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Method analysis of service process at Company Z

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Abstract

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This Bachelor's thesis concentrated on the process analysis of the case company, using SAP data and comparing it with the current service process of the company.

The case company is this study was a multinational publicly listed company that operates in field of building technologies. The company HQ and most of its support services are located in the metropolitan area of Helsinki.

The objective for this quantitative study was to find the current state of the case company's maintenance service process map through observations and SAP analysis and to find out if the process is compliant with the company's new strategy. As the maintenance service process is the same in the entire company, all improvement points can be multiplied to extend to international business units.

The author of this study was in a key position to evaluate the process and performance. Therefore the analysis contains information that would have been otherwise inaccessible for study and analysis. The main data used for this thesis included company's SAP data and first hand observations by the author.

The SAP data and the maintenance service process were evaluated carefully so that no confidential information was disclosed and the data and service process are only referred to on a general level or through information that is publicly accessible due to Finnish legislation concerning publicly listed companies.

The process analysis was implemented by using tools such as a method study based on principles of motion economy and validated by using the DMAIC process tool. The analysis included critically observing the current process and recording all known factors from the process under evaluation. After all factors were recorded, the process went through a multiple stage analysis and was finally compared against the SAP data previously collected and refined.

The results of the SAP analysis indicated that the current process or service performance is not entirely supporting the company strategy and the study identified some possible causes for that. This indicates that the process of the company is not compliant with the strategy.

The outcome of this study is the acknowledgement that the current maintenance service process and performance are not compliant with the company strategy

Keywords
Method, analysis, process, improvement, strategy and compliance.

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1 Introduction

This study provides insight and laid out analysis on how the case company's maintenance process is functioning in correlation with the company's strategy.

1.1 Background of the research

Currently the competitive situation related to building technologies is intense, as more technology is brought to market almost on a weekly basis. Even a study conducted by New York Times indicates that new technology is adopted much faster than 20 or 10 years ago. Though the study emphasized on penetration of technologies in US households, the results do correlate with automotive industry's design cycle as a typical design cycle for 2013 was 24 to 36 months when compared to 60-month design cycle only five years before (Harvard Business Review 2013).

The company has had operational challenges in the past years with its international operations. Financial targets have not always been achieved and the challenge has been pinpointed to operational efficiency. This creates a need for an analysis and a set of guidelines for improving operational efficiency in current service processes. For this, the author is in unique position to observe, analyse and obtain performance data and has the possibility to develop the service model of the case company in question, based on the project outcome.

In addition the building technology industry is going through a transition phase where companies are transforming their operations to more service oriented approach. This means that having an effective process how to handle and fulfil service requests either creates competitive advantage or aids the company to retain the market share it has achieved (Wang & Ahmed 2007).

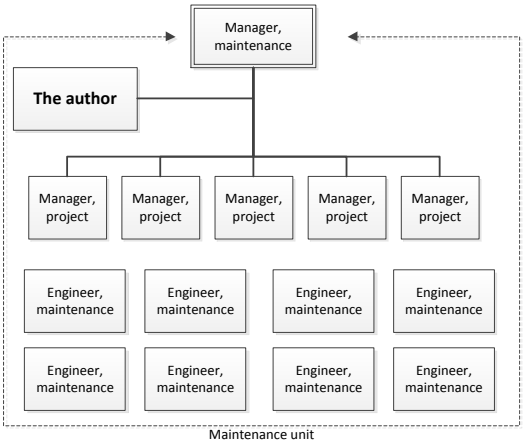


Figure 1: Organizational hierarchy of the case company's reference unit

1.2 Case company introduction

The case company Z designs, builds, operates and maintains intelligent and energy-efficient solutions for buildings, industries and infrastructures in Northern, Central and Eastern Europe. The company is among Europe's leading providers of technical solutions for buildings and industries.

Company Z is operating in various locations around the Europe and is a publicly listed company on the Helsinki stock exchange (Nasdaq Helsinki 2018).

The current strategy of the company has 2 phases. The first stage aims to improve company's current performance by optimizing current service performance. After the company's performance is fit and optimized, it will move to the growth phase of its strategy. During the growth phase the company's main focus is to increase and accelerate growth in its service business.

To succeed in this the company has set so-called must haves or must wins, which are:

- Excellent customer experience
- Top performance at every level
- Best solutions
- Winning team

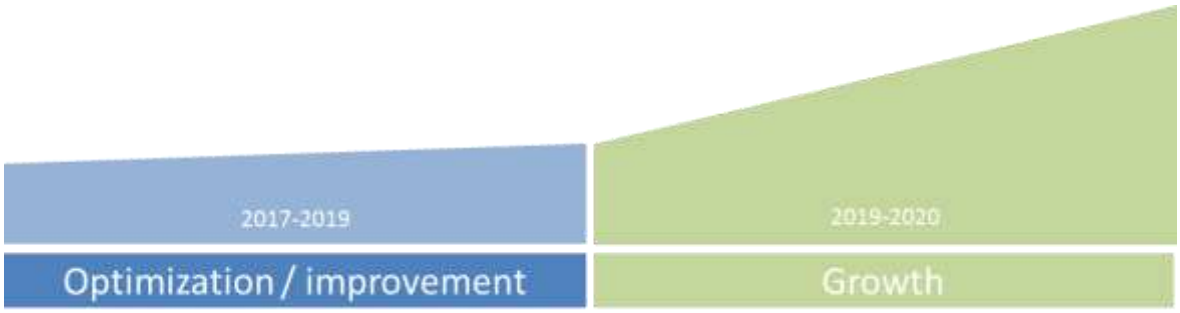


Figure 2: The current 2 phased strategy illustrated.

The company has divided itself in two main business units, Services and Projects. The current strategic focus is on the services aspect and the company aims to increase its service concepts and recurring contract sales in that business unit.

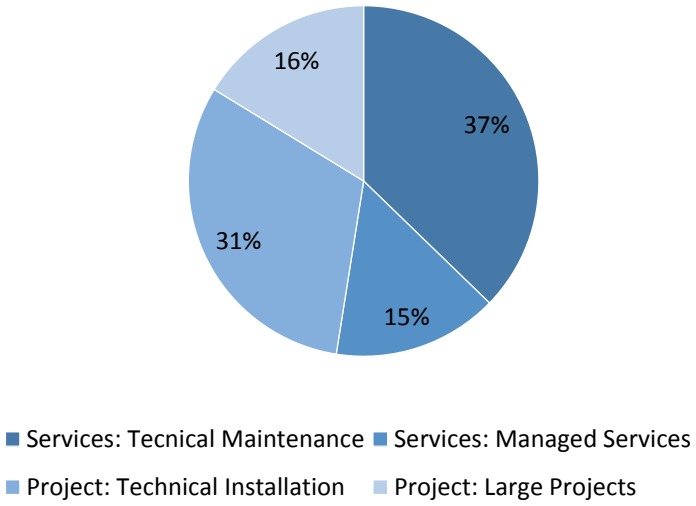


Figure 3: Revenue breakdown of business units of the case company.

1.3 Research objective and research questions

As the strategy indicates, the company aim to optimize its operations in various levels before seeking growth. This creates a need for an analysis and guidelines that would find out if there are any failure points, bottlenecks or other areas of improvement.

The main objective for this research is to find generally applicable improvement points for the current maintenance process and that way create value for the company and its stakeholders.

Research questions:

1. What is the current state of the maintenance service process?
2. How is the current maintenance service process measured?
3. Is the current performance compliant with the company strategy?

Table 1: Overlay matrix

Research task	Theoretical framework	Research management method	Outcome
What is the current state of the maintenance process	Background information for the project and PO	Observations bu author and quantitative SAP analysis	Current state analysis
How is the current service process measured	Comparison to company strategy	Observations	Strategy requisites for service process
Service process analysis	Method study by Frank Gilbreth	Comparison of current state information against company goals and strategy	Improvement points or confirmation that current practise is most effective

After completion of all research tasks, this study aims to answer the questions that is the current maintenance service process strategically compliant, meaning that is it supporting the company strategy.

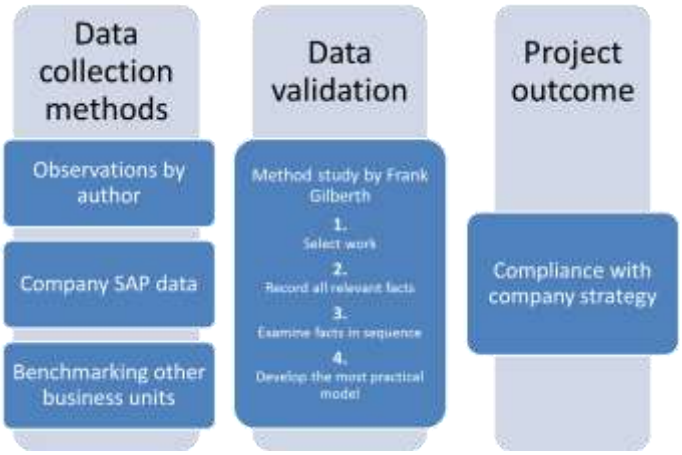


Figure 4: Research outline illustrated

1.4 Scope-of-works (SOW)

The scope of this research is delimited to study and analyse the maintenance service delivery process of particular maintenance service unit within company Z's Services business unit. The study does not take into account services delivered from other units, although if further study is made, the results are comparable as the service process should follow the same company set guidelines.

Analysis is based on observations, SAP CS data and information not deemed confidential or considered as a trade secret. This and the fact that the case company is a publicly listed company, creates certain confidentiality challenges when presenting the data and results of this research.

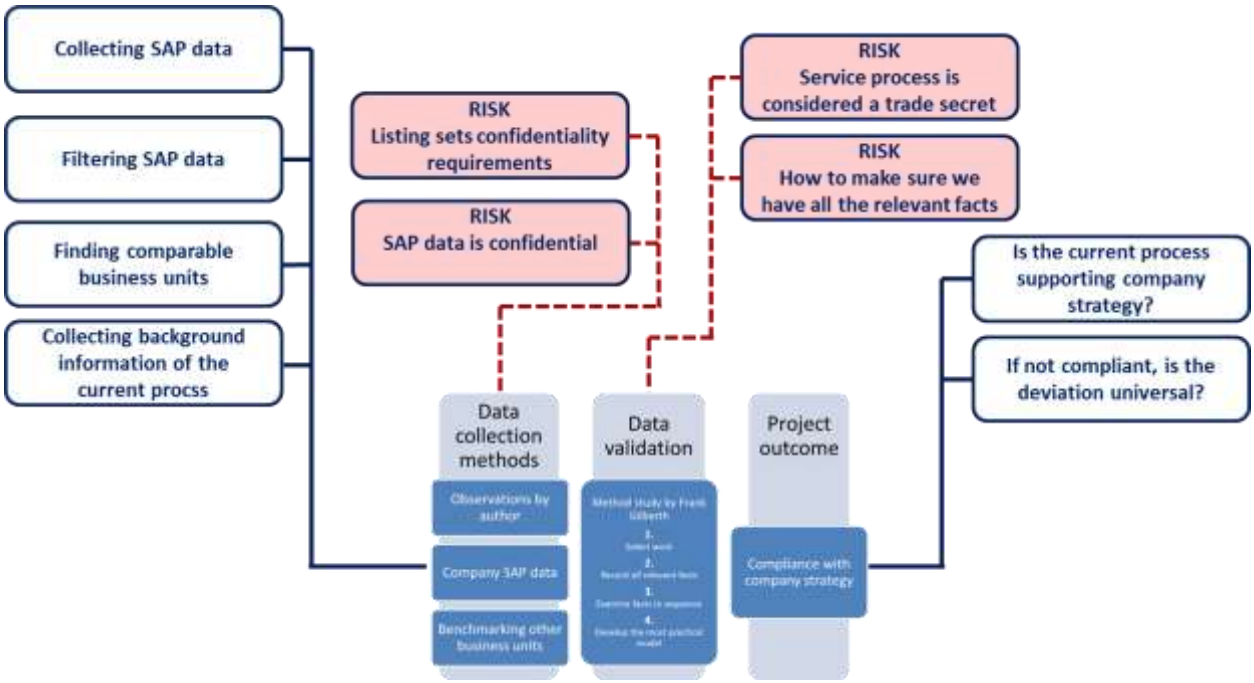


Figure 5: Steps and risks illustrated

For successful completion of this research, following tasks need to be studied and taken into account.

Scope-of-Works (SOW) for this study includes:

- Collecting enough relevant SAP data to create a sample for whole population
- Filtering the data so it can be analyzed
- Anonymizing the SAP data, so it does not contain any customer information
- Finding comparable business units for benchmarking purposes
- Risk assessment of confidentiality aspect for publicly listed companies
- Risk assessment of other information published in this study
- Analysis and comparison of the outcome and the company strategy

1.5 Key concepts

ERP software

Commonly known and also an acronym for Enterprise Resource Planning software. A software platform used to measure and automatize business processes and keep track of business operations, finances, logistics, purchasing, suppliers and supply chain (Gartner 2019).

SAP

A German originated and now multinational software company, whose products allow businesses to track customer and business interactions. SAP is especially well-known for its Enterprise Resource Planning (ERP) and data management programs and the most

used ERP module is generally referred only as SAP. SAP is an acronym for Systems, Applications and Products (Business dictionary 2018).

SAP CS (Customer Service)

A module within SAP ERP that supports companies managing and processing any services that they provide to their customers. The module is used to manage technical objects, create service requests, plan and commence requested services, keep track and invoice the service requests (SAP Gmbh. 2018).

Ebitda

Ebitda is an acronym for Earnings Before Interests, Taxes, Depreciation and Amortization. Commonly used metric by modern day businesses as it states and represents a clear view of operations of the company by excluding all expenses that may screen how the company is really performing (Investopedia 2018).

Free Cash Flow (FCF)

Free cash flow represents the cash a company in generating after cash outflows required to maintain operations and manage its capital assets. FCF is used to measure profitability of a company and excluding all non-cash expenses of the income statement but including spending on equipment and assets as well as changes in working capital (Investopedia 2018).

Process

Process is defined as a sequence of interdependent and/or linked procedures which, at all stages, consume one or more resources (labour, energy, machines, assets) to convert inputs (data, material, parts, etc.) into outcomes. These outcomes then serve as inputs for the next stage until an end result is reached (Oxford dictionaries 2019).

EOL (End-of-life) product

End of life product refers to products or components that are no longer manufactured due to low demand or obsolete technology. It is used to indicate that the component or a product it uses is no longer available (Technopedia 2019).

KPI (Key Performance Indicator)

Metrics used to define key business statistics such as number of orders, cash collection or retention efficiency, return on investment or any metric that is used to measure a company's performance in critical areas. KPI’s show the progress or lack of it of company's objectives or strategic plans. (Investopedia 2018)

Building technologies

Instruments and/or equipment installed in buildings or facilities for a specific purpose. Examples of these equipment are surveillance cameras, intrusion alarm systems, coolant machines, data transfer modules, workstations, etc. (Business dictionary 2018).

2 Toolkit for analysis

This part of the research concentrates on how and where the data was acquired and how it is going to be refined and analysed in this research.

2.1 Data collection methods

To measure the performance of the case company's maintenance service, applicable data must be used. The data was extracted from the company SAP

2.2 Quantitative SAP data analysis

The main data used for analysis is the company SAP CS data from collected between January 1st 2017 and December 31st 2017.

The data used has following criteria:

- The data contains all ZY05 objects from 2017 from a single service area
- The data is valid as 2017 has been closed as fiscal year, thus no more revenue or expenses can be placed to those objectives

Even that the data can be considered valid, it includes objects that falsify the results unless filtered. As the raw data includes service objects that have fallen under warranty and objects that does not have all data in all fields. The data forms a whole population under above mentioned terms, whereas the sample is created by filtering out incomplete or unusable objects. Criteria for exclusion are incomplete information, missing currency or date data. If any of those data labels is missing, the object is void, disabled or done under warranty and is thus not applicable for this study.

Data Overlay TAB			
Name	Total objects	Complete objects	Valid objects
ZY05 objects	718	598	423

The filtered data contains following information			
Beginning date	Date of reference	Object type	BU information
Total costs	Total revenue	Total margin	Total margin %

Figure 6: The data overlay information

The data itself is deemed confidential and thus cannot be published as an appendix of this thesis; however a sample of the data can be shown.

2.3 Requirements set by company strategy

As this thesis is an actual company related and commissioned project, the most important part is to tie this study to the company goal setting and strategy.

As mentioned before in company strategy, the ongoing phase is to study, optimize and improve current processes and services. This means that processes and services must be measured from the company's perspective and how the company perceives that they support the strategy.

The case company has set following criteria for its strategy to succeed:

- Customer experience must be excellent
- Solutions provided to customers must be best available
- Company must perform excellently in all levels of service when interacting with the customer

In addition, following financial targets are also set by the company to achieve its strategy:

- Profitability in terms of EBITDA must be at least 6% of the revenue.
- Cash conversion before financial and tax items must be below 100%

Above mentioned criteria would assume that the company sets quite high service quality standards it wants its customers to perceive and requires so that the service process is profitable and that there is no remarkable latency in invoicing. So in order to compare the current service level, a metrics must be set from low quality to high quality.

From cutomer's perspective high quality in services can be seen dependant on two different variables, expected service quality and perceived service quality, where both variables are dependant on factors inside and outside of the company's control (Grönroos 1984). There are basically two factors that have effect on the perceived service of the customer, technical quality of the service and functional quality of the service. Technical quality can be seen as the outcome or something material the customer receives as a result of the service whereas the functional quality is how the an individual feels about the service process. These two dimensions form an image that affects how the customer perceives the received service.

Figure 7: The Service quality model by Christian Grönroos (1984).

However if quality in services is inspected from company's perspective, then other aspects play a bigger role. As quality in the case company's operation means making fewer mistakes in service delivery or service process in general, it means that less time and labour is spent to correct the faults which leads to cost savings and better margins. In addition the company emphasizes high quality in services as it results in higher customer satisfaction, dependability of the company and fluent process development (Slack et al. 2013, 47).

For the analysis of current service level, following hypotheses are set:

Hypothesis 1:
The market leader position of the case company comes with high expectations for service. The customer is not expecting low or mediocre service on from a market leader in a highly competed market.

Hypothesis 2:
It can be assumed, that the employees of the case company are professionals in their own field, thus the technological solution or technical quality provided to customer is considered to be best possible in a cost-effective manner (eg. customer would not achieve any more value added, even that the solution would be more richer in terms of functionalities or aesthetics).

To find out the functional quality of the service, the SAP data will be analysed from temporal perspective to find out how long does it take for the customer to receive service they have requested.

2.4 Applied Method study

After the metrics for the analysis have been set, the study requires a framework used to evaluate the current service process against the established metrics in order to find out if the measured performance in compliant with the company strategy.

When selecting the framework, the case company expectations must also be taken into account and therefore improving the performance of the service process shall be established as a red line of this evaluation. Various justifications, such as increase in competitive pressures, emerging markets and market disruption by introduction of new technology, support the case company's motives when seeking improvement in performance. After all, improvement of operational performance should be the ultimate objective in management of operations and processes (Slack et al. 2013, 279).

Also when evaluating the data, we must consider the framework so that the case company has the capabilities and resources to implement the changes according to applicable guidelines provided (Hitt et al. 2005, 79-81).

Figure 8: Outcomes of external and internal Environmental analyses (Hitt et al. 2005)

After taken into consideration, both case company's expectations and ease of implementation, Method study published 1911 by Frank Gilbreth will be used by applicable parts as main framework to evaluate the SAP data against the company expectation to find out if the current service process is compliant with company strategy (Slack et al. 2013, 279).

Method study concentrates on evaluating and improving work performance based on relevant facts and is used to develop improvement points based on findings. Even that the study was originally developed to improve performance in repetitive work; it can be applied to modern analysis as well. The 6 phases defined by Frank Gilbreth are:

1. Select work to be studied

The first stage is to select a work chosen under study. Selection of work or process should be the ones that will yield most return on investment on the time spent improving the outcome.

2. Recording the present method

Stage 2 studies and records the present method, and more importantly the sequence, how the work is conducted. This stage is based on the usual assumption that it is easier to observe an existing method and criticize it than create a new method from the scratch.

3. Examine the facts

This stage is the most crucial part of this analysis method, as the idea is to examine the current method thoroughly and objectively. Common approach for this stage is to use the so-called “questioning technique” where various detailed questions are asked and thus the examiner is forced to find an answer to those questions before proceeding to the next stage.

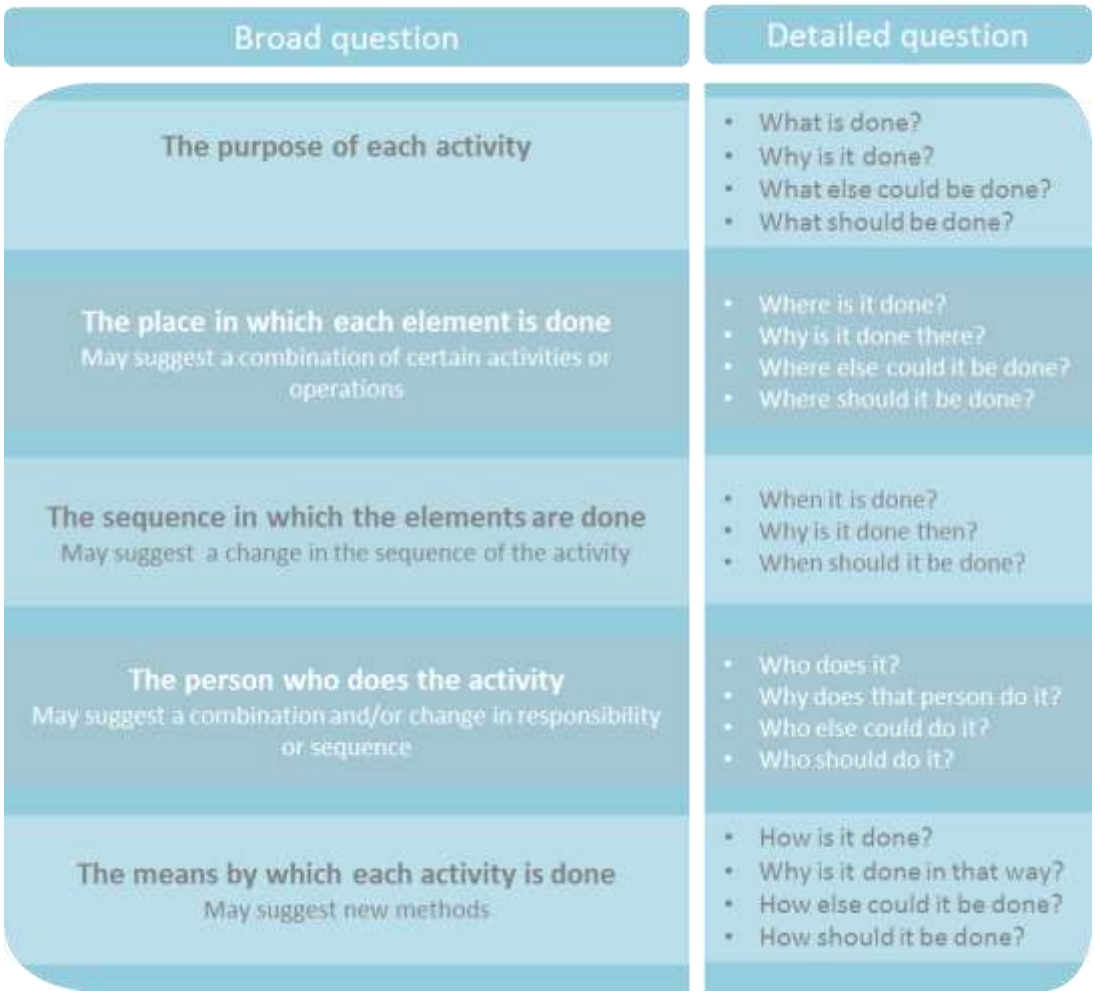


Figure 9: The method study questioning technique (Slack et al. 2013)

4. Developing a new method

After the method has been critically evaluated, it should provide indications of changes and improvements to the performance of the work under evaluation. This stage involves implementing the improvements by:

- Eliminating parts of the activity altogether;
- Combining elements together;
- Changing the sequence of events to improve efficiency; or
- Simplifying the activities to reduce workload.

When evaluating the improvements, a useful tool is a checklist created based on the revised principles of motion economy. While the list concentrates on more conventional improvements of work efficiency, which might seem a bit old-fashioned in the 21st century, it is still valid when applied with whatever work method has formed as the de facto of that time (Barnes 1983).

In addition the outcome can be validated with other well-known and commonly used methods, such as DMAIC method created by William Deming and later adopted by Lean six-sigma ideology. It is also a 5 step process, where the problem is defined, process performance is measured, root causes of the process variation are identified, process performance is improved by eliminating the root causes for deviations and the improved process performance is controlled (Deming 1982).

However if no improvements are found, then the current method is the most efficient available, based on this evaluation. This usually refers to previously automated and optimized work method or a fault in the evaluation process (Slack et al. 2013, 281).

5. Install the new method and regularly maintain it

Method study approach, when implementing the new work or process practises, relies heavily just managing the implementation and installation of the new method like any project that requires supervision. It also emphasizes the need for regular revision of the new method by monitoring and evaluating the effectiveness. This phase includes phases 5 and 6 from the method study as they are linked to each other.

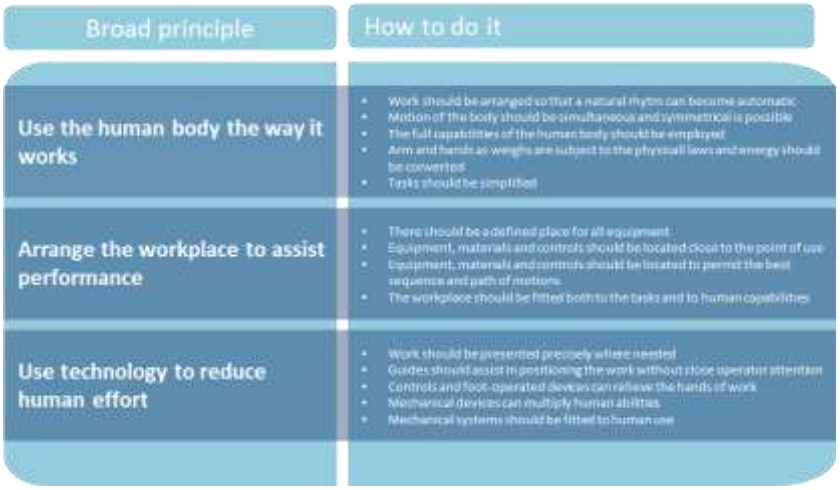


Figure 10: The principles of motion economy (Barnes 1983, 298)

3 Data collection and analysis

Now that the framework for evaluation and data sources have been established, natural step is to proceed with the evaluation and find out if the current process is compliant with the strategic goals of the case company.

Main objective for this part of this study is to evaluate and see if the current service process corresponds and supports the strategic goals of the case company, based on the metrics set for this study.

3.1 Data analysis

The data was analysed so that it serves the purpose of this study by focusing on the temporal perspective to find out the effect of time to the financial performance of the company's service process.

First analysis was done to find out the relation of time spent to margin, the service requests generates. For this the data was filtered so that it revealed the average margin vs. days to complete the request. This revealed that longer it takes to complete the service request, the lower is the average margin left from that object. As can been seen from chart 2, if the service request will take more than 80 days to complete, it will yield negative financial outcome. Further analysis was done to see the distribution of service objects to reveal any deviations and to see which objects yield the most results. This revealed that most of the objects are completed in less than 2 days and thus form a majority.

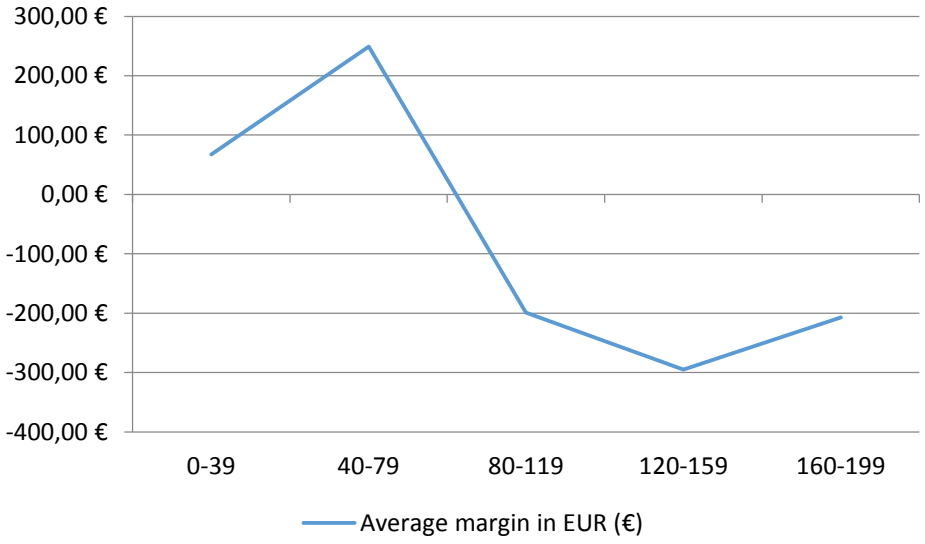


Figure 11: Days to complete service request and its effect on average margin of the service object (n=423).

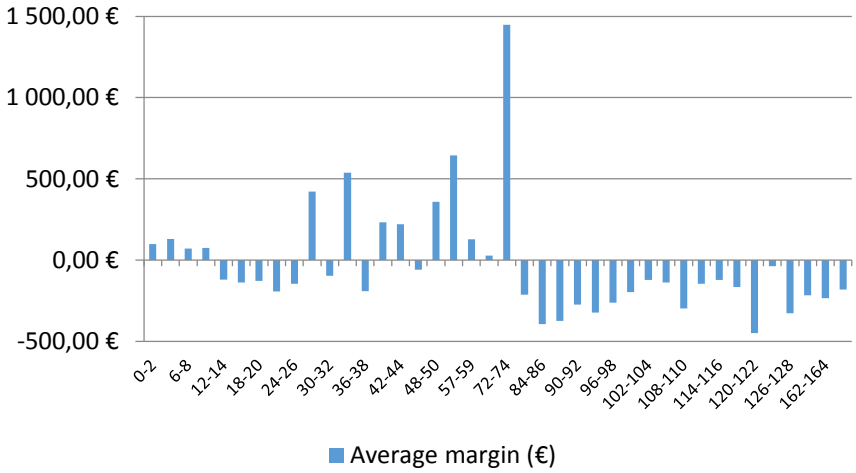


Figure 12: Average margin distribution based on days to complete (n=423)

When studying the distribution of margin and compared to how many days it has taken to complete the request, it can be seen that when a request is fulfilled and completed within fourteen days, the margin remain positive. Requests that take fifteen to 30 days to complete produce generally a negative margin outcome. Deviations were also found, but they can be isolated to a handful of larger projects and thus should be excluded from conclusions and discussion.

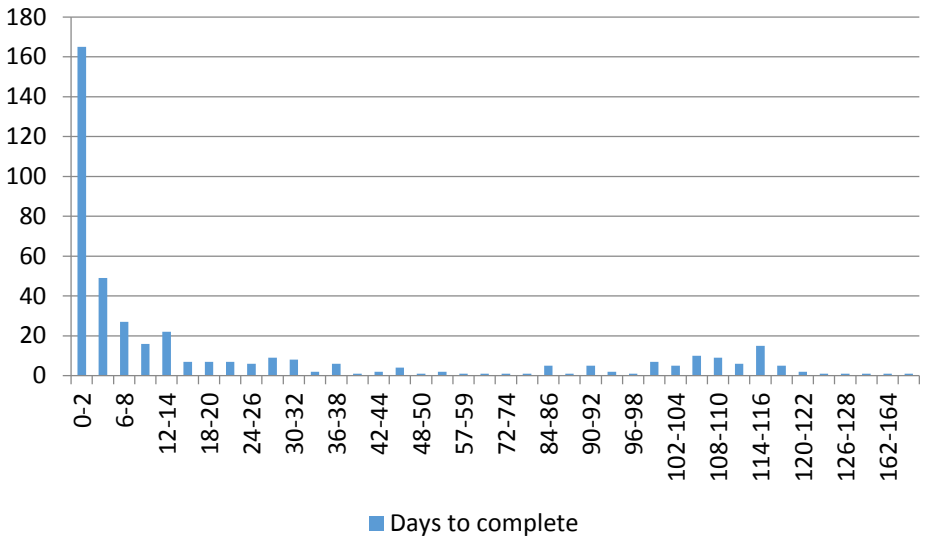


Figure 13: Amount of service objects based on how many days to complete it (n=423).

By dividing the amount of service objects based on time to complete, it is clear that majority of objects are completed within fourteen days from request. By examining table 4, we can also validate previous statement to isolate the deviations, found when comparing margins, to a very small amount of objects.

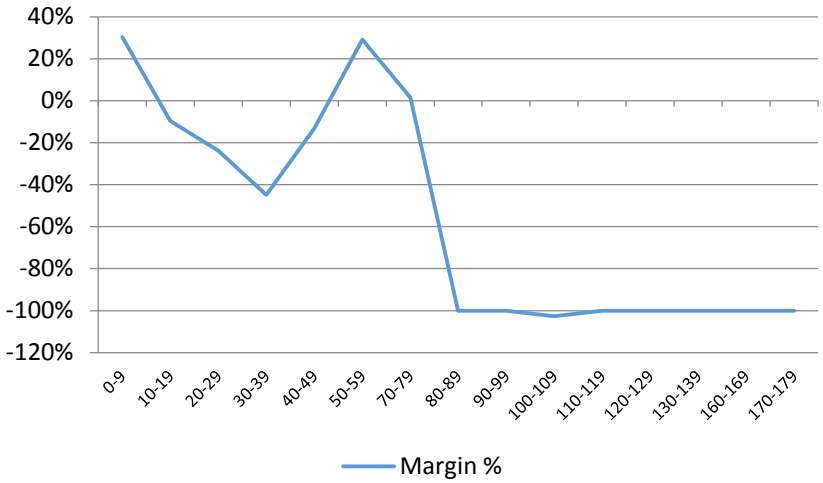


Figure 14: Days to complete service request and its effect on the margin percentage of the object (n=423).

As can be seen from tables 1, 2, 3, 4 and 5, an assumption can be made that longer it takes to complete the service request, more probable it is that it will yield negative financial outcome for the company. Exact reasons for this are impossible to extract from the SAP data evaluated, unless the cost structure of each object would be more thoroughly inspected. However this is not possible in the light of this study as the data within the ZY05 objects is deemed confidential.

Other sources in this research are limited to first hand observations of the maintenance service process, done by the author itself. The observations collected cannot be seen or processed as empirical or objective information due to the source of the data. However they can be used to consolidate the findings from other sources and evaluated only in case they correlate with the results.

Findings from desktop research concur mostly with the SAP data analysis as among the observations, is that the invoicing process of the company is not optimized. If invoicing latency is calculated from the start of the request to the closing of the request, the correlation can clearly be seen from chart 5 which displays the average latency distributed by days to complete the object. However this chart does not tell the truth as the objects with high latency are also most likely larger projects which are invoiced according to mutually agreed payment programme. In addition, the author has access to the more detailed and exact invoicing latency, which is actively measured by the case company through different metrics. This data is, however, seen sensitive and thus not published in this thesis.

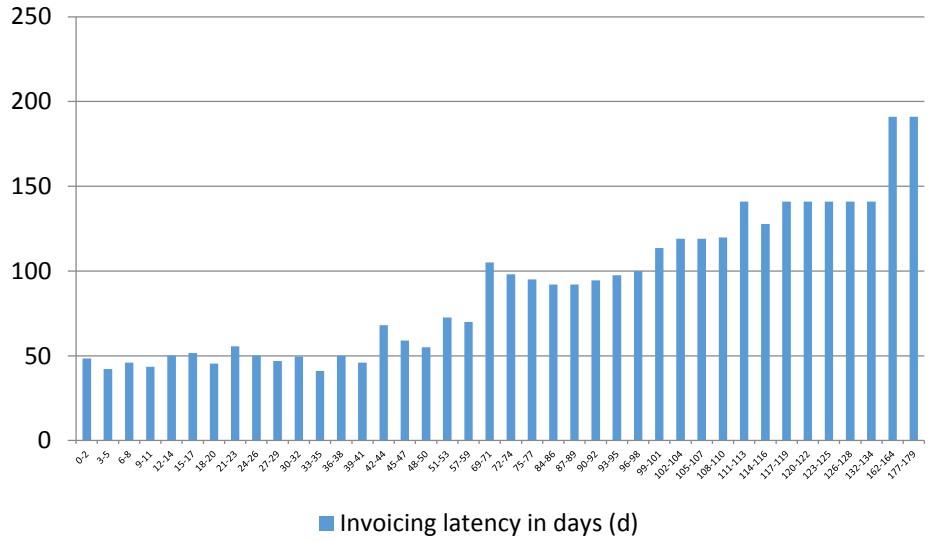
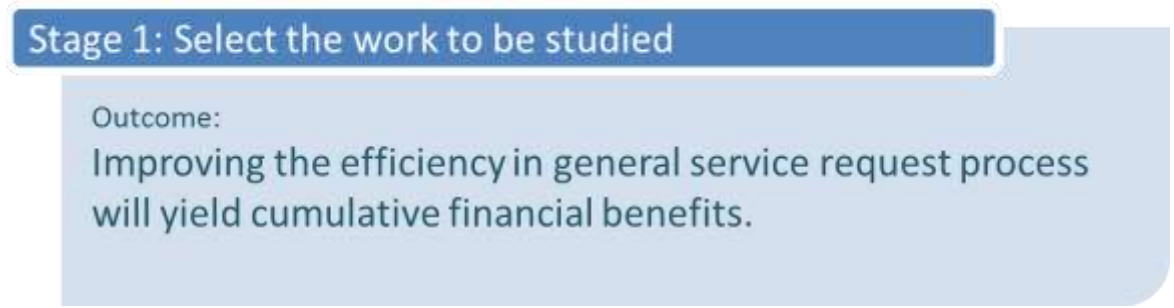


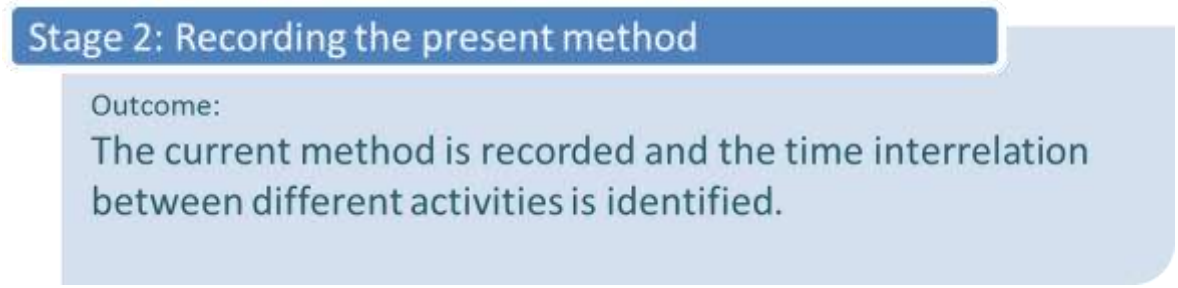
Figure 15: Invoicing latency of ZY05 objects when distributed by days to complete and calculated from creation to when it is invoiced (n=423).

3.2 Compliancy analysis

Finally, now that we have established the metrics and have analysed the SAP data, the current service process can be evaluated through the method study.



As stated before, the work or process under evaluation is the case company's service process, in order to find improvement points that can be utilized generally in different business units, domestic and international. As the company is operating in various European countries, it would be safe to assume that there is indeed a high potential for cumulative benefits and if actualized, will yield high return on investment as the project itself has not brought any costs or direct expenses to the case company.



The present method of the service process cannot be defined in detail in this thesis, as it is seen as a trade secret of the company and if revealed may harm the company or provide competitive advantage to other companies associating and operating in the same industry.

The process itself can be seen as reactive and it starts from a maintenance request that originates from an outside source like for example case company's customer is using a technical system that requires maintenance or fault repair services.

Measuring delay time in the maintenance service starts after the request has been received and acknowledged and ends when the engineer arrives on-site. The delay time in this case is subject to various conditions, such as the current workload of the engineer,

amount of available engineers which is in straight relation to amount of ongoing projects and workload of the operational management of service units.

Good to remember that the time to complete the maintenance varies as the engineer in most cases doesn't know what is needed to repair the fault he/she was sent to investigate. In cases where there is a faulty component, it might even take weeks to get a replacement part or in EOL situation to find a suitable substituting device (Technopedia 2019).

Figure 16: The main outlines of the service process in the case company

After receiving the request, it is processed and channelled to operations. The operational management will acknowledge the request and appoint and dispatch an available engineer to the site. After the service request has been fulfilled, the customer is provided with a detailed report which includes all labour hours and cost objects required and the service request will be transferred to financial department for invoicing. Even that most of the process is operated through an ERP system; the transition to financial department is not an automated process and is based on operational management's workload and even subject to individual variation.

SAP analysis and observations by the author both indicate that most time consuming part of this process is transferring the request from operation to invoicing.

Stage 3: Examine the facts

Outcome:

The current method is recorded and the time interrelation between different activities is identified.

When examining the facts, the questioning technique is used to achieve comprehensive understanding of the present method. Evaluation is done to all activities defined above in the service delivery of the service process, by asking why, where, when, by whom and how.

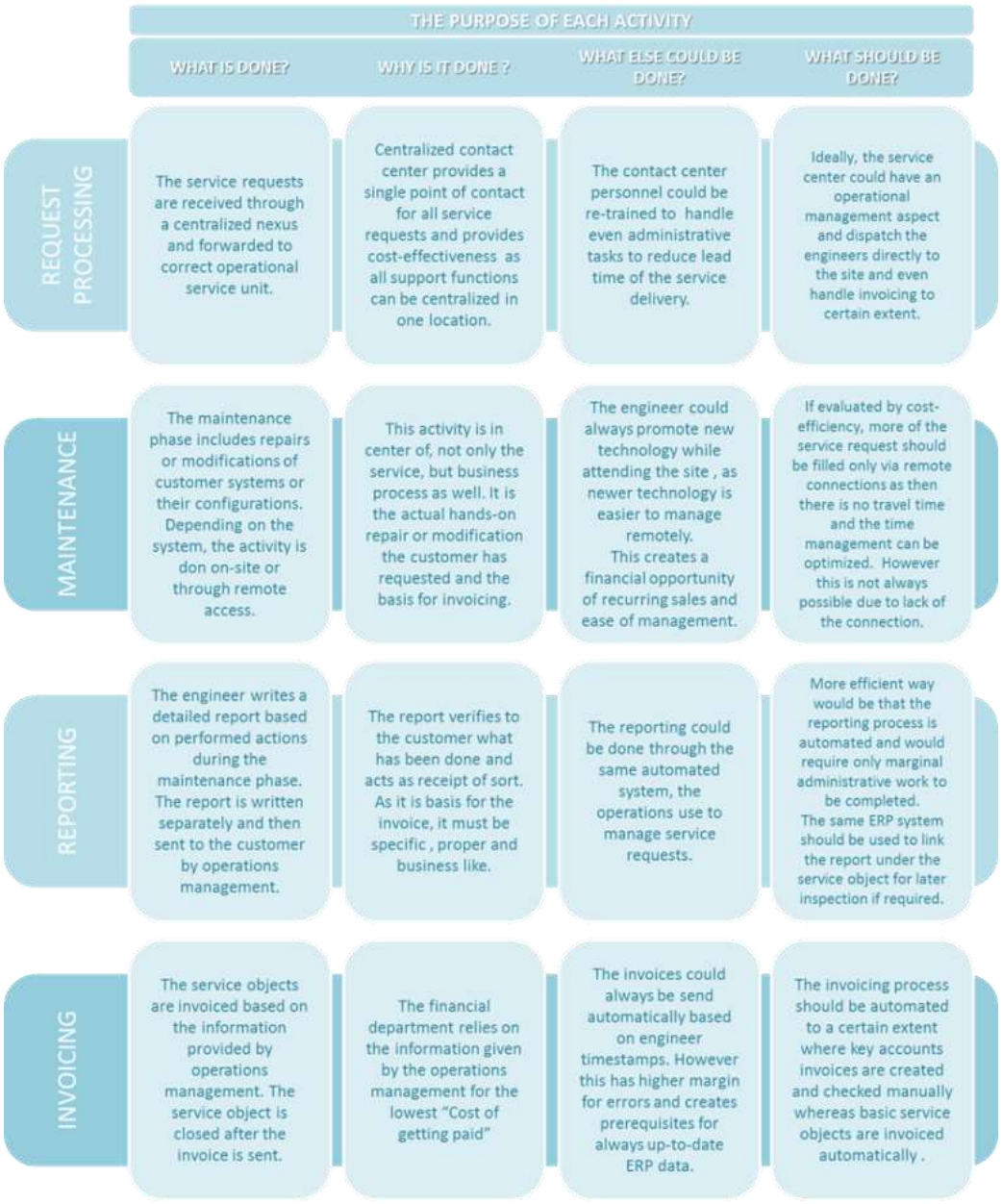


Figure 17: The questioning matrix - The Purpose of each activity (Slack et al. 2013)

The service delivery phase starts from “Request processing”, where the requests are received to a centralized contact centre and forwarded to operational units. The service centre then creates the service object into the company ERP, which will then tarry along all the way until it is invoiced and closed. While there is good reasoning why the centre exists, such as centralized service processing and support is cost-effective, a single point of contact for external stakeholders and ease of management than multiple sites, the process has still space for improvement. The service centre acts only as a support function and has no managerial or administrative role in the process itself. Ideally, the centre could work as a supervising authority, which would reduce the need of operational management and those resources could be channelled to other projects. In addition, the location of the center could also vary as majority of the tasks can be completed if access to company network is established.

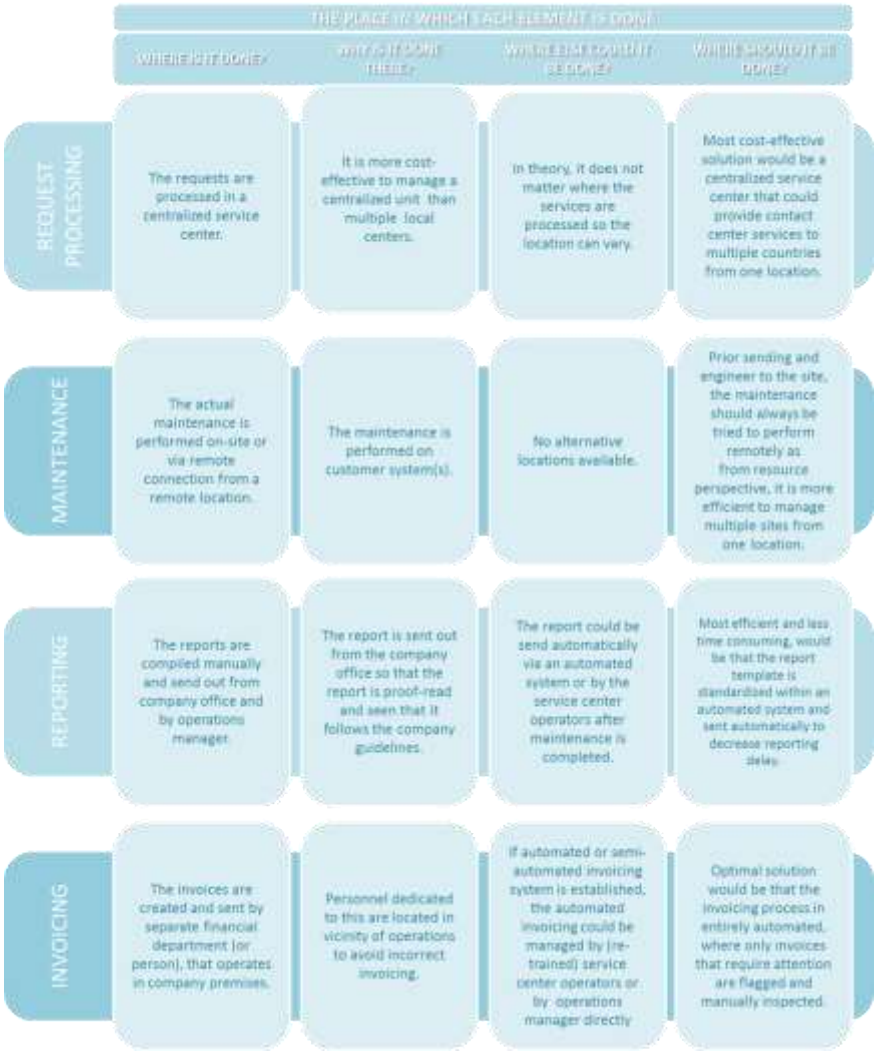


Figure 18: The questioning matrix - The place in which each element is done (Slack et al. 2013)

The tangible service customers receive, are within the “Maintenance” phase and include the repair or modification of customer system. The service can be implemented, depending on the site, system and content of the request in question, via remote access or on-site attendance. Naturally in corrective maintenance if a component is broken, it cannot be changed without attending the site. However, from resource perspective, it would be more eligible to perform the maintenance remotely if possible.

As the maintenance phase is still mostly performed at customer site, certain aspects must be taken into account before dispatching the engineer to the site. The operations must ensure that the engineer possesses the required competences and know-how to maintain the system in question as it would not be financially viable to send multiple engineers if the labour cannot be invoiced in full. In addition when working with governmental organizations, all engineers that have access to government sites must be individually pre-applied an assent that validates that specific engineer to work within that site and for that organization. As this assent must be applied beforehand and renewed periodically, it limits the options when selecting the engineer.

All service requests are fulfilled with as little latency as possible, but it is always dependant on the current availability of engineers. Human resources, or in this case amount of professional engineers, are scarce and the operations management must sometimes prioritize service requests based on urgency or contractual obligations which might require engineers to attend certain sites within a set timeframe. What the maintenance aims at, of course, is to perform all service requests as soon as possible to ensure high level of service to all of the case company’s customers.

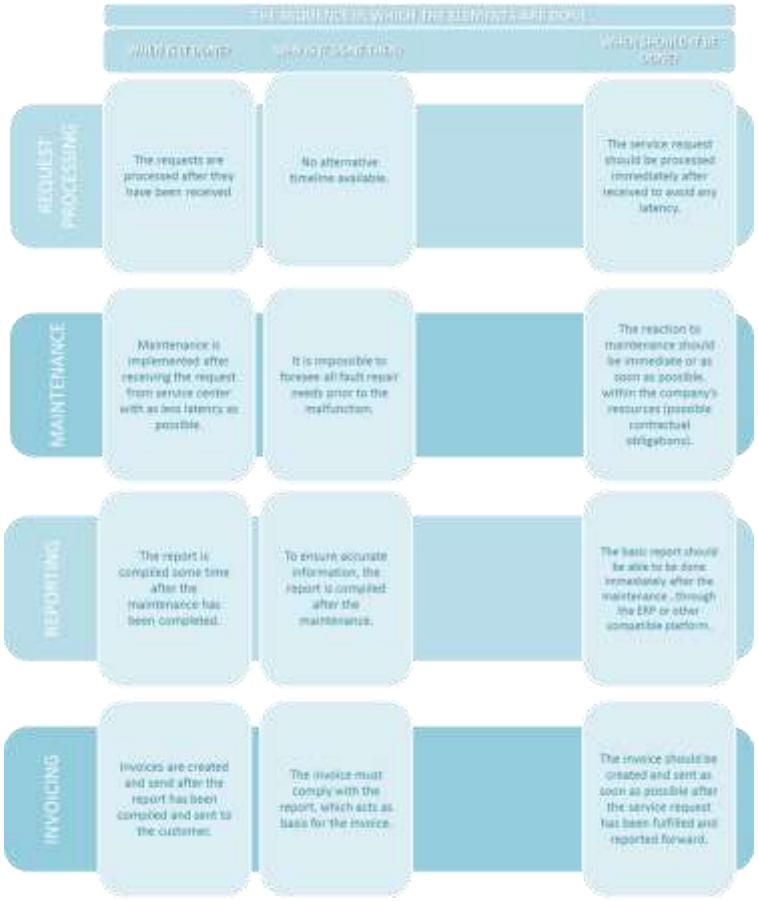


Figure 19: The questioning matrix – The sequence in which the elements are done (Slack et al. 2013)

Before the customer can be invoiced, a report must be produced and presented to the customer. This report should contain all information relevant to the service request including maintenance actions and all spare components required to maintain the system in question. These reports act as basis for invoicing, a receipt of sort. Currently the report is produced after maintenance has been completed to ensure it contains accurate information to avoid any misinterpretations and incorrect invoicing.

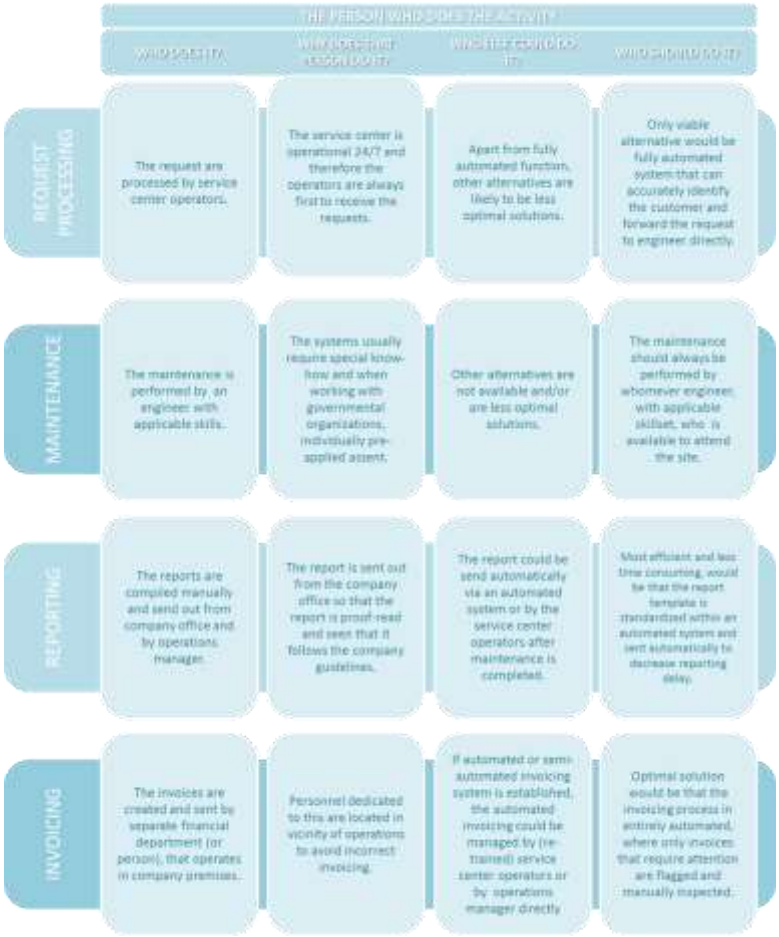


Figure 20: The questioning matrix – The person who does the activity (Slack et al. 2013)

The invoice itself is created after the maintenance has been completed and reported to customer contacts. The maintenance manager or project manager compiles all information needed for the invoice and send that information to financial department, where is it invoiced. Currently the invoices are created manually by financial department from whatever information is provided from the operations.

This however leaves room for human error and may cause latency in invoicing if the invoice order is not delivered to financial department.

Stage 4: Developing a new method

Outcome:

The current method's effectivess is improved by eliminating and combining elements or by changing their sequence.

Based of observations and results gathered from step 3 of the method study, this stage includes indications for changes and improvements for the process under evaluation.

The method study suggests that the results are evaluated using the revised principles of motion economy (see figure 9), however as the motion economy focuses on labour done by humans in an industrial environment and it is outdated and doesn't take modern technology into account, the results are evaluated using the method study and complemented by DMAIC methods.

As mentioned before, the process consists of 4 phases: Request processing, Maintenance, Reporting and Invoicing.

Request processing is already rather optimized environment as they operate from a centralized location which supports high efficiency in terms of human resources, costs and response time for request processing. However they are lacking an operational management aspect, which may cause latency and increase response times for requests.

Capable engineers are currently a scarce human resource and as the customer base increases, so does the variety of different systems. This creates a challenge as the proficiency for different systems in the market is limited with engineers and it would suggest that if the company wants to keep the response times low, they either need to invest in system user training for the engineers or limit the variety of systems they maintain.

Also, the maintenance process currently requires the engineer to be physically present at the site in order to fulfil the maintenance request. As observed before, it would be more efficient to focus on systems that support remote connections in order to yet lower the response times and increase cost-effectiveness of the maintenance process.

The maintenance report acts as a proof of completion and is thus critical part of the process. Currently the reports are compiled by operational management and the process is rather heavy and inefficient.

The author's observations can be interpreted that the effectiveness could be improved if an automated process is implemented by creating a ready report template to already existing ERP system, from where the engineer can effortlessly fill it and send it directly to the customer contact person. Furthermore if the system would even flag events that are not yet reported to the customer, it would basically eliminate the possibility of human error and decrease managerial involvement in root processes as their involvement is required only when necessary.

Invoicing is probably the most important part of any process as it ensures the continuity of the company and for that alone, it should be the most effective part of any process.

The observations continuously suggest that the invoicing process is dependent on the operations management to deliver the invoicing information to financial department for invoicing. This process can be improved by automating the invoicing within the same or integrated platform as the reporting. As the reports act as a proof of completion, it could also act as a triggering effect for an invoice. The ERP system already includes hourly fees for different customers and could easily be used to invoice basic service requests that form a majority of the company's turnover. By doing this, the invoicing latency most likely would decrease as the invoices are created the instant the engineer submits the report.

4 Discussion and conclusions

Main purpose of this conclusion part is to analyse if the current process is compliant with the company strategy and possibly suggest points of improvement for further consideration by the company.

By interpreting the results from the SAP data analysis, the sample clearly implicates that the objects should be invoiced with as little latency as possible to ensure steady margins, fast cash conversion and FCF. When compared against the financial targets in the company's strategy, they are conditionally aligning with the strategic goals of the company. As majority of the service objects are completed within six (6) days from requisition and the average margin (%) turns negative if the object takes more than seven (7) days complete, it is suggested that in order to support the financial targets the company should consider further analysing what causes the dramatic drop in average margin (%) when temporal aspect increases.

To compare the data and the current service process, this study limits the comparison to following metrics discovered in the data:

- Days to complete the service object from requisition
- Change in margin percentage for objects that take longer to complete
- Invoicing latency

The SAP data analysis clearly indicates that the majority of the service objects are already completed within six (6) days from requisition and those are also the objects that produce positive margins in average. However, the process analysis revealed that the some objects cannot be completed within the optimal timeframe due to lack of capable human resources. Also the process analysis suggested that the company should harness remote connections more efficiently to increase effectiveness and response time to attend the sites.

According to the data, the average margin goes through a dramatic drop if the time to complete the service object exceeds six (6) days, but this study does not include further study of the exact causality as it is generally confidential and cannot be disclosed. Some reason can however be stated. For example, the drop can occur in situations where the object requires more labour than has been calculated and a fixed price has been quoted, incapable engineer is initially dispatched to attend the site and requires alter attendance from other engineer thus creating double labour or if the response time is agreed contractually and operations exceeds the fixed response time thus resulting that the object can be invoiced only partially or not at all. This suggests that by annulling the scarcity in human

resources from the equation, the company might be able to complete even more service objects within the optimal timeframe and thus increase the margins from its operations.

The data also indicates some latency in invoicing which is also validated from process analysis. This latency cannot be exactly pinpointed in the outline of this project study, but indications exist that the latency is caused by human factors as the invoicing process is still dependant on manual labour and activities performed by different elements of the process.

Compliance summary

Based on the critical examination of the process and by comparing the results to company's current state of performance, a following summary and improvement points for further consideration can be made:

Figure 21: Outcomes of the study

Current performance supports the company strategy only conditionally, when the service objects are completed within, previously established, optimal timeframe. This also indicates that the process itself has room for improvement if it allows such performance with no actual fail-safes for deviations in service level.

To improve response time, the company should consider adding at least partly automated functions for reporting and invoicing and by adding managerial aspect to their service centre to only involve operational management when deemed necessary and thus allowing the operational management to allocate more time for financial management. In addition to address the challenge considering capable engineers, the company should focus on limited amount of systems that support remote connections to ensure that majority of their engineers are proficient with majority of systems used in maintenance sites and the sites can be attended remotely if possible.

These actions would decrease the latency in invoicing by eliminating parts from the current process entirely and thus support the compliance with the company strategy.

For further studies, the author suggests that the case company should explore possibilities for ready business solutions already sold in open market and benchmark the properties they might have to offer. In additions the company should start evaluating the process performance in other business units and compare the results to findings done in this research.

What comes to the learning process of the author while completing this research, it is clear that the author has deepened his insight and understanding of the case company's maintenance service process. Before starting to gather the data required to complete this study, the author had no or very little knowledge of how the different stages of the maintenance service process are connected and how dependant they can be from each other. It remains to be seen if the process can be improved based on results of this study and insight gained while conducting it.

References

Main data used for this study is taken from internal ERP system of the case company. No further details can be published, due to legislation considering publicly listed companies in Finland.

Deming, W. 1982. Quality Productivity and Competitive Position 1st edition. Massachusetts Institute of Technology. Cambridge

Fidesic Corporation Whitepaper. 2002. The True Costs of Invoicing and Payment. URL: https://www.enlivensoftware.com/Portals/0/docs/Cost%20of%20Invoicing.pdf. Accessed 19th October 2018

Gartner – IT Glossary: Enterprise Resource Planning (ERP). 2019. URL: https://www.gartner.com/it-glossary/enterprise-resource-planning-erp/. Accessed May 5th 2019.

Grönroos, C. 1984. A Service Quality Model and its Marketing Implications. European journal of Marketing, Vol 18, No 4. URL: https://www.researchgate.net/publication/233522386_A_Service_Quality_Model_and_Its_Marketing_Implications. Accessed 12th October 2018

Hitt, M. Ireland, R. & Hoskisson, R. 2005. Strategic Management: Competitiveness and Globalization 6th edition. Thomson South-Western. Mason.

Investopedia Business dictionary. 2018. URL: https://www.investopedia.com/terms/. Accessed 12th October 2018.

McGrath, R. 2013. Harvard Business review: The Pace of Technology Adoption is Speeding up. URL: https://hbr.org/2013/11/the-pace-of-technology-adoption-is-speeding-up. Accessed 15th October 2018.

Nasdaq OMX Nordic. 2018. URL: http://www.nasdaqomxnordic.com/. Accessed: 9th October 2018

Oxford living dictionarys. 2019. URL: https://en.oxforddictionaries.com/. Accessed 5th May 2019

Slack, N. Brandon-Jones, A. & Johnston, R. 2013. Essentials of operations management, 7th edition. Prentice Hall. London

Technopedia dictionary. 2019. URL: https://www.techopedia.com/definition/30051/end-of-life-product-eol-product. Accessed May 5th 2019.

Wang, C. & Ahmed, P. 2007. Dynamic Capabilities: a review and research agenda. The International Journal of Management Reviews, Vol 9. Pages 31 to 51. URL: https://repository.royalholloway.ac.uk/file/591eb589-5df7-45b1-89e0-6ed34222d85d/1/Wang%20C%20IJMR%20final.pdf. Accessed 14th October 2018