, Feby Artwodini, Hanim Maria Astuti, Eko Wahyu Tyas Darmaningrat, and Fenty Rizky Aprilian. (2017). "Usability Evaluation to Enhance Software Quality of Cultural Conservation System Based on Nielsen Model (WikiBudaya)." Procedia Computer Science 124:513–521.

Nemtajela, Ndivhuwo, and Charles Mbohwa. (2017). "Relationship between Inventory Management and Uncertain Demand for Fast Moving Consumer Goods Organisations." *Procedia Manufacturing* 8(October 2016):699–706.

Netsuite.com (2020). Official web page. Retrieved 2020-06-20 : http://netsuite.com

Nguyen-Duc, Anh, Manh Viet Do, Quan Luong Hong, Kiem Nguyen Khac, and Anh Nguyen Quang. (2021). "On the Adoption of Static Analysis for Software Security Assessment–A Case Study of an Open-Source e-Government Project." Computers and Security 111:102470.

Oluwaseyi, Joseph Afolabi, Morakinyo Kehinde Onifade, and Olumide F. Odeyinka. (2017). "Evaluation of the Role of Inventory Management in Logistics Chain of an Organisation." LOGI – Scientific Journal on Transport and Logistics 8(2):1–11.

Pathak, V., Jena, B., & Kalra, S. (2013). Qualitative research. Perspectives in Clinical Research, 4(3)

Priniotakis, G., and P. Argyropoulos. (2018). "Inventory Management Concepts and Techniques." IOP Conference Series: Materials Science and Engineering 459(1).

Ren, Zhengping, Song Huang, Yi Yao, and Yu Hong.(2011). "Confidence Measures Analysis of Software Security Evaluation." Procedia Engineering 15:3505–10.

Rindell, Kalle, Jukka Ruohonen, Johannes Holvitie, Sami Hyrynsalmi, and Ville Leppänen. (2021). "Security in Agile Software Development: A Practitioner Survey." Information and Software Technology 131.

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. Qualitative Research in Psychology, 11(1), 25-41.

Rolia, Jerry, Giuliano Casale, Diwakar Krishnamurthy, Stephen Dawson, and Stephan Kraft. (2012). "Predictive Modelling of SAP ERP Applications: Challenges and Solutions."

Rudolf Ferenc, Peter Hegedus & Tibor Gyimothy (2014) Evolving Software systems:

Springer-Verlag Berlin Heidelberg 2014. 65-100

Russo, Daniel, Paolo Ciancarini, D Russo, P Ciancarini, ; T Falasconi, and M. Tomasi. (2018). "A Meta-Model for Information Systems Quality: A Mixed Study of the Financial Sector TOMMASO FALASCONI and MASSIMO TOMASI, Deloitte Consulting." ACM Transactions on Management Information Systems 9(11):11.

Salleh, Masrina A., Mahadi Bahari, and Nor Hidayati Zakaria.(2017). "An Overview of Software Functionality Service: A Systematic Literature Review." Procedia Computer Science 124:337–344.

Sammut-bonnici, Tanya. (2017). "Benchmarking." (January 2017).

Sedef A. Kocak, G.I. Alptekin & Ayese B. Bener (2014). Evaluation of software product quality attributes and Environmental Attributes using ANP Decision Framework. Online article available at: http://ceur-ws.org/Vol-1216/paper7.pdf. 1-6.

Selecthub.com (2019). ERP software price and cost Guide. Retrieved 2020-02-20 http://selecthub.com.

Shenoy, Dinesh, Roberto Rosas, Dinesh Shenoy, and Roberto Rosas.(2018). "Introduction to Inventory Management." Problems & Solutions in Inventory Management (June):3–11.

Syspro.com (2019). Syspro Infinite summary solution. Retrieved 2020-01-20 http://SYS-PRO-Infinite-Possibilites-BR.pdf

Viale, J. David. Basics of Inventory Management: From Warehouse to Distribution Centre, edited by Christopher Carrigan, Course Technology Crisp, (1996). ProQuest E-book

Central,https://ebookcentral-proquest-com.proxy.uwasa.fi/lib/tritonia-ebooks/detail.action? docID=3116996.

Walkinshaw, Neil. (2013). "Using Evidential Reasoning to Make Qualified Predictions of Software Quality." ACM International Conference Proceeding Series Part F1288.

Waters, CDJ (2011). Supply chain risk management: Vulnerability and resilience in logistics (2nd ed.). London; Philadelphia: Kogan Page: 230-238.

Appendix 1. Interview questions

Interviews questions

1. Overall experience of the current tool.
   - Data accuracy
   - Satisfaction level of the employees and decision makers
   - Further Improvements if required
   - Unnecessary functions if any

2. Why do you think this tool is necessary?
   - Advantages/disadvantages

3. What benefits it provides for inventory management?
   - Reliability on Inventory status
   - Distortion of the data
   - Overall dashboard view

4. How often it requires maintenance?

5. How about the customization of the tool based on necessity?

6. How easy/difficult it is for new users?
   - Training for newcomers/users.

7. How often system upgrades in the tool?
   - Easy/complex after upgrades.

8. Do you get enough technical support when required?

9. Is there any other software used by decision makers?

10. Any thought about switching the current ERP tool with another.

11. Is the current software better/worse than previous one if used?
    - Quality of current tool that differ from others

Appendix 2. Questionnaire

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Current software is time consuming	○	○	○	○	○
I doubt for data accuracy	○	○	○	○	○
Requires complete manual intervention	○	○	○	○	○
Effects daily work as well	○	○	○	○	○
Communication issue within software	○	○	○	○	○
Replacing might increase productivity	○	○	○	○	○
Productivity is hampered as well	○	○	○	○	○
I am not aware of other department development	○	○	○	○	○
Inventory status is unknown	○	○	○	○	○
Upgrade might be helpful for less inventory	○	○	○	○	○
Current software issue might affect in long term as well	○	○	○	○	○
Reporting is disturbed as well	○	○	○	○	○
Current tool is complicated to use	○	○	○	○	○
Analysed data is difficult to understand	○	○	○	○	○
This problem is affecting my motivation	○	○	○	○	○
Training is complicated	○	○	○	○	○
Technical support is provided	○	○	○	○	○
Downtime of current software is long	○	○	○	○	○
Maintenance is cheaper	○	○	○	○	○
Maintenance is easier	○	○	○	○	○