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Bachelor thesis

Getting insight into the bookkeeping department at Emons Group

Axel Dasbach
INDUSTRIAL ENGINEERING AND MANAGEMENT

Getting insight into the bookkeeping department at Emons Group

Analysing processes and making them more efficient

Supervising company
Emons Group B.V.
Rijksweg 4
6596 AB Milsbeek
The Netherlands
https://www.emons.eu/en/

Educational institution
University of Twente
Drienerlolaan 5
7522 NB, Enschede
The Netherlands
https://www.utwente.nl/en/

Company supervisors
M. Wouterse
T. Massop

University supervisors
J.P.S. Piest
I. Seyran Topan

Author
Axel Dasbach
BSc Industrial Engineering and Management

Preface

The following thesis is the result of my research done as part of the bachelor thesis assignment under the program Industrial Engineering and Management at the University of Twente. The research was conducted at Emons Group B.V., located in Milsbeek, the Netherlands.

First of all I want to thank the employees within Emons who have helped me to conduct this research. This includes, but is not limited to, the employees of the bookkeeping department for letting me observe their work, the company supervisors for the general guidance of the project and the financial employees for providing various inputs into the project.

Secondly I want to thank my supervisor from the University of Twente, Sebastian Piest. He has provided much feedback for this research and was always ready to help when I needed some guidance. Furthermore I would like to thank Ipek Seyran Topan for taking the role of second supervisor for this research.

I would also like to thank the other students who conducted their research at Emons. This project started out as a collective project. We started with online bi-weekly meetings and later had some meetings with the company supervisors at Emons itself. This made for some valuable contact with other students who were in the same situation as me.

Lastly I would like to thank some people around me who have helped me to get good inputs into the research and sometimes helped me to stay focused.

Axel Dasbach

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Management summary

Problem context

Emons Group is a transport company that specialises in niche transport markets, such as transport of glass and mushroom waste and consists of twelve companies. The financial administration for these companies is done by Emons themselves. A bookkeeping department takes care of this administration. The problem that was encountered and has led to this research is that the bookkeeping department experiences a high work pressure. Not all the tasks assigned to the department can be completed within the working time. Furthermore, there is little insight in the processes that are performed. Therefore, the goal of this research is to get more insight into the processes and then find ways to relieve some of this work pressure from the department. This is done by first mapping the current processes and with this information find ways to improve them and measure the performance.

Theoretical framework

The first step to solve the problems is to find relevant frameworks that can be used to solve them. By reviewing existing literature, it was found that one framework would be quite effective to solve the problems at hand: Business Process Management. This framework contains a cycle which consists of five phases which are used to improve processes: discover, (re)design, implement, monitor and optimise. Next, other frameworks were found to execute these phases. It was found that BPMN by means of flowcharts (discover and (re)design), Lewin's change model (implement) and performance measurement by process metrics (monitor) are some useful frameworks to reach this end.

Current situation

The first step of Business Process Management is to discover the current tasks and processes. This task analysis provides necessary information to conduct the remainder of the research. It also partly solves the problem of getting insight into the tasks and processes. The processes and tasks are graphically mapped by means of flowcharts. The process mappings can be used by the company for their processes database and to see what exactly the processes of the department are about. It was also found that there is no performance measurement currently, so with the help of a dataset a baseline measurement was set.

Process improvement

After getting knowledge on the processes, ways to improve them can be found. It was found that there are quite some simple solutions which could be implemented on a short term. Furthermore, there are some changes that require software systems to be updated. After the processes are redesigned, a plan of approach to implement them is written using Lewin's change model. Finally, ways to measure the performance have been found. These metrics show the performance of the invoice approval system and how busy and efficient the bookkeeping department is working.

Recommendations

Various recommendations have been done towards the company concerning solutions. Below the short-term changes that can be implemented will be named. Furthermore, the proposed process metrics will be mentioned.

- First of all, it is proposed to put a threshold on when a certain invoice should be sent to an approver. With the help of a risk-benefit analysis it was calculated how many hours can be freed up by implementing this change and what the maximum risk is. The change recommended by this research would free up an estimated total of four working days per month which can be used for other tasks. The threshold found with this analysis is €100.00.

The threshold can also be lowered if the company wants to have a lower risk. This is the most significant change that is being proposed.

- Secondly, changes to the way the department is working are recommended. Two changes that came up in this research are setting up a second monitor and checking the email on set moments every day. These changes should reduce some stress and increase the satisfaction of the work, thus relieving work pressure.
- The rest of the changes require system updates so that these processes are more automated. One change that would especially increase efficiency is that approvers can upload a purchase order to the system, which the bookkeeping department then matches with the invoice. This then omits the step of sending an invoice to the approver and waiting for approval, since the purchase order is already proof of the purchase.

In total five metrics have been recommended to be used by the company. The first one is the average number of days paid late. It is important to get insight into this as it can affect relationships with suppliers. The second metric is the average processing time of an invoice. This metric shows how efficient the invoice approval system is. The third and fourth metric are the number of invoices processed and number of invoices paid per day. This shows how busy the bookkeeping department is on a certain day. The last metric is the number of days needed to close a month. With this metric can be seen how efficient the month-end closure process is and whether there is any variation between months.

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Definitions and abbreviations

BPM	Business Process Management
BPMN	Business Process Modelling Notation
KPI	Key Performance Indicator
FCI	Software program which is used for processing invoices
Workflow	Software program where invoices are being approved and booked
Coda	Financial package of the company
SPSS	Software program used to analyse data and perform statistical analysis
Power BI	Software program which is used to make the dashboards

1 Introduction

The first chapter serves as an introduction to this research and the organisation. In Sections 1.1 and 1.2, some information about the company and the motivation for this research will be given. Section 1.3 introduces the problem that will be solved by means of a problem cluster. In Section 1.4 the problem-solving approach and research design will be described, which is about how the research will be conducted. In Section 1.5 the deliverables are stated. Finally, in Section 1.6 the structure of the paper will be presented.

1.1 Company introduction

This research was done for Emons Group (called Emons from here on). Emons is a family-owned group of logistics companies which was established in 1943 and now has over 700 employees. The company is based in Milsbeek, the Netherlands, and operates in multiple European countries. The company has specialised itself in niche markets, such as the transport of glass and waste of mushrooms. Furthermore, they have an innovative concept in the form of a double deck trailer, which can carry roughly twice the load of a normal trailer with pallets up to 1.80 meters high. Currently, the company has over 150 of these double deck trailers.

1.2 Research motivation

The company has come to five students of the University of Twente with the problem that they want to improve various departments within their company to make them work more efficiently. This research will look at the bookkeeping department, which consists of two full-time employees and one part-time employee. The problem that was given by the company is that the department can be more efficient, but there is little insight on how this can be done. The department has not been managed for some time and there is no clear overview of the tasks and how they are organised. The management suspects that a lot of time can be won because of this. There are no measurements of the performance, so there is no baseline on which can be improved. Because of this the department experiences a high work pressure, there is not enough time to perform all the tasks on time. The company wants to find out how this work pressure can be relieved so that the employees are more satisfied.

1.3 Problem identification

In order to find solutions to the given problem, first the causes need to be found. The employees have been observed and interviewed to find these causes, after which they are combined in a problem cluster. The problem cluster can be seen in Figure 1. In this cluster, the problems leading up to the main problem, called the action problem, are mapped. The action problem means any situation which is not how it should be, so a situation where the reality deviates from the norm (Heerkens & van Winden, 2017). The action problem that was chosen for this research is 'The bookkeeping department loses time and experiences a high work pressure'. Here the norm is that the department should have enough time to do all their tasks and should not experience a high work pressure. However, the reality is that this is not the case. Hence the situation is not how it should be, so there is an action problem. The underlying problems that cause the action problem are called core problems (Heerkens & van Winden, 2017). In the problem cluster made for this research, five core problems were identified that can be solved to improve the efficiency of the department. An explanation of this problem cluster and the motivation for the chosen core problems will be given below.

The first core problem is that many tasks need to be done by hand. There are quite some tasks that require filling in forms or checking whether the information in the system corresponds with the information the bookkeeping department has. An example is that the department needs to check

whether the customer has paid the right amount, corresponding with the invoice. There is a system which matches the payment and invoice automatically, but it can make mistakes. Since there is no performance measurement it is unknown how many mistakes the systems make. Some of the tasks are also done by less experienced staff. It is easy to make mistakes when doing tasks that require everything to be exactly correct all the time, like booking a credit note as a debit note. These mistakes need to be corrected later on, which means that time is lost. This brings us to the second problem, which is that the software programs/systems can be slow or do not respond. When the system is slow the employees will get frustrated because they cannot do their work properly. A slow system also means that the tasks will take longer to complete.

The third problem is that there is no insight into the tasks and processes performed. The performance of the bookkeeping department is not measured in any way. There is no data on which processes perform better and worse. Metrics should be set with which can be seen how long each task takes and how many times it is being done. Certain goals can be set to get the metrics to a certain level in a certain period. Also if there is no data on the performance of every task, it is hard to see which tasks can use more improvement. Since there is little insight in the performance and in what tasks the department is currently doing and no clear job descriptions are available, the company does not know how to reorganise the tasks. It would be useful to reorganise them, for example get a more coherent working routine or to see if tasks can be done differently, given to someone else or stopped completely.

The next problem is that there are no rules or internal deadlines on the invoice approval system. Incoming invoices need to be sent to other departments for approval, as these approvers know the details of a certain invoice, in order for the invoice to be paid. The bookkeeping department sends all the invoices to the approvers, independent of the type of invoice, repetition of a certain invoice or the amount. Once it is sent out, the bookkeeping department does not do anything with the invoice until it is either approved and appears in Coda (where it can be paid) or if the supplier sends a payment reminder. This means that an invoice can be in the system for a long time if the approver does not approve it timely. The bookkeeping department then has to contact the approver about the invoice, which takes up quite some time. This can be led back to the problem of having little insight into the tasks.

The last problem is that there are some laborious processes with deadlines. There are tasks that need to be performed daily, weekly, monthly or yearly. Some of them have a strict deadline, but in the meantime the other tasks still continue. An example of this is the month-end closure, which takes on average 2 working weeks (twelve companies need to be closed). Meanwhile the other tasks still need to be done as well, so these other tasks have to be delayed.

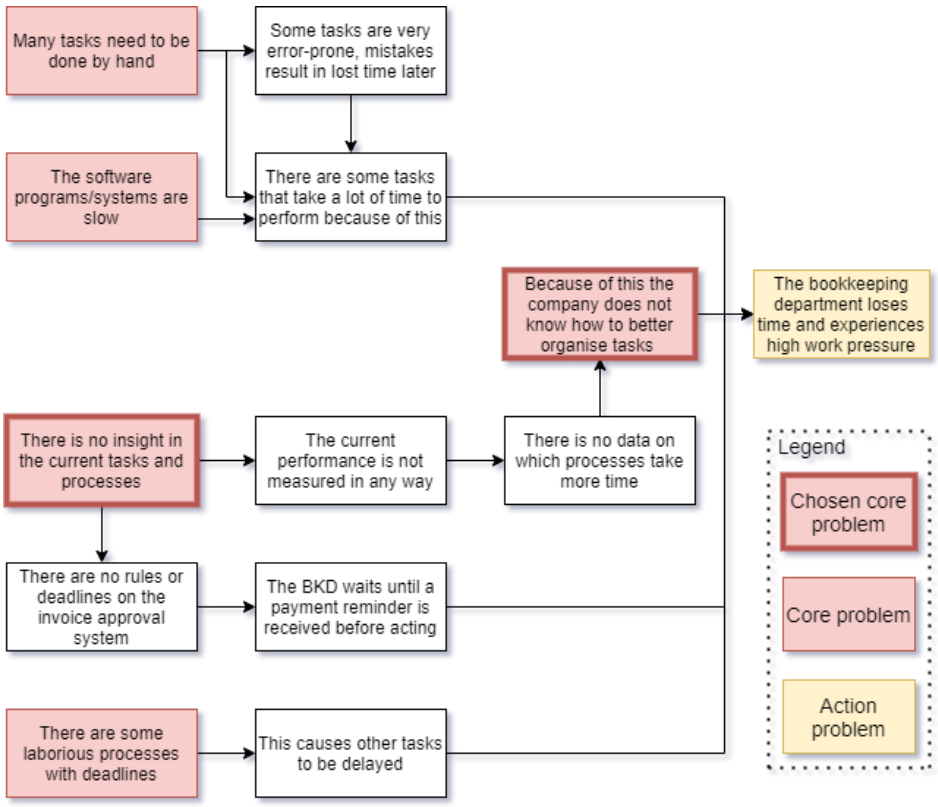

Figure 1: Problem cluster (own drawing based on Heerkens & van Winden (2017))

The first two problems are dependent on software systems and will need coding to change the way these systems work. Therefore, they could be seen as action problems in itself, it is a situation that needs to be changed. However, they have been noted as core problems here, because they are partially the problem behind the loss of time. The laborious tasks are also something that will be hard to change, as there is no measurement of how exactly other tasks are delayed because of this. Getting insight into the tasks and setting up a performance measurement are both things that can be done, for example by using models and thinking of metrics which can be used to see how the department is performing. When there is more insight into the tasks it will be easier to see how the tasks can be better organised. Setting rules on the invoice approval system could be a part of this. By looking at these two problems there will be a clear overview of the information that is needed to reorganise tasks. This should ultimately lead to an increase in time left over for other tasks and a lower work pressure. Thus, the two core problems that will be looked into are:

1. There is no insight into the tasks of the bookkeeping department.

2. Because of this there is no knowledge on how to better organise the tasks.

1.4 Research design and research questions

The objective of this research will be to get insight into the tasks of the bookkeeping department and to find a way to organise them in a better way. This has resulted in the following research question:

'How to get insight into the current tasks of the bookkeeping department and how can the tasks be organised in a better way?'

In order to answer this research question, some other knowledge and research questions have been defined. These questions will help to get an answer to the main question and are based on the different phases of this research which will be explained below. This approach is based on the

Managerial Problem Solving Method (MPSM) by Heerkens & van Winden and the Business Process Management lifecycle. They are both systematic approaches, where the MPSM is used to solve a problem and BPM is used to make processes more efficient. The phases are as follows:

1. Reviewing literature
2. Mapping the current situation
3. Redesigning the processes
4. Implementing the changes
5. Monitoring the changes
6. Evaluation

Theoretical framework

In the first phase certain theories which can be useful for solving the core problem are found. The knowledge questions that will be answered by means of a literature review are:

- *'How can Business Process Management be used to optimise business processes?'*
- *'Which frameworks can be used to successfully utilise Business Process Management?'*

Since part of the research goal is to get insight into the tasks, a way to model them has to be found. The models will be useful for the company to see what tasks need to be performed by the bookkeeping department and how. Another goal is to reduce the workload so that the department will experience a lower work pressure. Thus it is useful to find some methods which can be used to reduce waste in the tasks so that they can be done more efficiently. A preliminary research has led to Business Process Management (BPM) being chosen as the main framework. Then frameworks to successfully execute BPM will be found. The company can use these methods to implement the proposed changes. The questions will be answered by reviewing existing literature and can be found in Chapter 2.

Methods

This is not a phase in the research, but Chapter 3 will explain how the different methods have been used to conduct the research. This consists of the models that were found during the literature review in the previous chapter and the research methods that were used within the company. During this chapter the following question will be answered:

- *'How can the theoretical frameworks be used to solve the core problems?'*

Current situation

The second phase of this research design consists of mapping the current situation at the bookkeeping department. The following research questions will be answered:

- *'What are the current tasks and processes of the bookkeeping department?'*
- *'What is the current performance of the bookkeeping department?'*

The tasks and processes as performed by the department are mapped through observations and interviews held during multiple sessions. This partly solves the first core problem of getting insight into the tasks of the department. The task analysis is the first phase of the BPM cycle and is needed to perform the rest of the research. Furthermore, a look will be taken into the current performance of the bookkeeping department. This phase is described in Chapter 4.

Process improvement

The third, fourth and fifth phases are about improving the current processes. During these phases the remainder of the BPM cycle is carried out. The following research questions have been set up based on the BPM cycle:

- *'Which tasks can be made more efficient?'*
- *'How can the redesigned processes be implemented?'*
- *'How can the performance of the bookkeeping department be measured?'*

Once there is a clear picture of the tasks, ways to redesign the tasks can be found. Bottlenecks in the current processes are analysed to see what can be improved. This will be done by reviewing literature and having discussions with the company discussing their opinions on potential changes. Then the changes need to be implemented, which will be done with the help of frameworks that were found. This is written in the form of a plan of approach on how to implement the changes. Finally ways to measure the performance of the bookkeeping department are found by analysing a dataset and again reviewing literature. The metrics are set up in such a way that they reflect what the company wants to measure. The questions will be answered in Chapter 5.

Evaluation

In the final chapter, Chapter 6, an evaluation on the research will be given. Firstly, the research question will be answered and the research will be concluded. Then, certain recommendations towards the company will be given based on the findings of this research. Furthermore, the scientific contribution of this research will be discussed. Finally, limitations of the research will be discussed and where applicable further research that can be done on these topics. The question that will be answered is:

- *'What are the main findings of this research?'*

1.5 Deliverables

The first deliverable is a dashboard containing all the current tasks done by the five departments that were followed. This is made together with the other students. For every task attributes, subtasks, software used and triggers (some tasks need a trigger before they can be started, some tasks trigger another task to start) are noted. These characteristics are then linked to each task by means of a code. For example task 100001 is linked with subtask 500001. In this way a dashboard can be made where it is very easy to see which tasks belong to a certain department and what the characteristics of that task are. The company currently does not have something like this and it gives a very clear overview of all the tasks. A preview of this dashboard can be found in Appendix C.

The second deliverable is an analysis of the current tasks and processes as performed by the bookkeeping department. This deliverable will consist of flowcharts which show the steps of a certain process. Also, separate explanations of the processes will be given to clarify the flowcharts. These flowcharts can be found in Appendix A. Furthermore, a baseline measurement of the performance will be given.

The third deliverable consists of different recommendations. First of all there are recommendations on different changes to processes which can be implemented. The aim of these changes is to reduce the time the department spends on certain processes, relieve work pressure and increase satisfaction of the work. Then recommendations are given on metrics that can be used to measure the performance of the invoice approval system and efficiency of the department. A design of the dashboard is also made and can be found in Appendix B.

1.6 Paper structure

The remaining part of this paper proceeds as follows: First the theoretical frameworks that have been found are discussed in Chapter 2. In Chapter 3 will be explained how the different frameworks have been applied to the research at hand to solve the core problem. This chapter also contains information

on which research methods were used at the company. Chapter 4 describes the current situation, which includes the tasks and processes of the bookkeeping department and the current performance. In Chapter 5 the processes will be improved. Firstly, possible changes to the processes are found, then a way to implement them is described and finally a dashboard containing process metrics is proposed. In Chapter 6 the research will be concluded and the results will be evaluated. Finally there are some supporting appendices which contain the deliverables and clarifications.

2 Theoretical framework

The goal of this chapter is twofold. In Section 2.1 will be explained what Business Process Management is and the question *'How can Business Process Management be used to optimise business processes?'* will be answered. Sections 2.2 to 2.5 will discuss different frameworks which can be used to execute Business Process Management properly. The question *'Which frameworks can be used to successfully utilise Business Process Management?'* will be answered.

2.1 Business Process Management

2.1.1 About processes

Business Process Management (BPM from now) is a way to look at the processes within a company in order to make them more efficient. Before a deeper look will be taken at BPM, first the definition of a process will be given. Zairi (1997) notes that a process is a series of related activities which transforms a certain input into output by adding value. This is done to reach a certain goal. As cited by Zairi (1997), Bulletpoint (1996) notes that there are four criteria for a process:

- The first one is that there are predictable and definable inputs. This means that it is clear what the process needs to start and to be carried out.
- The second criteria is that there should be a logical flow. It should be clear that certain activities are needed to trigger another activity. It is for example not possible to send a package without transport, first the transport has to be arranged.
- The third criteria is that a process consists of clearly definable tasks or activities. Thus, a process can be broken down into smaller tasks which put together lead to the end goal of the process.
- Finally, a process should have a certain outcome that was set in advance. As was described above, a process needs to have a certain goal. This goal should be clearly defined so that it is clear why the process needs to be carried out.

Now that it is clear what exactly a process is, a deeper look can be taken into BPM. As noted before, BPM is used to make the processes within a company more efficient. Every company makes use of processes in order to run their business. A lot of companies may not have defined their processes specifically. This is where BPM comes in. By using BPM, a company can look at and analyse their current processes to see whether there are any inefficiencies and where they are.

2.1.2 BPM phases

When a company wants to start using BPM to improve their processes, they will usually start with the BPM life cycle, depicted in Figure 2. The cycle below is partly as explained by Vercruysse (2017) and vom Brocke & Rosemann (2015) and consists of five phases: discover, (re)design, implement, monitor and optimise. It is a continuous cycle, meaning that once it ends the whole process will be done again, with continuous improvement as a goal (Achuthan, 2019).

Discover phase

During the discover phase the current tasks and processes are identified, also called as-is modelling. This phase is very important as it gives a clear picture of the current situation, which can then be analysed for improvement. By applying this step it will be easier to design a new process, as the company knows what has already been tried and done. It is a requirement for being able to redesign a process, because without knowing exactly how a process works it will be hard to redesign it. Some companies have already mapped their processes, in which case this phase can be skipped or reviewed and adjusted. As per definition of a process, in order to map all the processes as correctly as possible,

it is important to map all the inputs that go into a certain process, the outputs that come out of it and the flow of the data within processes. A commonly used tool is BPMN with flowcharts as a deliverable, which will be elaborated on in section 2.2.

(Re)design phase

In the second phase, the (re)design phase, the discovered processes will actually be analysed. This can be done by looking at the processes that were mapped during the first phase. Things that can be looked at for example are how many people interact with a certain process, whether there is any waste in the process and see if there are tasks that do not add value. Once the bottlenecks or wastes are found, ways to change the process can be thought of, which is called redesigning. Redesigning can be useful when the process is working fine, but there are certain bottlenecks which keep the process from reaching its full potential. It is also possible that a company wants to design a completely new process. This can be useful if the current process is only counterproductive or does not work anymore. The modelling of the (re)designed process(es) is called to-be modelling, the processes are modelled in a way they should be performed in the future.

Implement phase

After the processes have been (re)designed, it is time to actually implement the new processes. This implementation phase is an important phase, as new ways of working are introduced. The workers in a company have gotten used to a certain way of working, so it requires some adjusting to the new ways. It is also possible that certain systems need to be updated to be able to perform the new task. This means that it must be clear to the workers what their new task will be and why it is designed that way. Lewin's 3-stage model of change and Kotter's 8-step change model can be used to implement the new changes (Jouany & Martic, 2020). These models will be explained in Sections 2.3 and 2.4 respectively.

Monitor phase

In order to know whether a certain implementation has had the desired effect, its performance has to be monitored. This is mostly done by using Key Performance Indicators or other metrics. A deeper look into performance measurement will be taken in Section 2.5.

Optimise phase

Finally, the last phase is the optimise phase, also called the governance phase by Vercruysse (2017). During this phase, ways will be developed to further improve the process. With this phase the cycle both ends and starts anew, in order to improve the process even more.

Figure 2: BPM life cycle (Vercruysse, 2017)

2.2 Flowcharts

The as-is and to-be processes of a company can be modelled in a graphical way. Flowcharts can be used to reach this end. A flowchart uses different symbols which include a small description of the task and arrows to connect the symbols (Hebb, 2012). The arrows show which way the process is flowing. The flowcharts can be used by employees to see exactly how a certain process works or to analyse the process and improve it (Lucidchart, 2016). This can be done by finding bottlenecks in the flowchart or removing wastes in the process. There are different symbols which represent different steps in the flowchart, such as processes, decisions, documents and inputs or outputs. These symbols have been standardised and are a part of Business Process Modelling Notation (BPMN). BPMN was created to have a simple and standard way of showing business processes, while at the same time being able to show their complexity (White, 2004).

2.3 Lewin's 3-stage model of change

Employees in a company adopt a certain working routine over time. Implementing new changes is therefore something that could be resisted at first (Jouany & Martic, 2020). However, implementing new changes is vital for finding improvement and making processes more efficient. This is where Lewin's 3-stage model of change can be used, seen in Figure 3. Below the three steps of this model will be stated as explained by Jouany & Martic and Hartzell (2019).

Unfreeze

When changes are proposed, employees will likely resist them at first. The goal during this first stage is to prepare employees for change and make them aware of why change is needed. It is therefore important to show employees why their current working routine could use some changes and how it will benefit them. Once the employees get a sense of why the change is needed they may be more likely to accept the change. This requires good communication in order to bring over the message in a way that the employees will receive it and listen to it.

Change

Once the employees and processes are unfrozen it is time to implement the new changes. During this time, employees need to learn a new way of working and need to get used to a new routine. Although their routines were unfrozen before, once the change is actually implemented the employees may again start to resist the change. They should continuously be reminded of why the change is implemented and how it will benefit them once the change is in full effect.

Refreeze

In the final stage the changes are accepted by the employees. The goal of this stage is to refreeze the newly changed processes so that it becomes the new routine. This stage may be the most important, as performing this step in the right way ensures that employees do not fall back to old habits. A way to prevent this from happening is to acknowledge the efforts that the employees made, so that their motivation will stay high. Hartzell notes that some say the refreezing stage is not from this time anymore because of the increased importance of continuous improvement. However, it was emphasized that it is very important that employees do not fall back to old habits. Otherwise the whole process was done for nothing and can be started all over again.

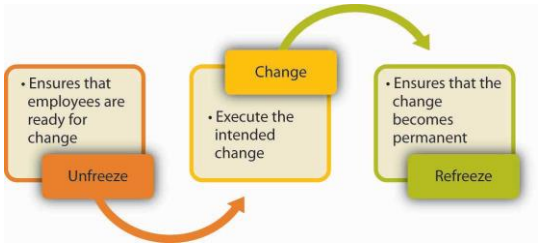

Figure 3: Lewin's 3-stage model of change (Joy, 2015)

2.4 Kotter's 8-step change model

Another implementation model that can be used is Kotter's 8-step change model, as seen in Figure 4. This model is more aimed at continuous improvement rather than implementing a single change like Lewin's model. Below the eight steps of this model will be explained as explained by Jouany & Martic and Kotter (2021).

1. **Increase urgency.** First of all, employees need to see that there is a need for change. This will motivate them to be engaged throughout the implementation of the change.
2. **Build the team.** In order to implement change there has to be a team that takes care of carrying out the changes. Leadership is needed to effectively put the changes into place and get support from the employees.
3. **Get the vision correct.** It should be clear what the future will look like and how that future can be reached. This makes it clear to employees why certain changes are being implemented and why there is a need for change in the first place.
4. **Communicate.** Forming a vision is one thing, but this vision should also be clear to the employees. Therefore it has to be communicated to them. It is important to communicate frequently, so that the change starts to live in the working place.
5. **Get things moving.** During this step obstacles are removed that stand in the way of change. This could be an inefficient process or an employee who resists the changes. It is important to find these barriers and remove them. Feedback can be received, for example by an employee who is resisting the change.
6. **Focus on short term goals.** It is important to not only focus on the end result, but also have some goals in between which can be reached. People like to have success and reaching these goals can motivate them to keep on going.
7. **Incorporate change.** Once a first success is reached, it is important to keep on pushing change. By making change part of the workplace, employees will get used to it after a while. New goals can be set after reaching a previous goal, until the vision that was set before is reached.
8. **Don't give up.** Obstacles may (re)appear when implementing a change. It is vital to not give up when such obstacles appear but try to remove them. The changes should become the new standard and replace the old habits.

Figure 4: Kotter's 8-step change model (Lean Six Sigma Groep, 2021)

2.5 Performance measurement

As mentioned above, during the monitoring phase of the BPM cycle, the performance of the chosen process has to be measured. There are multiple reasons why it is important to measure the performance, as discussed by Lebas (1995). First of all, it shows the current performance of a certain process and the measures can be used to set new goals for the future. With this in mind, the performance measurements then show whether there is a gap between the current and desired performance and if so, how big that gap is. Finally, the measurements can be used to see whether the goals that were set have been reached. One major drawback of measuring performance is that the data used is data from the past. In the future something could happen which can never be predicted by the data. However, the past data comes closest to what one could expect in the future. After all, if a company knows what will happen in the future there would not be a need for measuring the performance.

When thinking about performance measurement, the first thing that may come up for many is the Key Performance Indicator (KPI). A KPI measures the organisational performance of a certain company, focussing on critical aspects of outcomes (Chan & Chan, 2004). Bauer (2004) describes KPIs as "quantifiable metrics which reflect the performance of an organization in achieving its goals and objectives". It is usually advised that a company does not have too many KPIs, so that the company is able to keep track of all of them.

With the current ease of collecting data, there are many more things than just the KPIs discussed above that can be measured. By executing any process or task in a system, new data is collected and stored in a database. All of this data can be analysed to improve the every-day processes. These measures are called process metrics or business metrics. Process metrics measure the performance of day-to-day processes and, while important, are not necessary for reaching the strategic goals of a company (Enochson, 2021). So summarising KPIs and metrics: while a KPI is also a type of metric, a metric does not always have to be a KPI.

2.6 Conclusion

In this chapter the questions *'How can Business Process Management be used to optimise business processes?'* and *'Which frameworks can be used to successfully utilise Business Process Management?'* have been answered. It was found that the five phases of the BPM cycle provide a solid approach to improve processes systematically. To successfully execute the phases, different frameworks were found. First of all BPMN was discussed with the main focus on flowcharts, which can be used during the discover and (re)design phases. Implementation models by Lewis and Kotter were discussed as potential frameworks to execute the implement phase. Finally, performance measurement using metrics was found to be useful for the monitor phase.

3 Methods

In the previous chapter the theoretical framework was described. During the following chapter will be explained how the various frameworks will be used to conduct the rest of the research. The question that will be answered is *'How can the theoretical frameworks be used to solve the core problems?'*. Section 3.1 will talk about how BPM is used to improve the processes. Section 3.2 talks about different methods and data that have been used to conduct research at the company. Finally, Sections 3.3 and 3.4 will talk about the different frameworks that have been chosen to execute the BPM cycle.

3.1 Using BPM

As was seen in Chapter 2, BPM provides a very useful cycle that can be used to improve the processes within a company. Therefore, it was chosen to use this method to conduct the research and get results. Below will be explained how the first four phases of the BPM cycle were used during this research. The last phase is not used as this is a very broad phase and would not fit within the scope of the research due to the limited time. It is more of a continuous phase rather than a single cycle of changing processes and implementing the changes, which is what this research is about.

Discover phase

In the first step the tasks and processes as they are currently being performed by the bookkeeping department will be mapped. This will partly be done by means of flowcharts, where it can easily be seen how the inputs for a certain process flow through the process and become outputs. These flowcharts can be used by employees outside the bookkeeping department to see all the tasks. The flowcharts will be made for the processes that are done on a regular basis, which in this case means multiple times per week. Furthermore, processes that involve other departments are also being mapped. The other processes will not be made into a flowchart, either because they are stand-alone tasks or because not enough data was collected on them. The flowcharts will be presented to the company to get feedback, so that they are as accurate as possible. More on how the flowcharts are used can be found under Section 3.3.

The processes will also be explained, as they need extra explanation and some cannot be captured in a flowchart. For each process will be described what the inputs and outputs are, how the inputs flow throughout the process and what the different tasks within the process are.

Redesign phase

After mapping the processes, the current processes can be improved. During this research, the processes will only be redesigned. The processes as performed by the bookkeeping department are not outdated, recent systems are being used and many things are automated. However, there are still some inefficiencies which have led to this research. The processes will be redesigned by looking at every task to see whether there is anything that could be improved. The wastes for every process will be identified, so that these wastes can be reduced and thus bottlenecks can be removed. Then literature will be used to find what kind of improvements have already been thought of. The findings will be shared with the company and with their feedback the final changes will be proposed.

Implement phase

During the third phase, a plan of approach to implement the redesigned processes will be written. The bookkeeping department has gotten used to a certain way of working. Therefore, it is important to make a plan that not only describes what the redesigned process is, but also why it will be an improvement. The plan should describe what the thought process behind changing a certain process is. Then the changes need to be implemented. Lewin's change model is used to write a plan of approach on implementing the new changes, which is elaborated on in Section 3.4.

Monitor phase

The last phase that will be performed during this research is the monitor phase. This research will try to find ways to measure the performance of different processes. It is important to measure both the performance before and after the change was implemented in order to see whether the implemented changes have actually had an effect. This is also possible because the processes are being redesigned, the inputs and outputs do not change. A plan of approach will then be written on how the measurements can be implemented and used to further improve the processes.

3.2 Data collection

In order to map the current processes and tasks of the bookkeeping department, data has to be collected. First, two semi-structured interviews were held, each with one of the two employees of the bookkeeping department and with the company supervisors. During these interviews an introduction to the problems and the tasks and processes of the department was given. To get more insights into the processes, observations were done in combination with unstructured interviews based on the observations. During three sessions, the working days of the employees were followed by observing what the two employees are doing. While observing the employees, questions were asked depending on what was seen during the observations or to ask for clarifications. The findings were written down in a notebook. A semi-structured interview was held to get more information on some processes and on the problems experienced. Notes on the interviews and observations can be found in Appendix E.

3.2.1 Dataset

Since many of the processes the department performs are done through systems and processed into an administration, data has been collected on these events. The company has made a dataset on one of the processes available for this research. This dataset consists of information of every supplier invoice that was booked in the month of May. There is data on the amount that needs to be paid, when a certain invoice was created by the supplier, when it needs to be paid, when it first arrived at the company and, if the invoice was paid, the payment date. There is also data on when the invoice was first entered into the system and when it was approved. This dataset can be used during the monitor phase to find meaningful metrics, since this data is readily available and thus no other data has to be collected. It will also be used during the redesign phase to show supporting evidence for some of the claims. In total 1746 invoices were processed during the month of May. To give an idea of this dataset an anonymized extract can be seen in Table 1. The data that could be led back to a certain invoice or supplier has been left out due to privacy reasons.

Table 1: Anonymized extract of original dataset

Company code	Document code	Document date	Year/period	Home value	Due date	matching date	firstdate	lastdate	days in wf	org. Invoice date
121	X-PURCHASES	3/5/2021	2021/5	-0.75	24/5/2021	3/6/2021	5/5/2021	12/5/2021	7	1/4/2021
431	X-PURCHASES	1/5/2021	2021/5	-0.76	8/5/2021	31/5/2021	3/5/2021	12/5/2021	9	26/4/2021
451	X-PURCHASES	1/5/2021	2021/5	-1.37	11/5/2021	11/5/2021	3/5/2021	17/5/2021	14	14/5/2021
411	X-PURCHASES	1/5/2021	2021/5	-2.03	30/5/2021	3/6/2021	3/5/2021	17/5/2021	15	1/4/2021
431	X-PURCHASES	1/5/2021	2021/5	-2.50	27/4/2021	11/5/2021	21/4/2021	17/5/2021	26	20/4/2021
431	X-PURCHASES	10/5/2021	2021/5	-2.50	25/5/2021	3/6/2021	17/5/2021	28/4/2021	-19	15/4/2021
211	X-PURCHASES	12/5/2021	2021/5	-2.90	26/6/2021		14/5/2021	17/5/2021	3	7/5/2021
111	X-PURCHASES	1/5/2021	2021/5	-3.15	30/5/2021	2/6/2021	4/5/2021	17/5/2021	14	1/5/2021
461	X-PURCHASES	12/5/2021	2021/5	-5.47	22/5/2021	27/5/2021	14/5/2021	17/5/2021	3	10/5/2021
311	X-PURCHASES	1/5/2021	2021/5	-5.50	19/4/2021		10/3/2021	17/5/2021	68	20/4/2021
311	X-PURCHASES	1/5/2021	2021/5	-5.50	20/5/2021	17/5/2021	9/4/2021	18/5/2021	39	31/3/2021

3.3 Flowcharts

Flowcharts are used in this research to show the current processes. Every flowchart represents one process. The company is building a database where all the processes performed in the company are being registered. Therefore, the work done during this research can very well be combined with the work the company is doing. The symbols used are those of BPMN, as this is a standardised language to make flowcharts and is widely accepted. The different symbols that are used in the flowcharts can be seen in Figure 5 and will be explained below; they have been taken from Gagné & Ringuette (2015).

Solid arrows are used to connect the tasks, start, end and decisions. Dashed arrows are used to connect data or documents to the tasks.

- *Start process* is the starting point of the flowchart. Sometimes a trigger is needed to start the process, in which case this trigger is mentioned in this symbol instead of 'Start process'.
- *Task within a process* is a step that is taken during the process to transform the input into output. Simple examples are checking the email or checking an invoice.
- *Decisions* are points where a certain choice has to be made between two alternatives or a question is posed. It contains a question which can be answered with yes or no. Depending on the answer, a different route in the flowchart will be followed. Decision nodes are depicted with an X inside and the question next to the symbol.
- *Database accessed or data stored* means that the tasks leading up to that point have been performed multiple times and the outputs are collected in a software system or database, where the data can be accessed and the next task can be performed.
- *Document or data input* means that a certain document or data input has to be created to continue with the tasks. An example is an email that needs to be received. The difference with 'Start process' is that the document or data input is created during the process. For example the department performing the process has to send an email which is needed for the other department to continue the process.
- *End of process* simply means that a process has ended. The description in the symbol tells which process comes next.
- The swim lane diagram consists of different columns which can be given a name on top of the columns. Each column then represents a certain department. Every symbol that is in a certain column is performed by that department. On top of the swim lane diagram the process name can be mentioned.

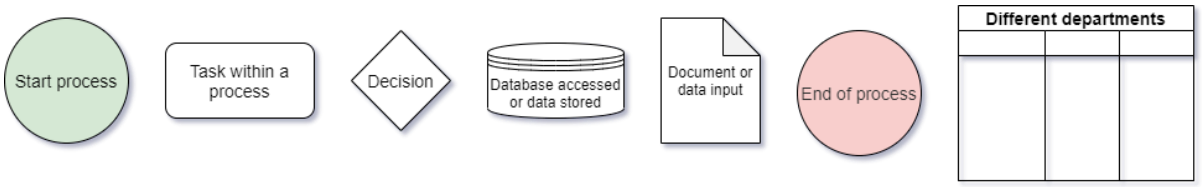

Figure 5: Symbols used in the flowcharts (own drawing based on Gagné & Ringuette (2015))

3.4 Lewin's change model

Lewin's 3-stage model of change will be used during the implementation phase of the BPM cycle. This research will describe how Lewin's model can be used to implement the changes that were thought of in the form of a plan of approach. Lewin's model was chosen because it is a model that implements a change and then takes this change as the new standard. Other models were considered like Kotter's 8-step change model, but these models were mainly focussed on continuous improvement. Lewin's model fits the bookkeeping department better because it implements change in a way that it can be overseen and adapted to. Also, since the department has not been managed for some time it is better to implement a few changes first and make them the new standard instead of continuously throwing changes at them in order to minimise resistance.

3.5 Conclusion

This chapter has answered the question *'How can the theoretical frameworks be used to solve the core problems?'*. It was found that the first four phases of BPM can be applied to this research to find and

implement a single round of changes. To discover the current processes, observations and interviews will be held. With the help of BPMN in the form of flowcharts the findings can be mapped. Using these flowcharts, improvements to the tasks are found and proposed to the company. By using Lewin's change model, a plan of approach on how to implement the changes can be made. Finally, with the help of a dataset, process metrics can be found and set up and a dashboard can be proposed.

4 Current situation

In this chapter the current situation at the bookkeeping department of Emons will be described. In section 4.1 the current tasks and processes as performed by the department will be defined, mapped and described. This information will be gathered by means of an observational study and interviews and will answer the question '*What are the current tasks and processes of the bookkeeping department?'*. In Section 4.2 the question *'What is the current performance of the bookkeeping department?'* will be answered by analysing some data to create a baseline measurement. The flowcharts that have been created can be found in Appendix A.

4.1 Tasks and processes

The bookkeeping department in Emons takes care of the financial administration of all the companies that are part of the Emons Group. This includes paying suppliers, making sure that customers pay, closing financial periods and other administrative tasks. The only task that does not belong to the bookkeeping department is making invoices for customers, the company has a billing department which handles this. Below the tasks and processes of the bookkeeping department will be explained. A process is a series of stages, which are called tasks, that are done to reach the end-goal. Thus a process can consist of multiple tasks.

4.1.1 Debtor management

One of the employees controls the debtor management. What this means is that the bookkeeping department has to make sure that customers pay their invoices. The main objective of Emons is to make a profit, so it is very important that customers actually pay their invoices. The billing department collects the costs that are involved with a certain order, creates an invoice and sends this invoice to the customer. This invoice is also printed out and handed over to the bookkeeping department. For these processes the inputs are the invoices as made by the billing department, while the outputs are payments made by the customer.

Matching payments with invoices

The first process that was encountered is matching payments made by customers with the invoices that were sent to the customers. Every morning the bank account of each Emons company is checked to see how much money has come in. The billing department sends the invoices that were send to customers to the bookkeeping department. Each invoice has a unique number or code which has to be mentioned with the payment. A software program then matches the invoice and payment depending on this number. Sometimes this system makes a mistake, for example when the number was not identified or the customer only mentioned one number while paying multiple invoices. It is also possible that an invoice is not found at all. When this happens the employee has to manually look for the invoice to make sure that the right amount was paid. Once the payment and invoice are matched they will be removed from the list and the invoice can be processed into the administration.

Sending payment reminders to customers

Another process that is part of the debtor management is sending payment reminders to customers. It can happen that a customer does not pay in time. When this happens the bookkeeping department has to reach out to the customer. This is being done by sending payment reminders, which happens by post. This is done every two weeks for each Emons company. The employee can see in their system which customers have not paid yet but should have, so that a payment reminder can be created and sent to the customer. Coda takes care of creating the reminders, after which they are edited in Word to make them look better. Then the reminders are printed, folded and put into an envelope, after which it is sent. When a customer still did not pay after passing the due date three times, the department will send an email to the customer or call them to ask for more information.

4.1.2 Handling supplier invoices

Most of the working time is spent on processing and paying invoices of suppliers. Emons has various suppliers, such as repair shops and energy companies, which provide services for them. Once a service has been provided, the supplier will send an invoice to the bookkeeping department with the amount to pay, this is the input into the process. It is the job of the bookkeeping department to pay this invoice, the payment being the output. There are a couple of processes that are part of processing the supplier invoices.

Approval of invoices

The first process is getting approval for an invoice. Emons gets a lot of invoices every month. It is important to make sure that every invoice was sent correctly and actually has to be paid. A supplier can for example make a mistake, send an invoice twice or a fraudulent invoice can be received. Within Emons, there are various employees who made the purchase or know the details of certain invoices or contracts with suppliers. These employees need to approve an invoice before it can be paid. Invoices come in on a special email for suppliers in pdf format. After the email with invoice is received, the invoice is downloaded and uploaded to a program called FCI, in which important data on the invoice are highlighted, like the amount, bank number and whether it is a credit or debit note. It is possible that this program did not highlight everything on the invoice, so every invoice also has to be manually checked by an employee.

After the invoice has been analysed, it is sent from FCI to the financial workflow. In this software system all the invoices are being collected. The workflow is where the approval of invoices happens. Both of the employees can see the same list of invoices. Each employee handles invoices for their assigned companies so that an invoice is not checked twice and to prevent confusion on who is checking which invoice. The employee can click on an entry in the list to see the scanned invoice. On the left side of the screen, data about the invoice can be found. This is the data that was highlighted in FCI, so again the employee has to check whether the data is right (whether the data was carried over correctly from FCI). This is an important step, as the workflow is where the invoices get booked on a certain account in the administration. Common mistakes are booking credit notes as debit notes and vice versa and mistakes with currencies, since Emons also gets invoices from countries with different currencies. Once the invoice is checked, a comment will be added stating the period (either the month or the week) depending on the type of invoice and then it gets sent to the person(s) that need(s) to approve the invoice.

The workflow has certain rules on where invoices will be booked and to which approver it will be sent. Every supplier has an internal code which is on the invoice and this code determines where the invoice is booked. Once an invoice has been checked it will directly be sent to the approver. The approver is an employee from another department who has made the purchase. It is also possible that there are multiple approvers, for example when different departments purchased different parts on the same invoice. Finally, there is a cost manager who has to check invoices above a certain amount. The company has put up rules that one approver can only approve up to a certain amount of money for an invoice. When an invoice is above this amount, it has to go through the cost manager before being able to be approved.

When the invoice is sent to an approver, an email will be received by the approver stating that the invoice is in their workflow. The approver then has to check the invoice to see whether the details are correct with what has been agreed upon with the supplier. When multiple approvers are needed, the invoice will automatically be sent to the next person after the previous one has approved it. The bookkeeping department can see the status of any invoice and at which approver a certain invoice is

at every moment. If the details are not correct the approver has to contact the supplier to sort out the issues. It can also happen that the invoice is rejected by the approver for certain reasons. The approver can place a comment with the invoice with which the bookkeeping department can recheck the invoice, for example to book it differently in the administration. Another thing that can happen is that the invoice was sent to the wrong approver, in which case it will be rejected. Once an invoice is approved by every approver, the invoice will appear in Coda, where it can be paid.

Payment of invoices

After an invoice is approved it is sent to Coda. This software system is where the financial administration happens and also supplier invoices are paid here. The invoices that have been approved are collected in a list, which is called a payment advice list. This payment advice list is checked to see whether there are some invoices which do not belong there. Every invoice must have X-Purchases next to it and internal payments are taken out as well. After that it is printed out and checked one last time with the invoices that were collected in the workflow to see whether the actual right amount is being paid to the right supplier. Then the payment advice list is exported to the bank where it will be paid. This has to be done for every Emons company. Again both employees have their own companies for which invoices are paid, in order to prevent double payments. Every payment has to be authorised by two employees within Emons, which is usually done by an employee of the financial department. For this process the inputs are the approved invoices and the output are the paid invoices. Invoices are usually paid once per week in a batch.

Payment reminders of suppliers

Similar to the invoices Emons sends to customers, supplier invoices also have a due date on which the invoice has to be paid. It is possible that an invoice is not paid in time. When this happens the supplier will send a payment reminder, which arrives by email. The bookkeeping department will then check the status of the invoice. It can be the case that the invoice was already paid or is on the payment advice list, in this case the department will not do anything. It is also possible that the invoice was not yet approved. The bookkeeping department then has to contact the approver to ask for the status and why it is not approved yet.

4.1.3 Other tasks

The processes described above are regular tasks and take up most of the working time. Below are some processes which are less regular. Some examples are that the process needs to be done monthly or because it is an incidental task, so a request for the task can come in at any time.

Month-end closure

The first process is the month-end closure. This process is done at the beginning of every month and usually takes up to two working weeks. During this process the previous financial period, in this case the previous month, is closed for all the Emons companies. The bookkeeping department needs to gather information from all other departments about their financial transactions from the month that is being closed. This information is then processed and archived. Once a month is closed nothing can be booked on this period anymore, so it is important to have all the information as accurately as possible. Similarly, at the beginning of the year the past year has to be closed.

Another task that happens in the first month of the year is that fixed costs which are known for the coming year are being spread out over the next twelve months. Take as a simple example an energy bill which is only sent to Emons once per year. It is not the case that the energy which is billed on this invoice was only used in the month the invoice arrived, it was used during the whole year. Spreading costs in this way gives a more accurate picture instead of booking costs for twelve different months

all in one single month. Since the month-end closure is quite a stressful period, no observation sessions have been held during the execution of this process.

Tax returns
Once a month is closed and all of its transactions are known, the tax returns need to be filed. The department has to file taxes for companies in four countries, namely the Netherlands, Germany, Poland and Belgium. For each of these countries the tax returns need to be filed separately. Since every transaction deals with taxes and tax returns are about a certain month it is necessary that the month is closed. This means that the taxes for that month are known and cannot change anymore. The taxes are also noted in Excel for their own administration. For the Polish tax returns a list of all the transactions that were done during a month needs to be filed. The other three countries only require certain balances.

Registering new assets
Another process that needs to be done roughly once per month is registering new assets. The trucks and trailers used by Emons are their own property, so they are fixed assets. This means that the trucks have a certain value, which depreciates over time. The bookkeeping department has to keep track of this depreciation. If for example a truck has a broken part it needs to be replaced. The new part then has a relatively higher value than the truck, since it is newer. The newly purchased parts need to be registered in Coda so that they can be written off on. The invoices of the purchase of the parts is used to establish the value, which will be noted down in Coda and also in Excel. After the parts have been registered, Coda will automatically write the parts off over a specified period of time.

Incidental tasks
The earlier mentioned incidental tasks consist of requests coming from other Emons employees. The first type of request can be to make an invoice on a non-revenue related matter, like selling a truck. This is the only type of invoice the bookkeeping department makes. The invoice will then be sent to the other employee and the buyer. The second type is to make a payment to another Emons company, for example when money is needed on a short notice. The payment will be made and the requester will be notified. This also requires authorisation of a second employee.

Payment of wages and damage claims
The bookkeeping department is also responsible for the payment of the wages, to make sure everyone gets their wage. Finally, one of the employees has recently acquired the new task of administering the damage claims. This means filing both damage to goods transported and the trucks itself. Since this is a new task it was agreed upon to not observe the task. It could however be an outcome of this research that the employee will have more time for this task in the future.

4.2 Current performance

As noted before, the bookkeeping department has not been managed for some time. The performance of the department is unknown. However, there is some data available with which the performance can be measured. Later in this report a look will be taken at different metrics that can be set up. In this section the current performance will be discussed with some statistics as a baseline measurement. A baseline measurement is the starting point of a process metric, from where the improvement of a change can be measured (WhatIsSixSigma, 2014). Here it is assumed that the month to which the data relates is representative for other months. SPSS was used to calculate some descriptive statistics. This is a statistical program used to process data and perform statistical analysis on the data. First, all the entries with blank cells have to be removed, as they will interfere with the correctness of the data. This is the case with invoices that are not paid yet, as could be seen in Table 1. After this has been done, 1461 invoices remain. Then some statistics were calculated which can be

seen in Table 2. The chosen metrics will form a baseline for the dashboard that is created in Section 5.3, where they are explained in more detail. They will be highlighted below in Table 2 to give an idea of the current performance. The statistics show how efficiently the department processes invoices.

Table 2: Descriptive statistics on performance made with SPSS

Descriptive Statistics

	N	Mean	Std. Deviation
days in wf	1461	10.00	17.274
Days paid late	1461	8.46	13.688
Days in system	1461	30.40	21.111
Processing time	1461	15.52	15.309
Valid N (listwise)	1461		

- *Days in wf* shows the number of days an invoice is in the workflow, so the number of days between entering an invoice in the workflow and it being approved. This shows whether invoices are timely approved by an approver.
- *Days paid late* is the number of days an invoice is paid late. A positive number means that invoices are being paid late.
- *Days in system* shows the number of days an invoice is in the system. This means the number of days between receiving an invoice from the supplier and paying the invoice.
- *Processing time* is the time it takes to get approval for an invoice, so the number of days between receiving an invoice from the supplier and getting the approval. Once an invoice is approved it is put on the list and not touched anymore until it gets paid, so this statistic shows how long it takes to process the invoice.

In Table 2 the N, which means number of invoices, mean and standard deviation (Std. Deviation) can be seen. For example, during the month of May, invoices were in the workflow for on average ten days. The standard deviation shows how spread out the data is and how much variation there is. If the standard deviation is low it means that invoices are consistently in the workflow for 10 days, while a higher number means more variation.

4.3 Conclusion

In this chapter the question '*What are the current tasks and processes of the bookkeeping department?'* was answered by giving descriptions of the main tasks and processes. Furthermore flowcharts were made which show some of these processes. After that the current performance of the department was discussed by highlighting some statistics that were taken from the dataset as a baseline measurement. This answered the question *'What is the current performance of the bookkeeping department?'*.

5 Process improvement

In this chapter the remaining three phases of the BPM cycle will be explained. In Section 5.1 the current processes will be redesigned by looking into existing literature for possible improvements and holding discussions with the company. This will answer the question *'Which tasks can be made more efficient?'*. Section 5.2 will answer the question *'How can the redesigned processes be implemented?'* by making use of Lewin's change model. Lastly in Section 5.3, the question *'How can the performance of the bookkeeping department be measured?'* will be answered, again by reviewing literature and by looking at existing data.

5.1 Redesigning processes

After the current processes have been defined in the previous chapter, it is now time to redesign them and improve their efficiency. This will be done by looking at the flowcharts to identify the wastes that are in every process. For every task will be checked whether the task is necessary or can be done differently. In the end a list of possible improvements remains. Tasks that were not observed or were done on a less frequent basis are not considered for improvement. These are the tasks that were described under Section 4.1.3.

Dual monitor setup

Improvement 1: First of all, a general intervention is proposed, which is to make use of a dual monitor setup. Previous research, such as by Owens et al. (2012), points out that when working with a dual monitor setup the satisfaction of the employees increases, thus increasing productivity. The same research also showed that a bigger screen is more satisfying than a smaller screen, which is what the bookkeeping department is currently using. The main advantage of having a dual monitor setup is that different windows that are needed at the same time can be put on the different monitors, for example the email and workflow. Then when a certain invoice needs to be found in the email, the employee can just move their mouse to the left instead of having to look for the windows every time. The research by Owens et al. showed that when workers use a single monitor, they have to switch windows more often, for example by having to minimise them.

5.1.1 Handling supplier invoices

The first and biggest process that will be looked at is the invoice approval process. This process takes up most of the time and is repeated many times per day. Thus, if a small improvement can be made for the processing of every invoice, adding them all together makes for a big improvement. The flowchart will be followed and for each step will be decided whether something can be improved.

Email

Improvement 2: First of all there is the email. The bookkeeping department uses one single inbox where everything supplier related comes in: invoices, payment reminders and other requests and correspondence with suppliers. This means that there is one big inbox with a lot of email. The department puts quite some time into checking the email. Supplier invoices can come in at any moment of the day, so there is almost always an invoice that is ready to be processed. At times when the employees finished a certain task and have some time left over they will start checking the mail for new invoices. A certain limit could be put on checking the email, for example only checking the email at the beginning of the day or once at the beginning of the day and once after lunch. Research by Kushlev & Dunn (2015) has shown that limiting the frequency of checking email reduces stress. The bookkeeping department gets notifications on their screen when a new email arrives, which are used to see whether a certain email is urgent or not. Additionally, Brumby et al. (2013) suggest that having fewer and longer email sessions on a day increases productivity.

Improvement 3: Another change that could be made is that the mailbox separates email automatically. For example, certain rules or a bot can be implemented which tells the inbox where a certain email should go. Invoices will be sent to a folder containing only invoices, payment reminders to a folder containing only payment reminders and so on. Sometimes the department needs to find a certain invoice, for example when a payment reminder was sent, but the invoice is not in the workflow yet. The department then needs to make sure that the invoice was actually sent. When the invoice is in a folder containing only invoices, it already becomes easier to find it. Another solution is that every supplier has its own folder, so that everything belonging to a certain supplier is in one place. The advantage of this is that folders do not get too full, so it is more clear where a certain invoice can be found.

FCI

Improvement 4: Highlighting data in FCI is a task that someone else can do. Currently it is already being done by other employees, but the bookkeeping department is still doing this task as well. Quite some mistakes are being made in this program, so if there would be one employee doing this task completely a lot of time can be gained by having to correct less mistakes later on.

Invoice approval system

The next task where improvement is possible is the task of getting approval for an invoice. Currently, every invoice is being sent to the approver, independent of amount or frequency. Certain rules can be put into place that change when an invoice is sent. For example, if every month there are ten invoices of company X with the same amount, it may not be necessary to get approval for this invoice ten times. Various solutions have been thought of to change the approval system, some were taken from Bragg (2013, 2021).

Improvement 5: The first solution is to put a certain threshold on when an invoice should be approved. This means that if an invoice is under a certain amount, it will not be sent for approval. During the month of May there have been, for example, 83 invoices with an amount of €30.00 and under and 374 invoices with an amount of €100.00 and under.

Improvement 6: The second solution is to change who is approving the invoices. There are some invoices that return multiple times per month, some even with the same amount. After a while these invoices become known to the bookkeeping department, so they know that the invoice was rightly sent. The department could take over the approval of some of the more frequent invoices in order to speed up the process. Another option is to assign more approvers in a certain department, so that the invoices can be divided over more employees.

Improvement 7: Simultaneously, a purchase order can be used to verify that an invoice can be paid, if it is available. This is simply a document that states what has been purchased and the amount. The purchasing department can send the purchase order to the bookkeeping department, after which the purchase order can be used as proof that the invoice can be paid.

Improvement 8: The last solution is called a negative assurance. What this entails is that the current system will be reversed. Currently, invoices are being sent to other departments to ask for approval so that an invoice can be paid and the invoice is not paid until it is approved. With negative assurance, invoices are automatically paid on the due date, unless the approver tells the bookkeeping department that something is not correct with the invoice. By doing this, the bookkeeping department does not need to chase after every invoice when it is not approved on time.

By reducing the number of invoices that need to be approved the average processing time of an invoice goes down. It also means that there is less chance of having to correspond with an approver

about a certain invoice. The disadvantage is that more mistakes may appear, but if the proposed solutions are implemented in a right way this can be prevented, for example with the use of purchase orders. Furthermore, communication is still possible, so if the bookkeeping department has any concerns about a certain invoice it can still be sent to the purchaser for approval.

Another advantage is that more invoices can be paid on time, since they were timely approved. Currently, many invoices are not being paid on time. Paying on time means that payment reminders are prevented. It can also improve relationships with suppliers, since the suppliers will have to contact Emons less for invoices.

Rechecking an invoice

Improvement 9: Having to recheck an invoice after it was rejected is something that does not happen a lot. However, when it happens it means that an invoice is going into the approval workflow for a second time. To improve this task, the approver can write a clear comment telling the bookkeeping department exactly what needs to be changed and also that the invoice can automatically be approved once it is changed. If an approver wants to recheck the invoice again after rejecting it once this is also still possible.

The remainder of the approval process can stay the same. It is important that invoices with a high amount are checked by multiple people, since a mistake can result in losing a large amount of money later. By implementing the proposed changes, the bookkeeping department will have some more influence on their own work by being able to approve invoices themselves. Furthermore some tedious tasks will be cut out.

Debtor management

Improvement 10: Under the debtor management is the tedious task of having to manually post payment reminders. The employee first has to see who has not paid yet, then convert this information to word where payment reminders are made automatically. There the reminders have to be edited in order to make them look better. Then they are printed, folded and put in an envelope, after which they can be sent. This whole process can be digitalised. When this process is digital, the steps of printing, folding and posting the payment reminders can be eliminated.

5.1.2 Feedback round

The improvements that have been found were presented to the company. It is important to get their feedback, as in the end the company will be using the improvements. Brainstorm sessions were held with the company supervisors and an employee of the financial department. During these sessions feedback was given on the proposed improvements, which will be discussed below, in order of importance.

Invoice approval system

Improvement 5: Putting a threshold on when an invoice should be approved was deemed as a risky change. The company is afraid that both employees and suppliers will misuse this system. It was mentioned that when suppliers find out that certain invoices are not approved anymore, they will change their prices to exactly below the threshold that was set. Furthermore, the company sees a risk because some control will be lost on the payments by having invoices being paid without approval. One question that came forth out of this discussion was whether there are certain suppliers that send a lot of low amount invoices.

Improvement 6: The second improvement of letting the bookkeeping department approve some of the invoices was seen as something that can be implemented. The company noted that this could be

implemented for invoices that have the same amount and arrive at regular time intervals. This idea was taken even further to automating these payments.

Improvement 7: Using purchase orders to verify that an invoice can be paid had a mixed response. The general conclusion was that this is something that could be done in the future when the systems are more advanced. Currently the fear is that by implementing this improvement, every purchaser will send their purchase orders to the bookkeeping department. This will then clutter the mailbox and make everything very unclear. In a future system it could be possible that the purchase orders are uploaded to a system and from there are automatically matched with the invoice. Furthermore, the purchase order should have a form of authentication from the purchaser so that it is clear who made a purchase. This would then replace the approval. Another thing that was noted is that not every purchase has a purchase order. For example if a driver gets gas for a truck he will not go to the counter to ask for a purchase order, but simply gets a receipt.

Improvement 8: The negative assurance solution was not perceived as a good idea. The company thinks that this system will be misused by employees, for example no one will check the invoice anymore. Right now it is mandatory to check invoices, otherwise they will not be paid. With a negative assurance this requirement falls away, so the company is afraid that control will be lost by implementing this system. A possible solution is to let purchasers account for their purchases at the end of every month. Doing this however, does not bring back the money that was already paid to the supplier.

The general problem with the proposed solutions is that part of the control falls away. By not approving and verifying certain invoices there is a risk of paying a supplier which should not have been paid. Another problem that came up during the discussion is that there are invoices about which the bookkeeping department does not know who has to approve them. This is a problem, because the bookkeeping department will send the invoice to a certain approver who then does not know the details about it or forgot that he/she made a purchase. The invoice will then be sent to another approver until the right approver has been found.

FCI

Improvement 4: When proposing the change to who is performing the task involving FCI, the company has said that the way it is currently being done was chosen on purpose. At first only one employee was doing this task, but the problem was that when this employee is out of office no one else can do the task. One improvement that was proposed is to automatically upload invoices from the email into FCI. This would then automate the process more and free up time spent in the email. The only question was whether this is technically possible. By doing this there is also a risk on missing certain invoices or missing texts that are written in the email itself by a supplier.

Email and dual monitor setup

Improvements 2, 3 and 1 respectively: The changes proposed to the email were overall seen as pretty positive, one representative mentioning that checking the email less is something that could be useful for everyone. Concerning automatically dividing email the question again was whether this is technically possible. Using a dual monitor setup is something that has been discussed before. The bookkeeping department employees think that there are easier ways that can be used, rather than using a second monitor, such as printing. Still it is something that could be implemented very easily and could be tried for a period of time.

Debtor management

Improvement 10: Digitalising the sending of payment reminders to customers is something that is already planned to be implemented. The company needs to upgrade Coda, after which this is possible. Something the company was more interested in is to have a registration system or a log where it is written down to who payment reminders are sent and how many times a certain customer has gotten a payment reminder. Another question that came up was what is being done after sending a payment reminder after two or three times and whether this is standardised.

One last question from the company was whether the matching of customer invoices with payments could be done more efficiently. The main question was whether the software system that is being used to match customer invoices with payments is utilised in an optimal way. This software system is meant to automate the process, but it does not find every match, so it does not reach its full potential (*Improvement 11*).

Based on all the feedback, Table 4 was made. This table shows all the proposed improvements together with the effect on efficiency, cost of implementation and impact on the bookkeeping department and company (in terms of getting used to something and having to change the working routine). These factors are roughly based on a scale from 0 to 3, where 0 means no cost, no impact or no effect and 1 to 3 means low, medium or high cost, impact or effect. Rough specifications on these numbers can be found in Table 3, where a change in working routine means for example having to learn something new like a new way of working in a system. The numbers are based on the comments made by the employees and personal findings, for example through the observations of the bookkeeping department. Furthermore the final comments by the company are summarised in the table. The tables can also be found in Appendix D in a more readable size.

Table 3: Specifications of scale numbers for improvements

Effect	1	Small effect on ease of work
	2	Would free up time
	3	Would free up a large amount of time
Impact	1	Can easily be implemented
	2	Needs a change in working routine and/or software
	3	Needs an overhaul of systems

Table 4: Proposed improvements

Improvement	Specification	Effect	Cost	Impact	Final comments
1	Dual monitor setup	1	0-1	2	Department thinks there are easier ways than having a second screen
2	Reduce frequency of checking email	1	0	1	Could be useful for everyone
3	Separate email automatically	2	1-2	2	Uncertain whether it is technically possible
4	Assign FCI to someone else	1	0	1	Current way is done on purpose
5	Threshold on when to approve an invoice	3	1	1	Risky, but could be implemented
6	Let bookkeeping department approve frequent invoices	2	1	1	Only for invoices that are exactly the same on regular intervals
7	Use purchase orders as verification	3	3	3	This would require a big overhaul of systems, something for the future
8	Negative assurance	0	3	3	Would be misused, not a good idea
9	Change rechecking of invoices	1	0	1	Not discussed
10	Digitalise sending payment reminders	3	1-2	2	This requires an update of Coda
11	Automate matching of invoices and payments more	2	2-3	3	Needs coding to better optimise the system

5.1.3 Results of the feedback

Overall, the company representatives thought there were some good improvements that could be implemented at some point. The representatives were quite surprised when the number of invoices with low amounts was presented. During the month of May, 1746 invoices were processed. Of these invoices, 83 were under €30.00, 193 were under €50.00 and 374 were under €100.00. It was decided

that this solution is one that could be implemented the easiest. The main drawback was that there was a fear of losing control on the process and as a consequence lose money. Therefore a cost-benefit analysis was performed.

The costs and benefits can be calculated to see whether this change will actually have a big financial impact. Here it was assumed that every invoice takes on average five minutes to process, where one working hour costs the company €50.00. The calculation can be seen in Table 1. The total amount column gives the total amount of all the invoices that are under the set threshold. The benefit is the money that is saved by freeing up working hours, while the possible risk is the benefit added to the total amount. This is the maximum amount that can be lost, for example when all the invoices are falsely sent, hence why it is called possible risk. However this is not likely to happen, therefore the risk is normally lower.

Table 5: Cost and benefit of implementing a threshold

Threshold	# Invoices	Percentage of total	Total amount	Benefit	Possible risk	Percentage of total	Time saved (hours)
€ 30.00	83	4.75%	-1,376.51	€ 345.83	-€ 1,030.68	0.0214%	6.92
€ 50.00	193	11.05%	-5,778.62	€ 804.17	-€ 4,974.45	0.1031%	16.08
€ 100.00	374	21.42%	-18,162.63	€ 1,558.33	-€ 16,604.30	0.3442%	31.17
€ 200.00	544	31.16%	-42,797.23	€ 2,266.67	-€ 40,530.56	0.8401%	45.33
Data summary			Working hour cost	€ 50.00			
Total invoices	1746		Processing time	5 minutes			
Total paid	-€ 4,824,224.94						

As can be seen in Table 5, setting a threshold of €100.00 takes 21.4% of all the invoices out of the workflow, while the maximum risk is to lose 0.34% of the total payments made. It also saves an estimated 31 working hours (almost four working days) every month which can be used for other tasks. Setting the threshold on €200.00 more than doubles the risk, while the time saved is not doubled. Therefore €100.00 seems to be the best choice based on this data. The threshold could be changed based on the amount of risk the company wants to take. For example, setting a threshold of €30.00 would still free up 7 working hours per month, which is almost a whole working day and the risk is way lower. However, saving four working days per month would be a big improvement. This means that each employee gets two days in a month to perform other tasks.

Concerning purchase orders, the financial employee mentioned that the company wants to have a commitment administration ("verplichtingenadministratie" in Dutch). This effectively means that a certain commitment is created together with a purchase order when a purchase is done, which is approved by the approver. This commitment states that a certain amount needs to be paid to a supplier. Then when the invoice arrives and the amount is exactly the same as the commitment, it will be paid automatically. This omits the step of having the approver approve the invoice itself, in which case a purchase is basically approved two times (Conclusion, 2021). In this way it is also possible to create commitments for invoices that are known to be the same or similar every month, like telecom subscriptions and leases.

There are also quite some invoices from the same suppliers that have exactly the same amount on them. Some of these invoices were even sent on the same day. It may not be necessary to get approval for all the frequent invoices, since there are some regularities. As described in the previous paragraph, a commitment could be made for these invoices so that they will automatically be paid. Another change could be to ask suppliers to bill everything on one invoice instead of sending multiple invoices. This however requires cooperation of the supplier.

The tasks under the debtor management can also be altered. A standard procedure can be put into place for what happens when a customer did not pay the invoice after getting two or three payment reminders. An idea could be to standardly send an email after missing the due date three times (so after two payment reminders) and call the customer after missing the due date a fourth time, which is after receiving three payment reminders. This should then be recorded in a log which can be used to see which customers may need some more monitoring.

5.1.4 Proposed improvements

Based on the previously described redesigns and discussions with the company, a final list of potential changes is presented to the company. The changes are divided in short-term changes, which can be implemented very soon, and long-term changes that need more time and resources. The long-term changes all require a change in the software systems in order to automate the processes more.

Short term

- Set a threshold on when to send an invoice to an approver of €100.00. This will free up an estimated four working days per month which can be used for other tasks. The threshold can be changed based on new data and on how much risk the company is willing to take.
- Make use of a dual monitor setup in order to increase satisfaction and ease of working, therefore increasing productivity. This can easily be implemented and tried out.
- Standardise the process of contacting the customer after missing a due date for a payment. Send an email after missing the due date three times and call the customer after missing the due date four times. Keep a log on which customers have been contacted about their payment and how many times.
- Set a limit on checking the regular email to once or twice per day. This will reduce stress and may increase productivity.

Long term

- Implement a system where frequent and similar invoices are automatically approved, such as leases or telecom subscriptions. A certain limit could be put on this to prevent mistakes concerning invoices with a high amount.
- Implement a system where purchase orders are being collected, after which they can be matched with invoices. This omits the step of sending an invoice to an approver almost completely. It also prevents situations where the bookkeeping department does not know who an invoice should be sent to, since the purchase order is used as proof. This would require the purchase order to have a reference to who made the purchase, which would suffice as an approval. Again a limit can be imposed so that high amount invoices still need normal approval.
- Automatically divide email into different folders depending on the type of email. It could be divided by invoices, payment reminders and so on or by supplier.
- Look at the invoice-payment matching software to see if it can be automated more and whether the error rate can be reduced.

5.2 Implementation

After the changes are created it is time to implement the changes. As described in Chapter 3, Lewin's 3-stage model of change is proposed to be used to implement the changes. Below will be explained how the three different stages can apply to the bookkeeping department, with help of the article by Levasseur (2001).

Unfreeze

First off, the working routines of the employees need to be 'unfrozen', it needs to be clear that a change is coming. They have been working in the same routine for many years, so it is only natural that they will not immediately see the need to change this routine or may resist the change. However, by cooperating in this research the department has already shown that they are willing to change certain routines. By using this model small changes can be implemented so that the department can get used to them. It is therefore important that they get notified about the proposed changes and give their own feedback on them.

So it is important to tell the reason for implementing the change, which in this case is to relieve the department from some of their work pressure. This is something that should be done by someone with a high authorisation and who has clear communication. It can be done by someone within the company, as everyone knows each other so employees are more likely to accept feedback from each other. A small project could be set up, where for example each phase takes one month. After every two weeks feedback can be collected on what worked and what did not work. This feedback can then be used to make changes to the proposed improvements or to change the way of communicating certain things. Another thing to note is that all the short-term changes that are proposed can be implemented quite easily and would not require a very different way of working or a big change in working routine. Once this is clear to everyone, the changes are ready to be implemented.

Change

After the department is prepared for the changes it is time to actually implement them. The short-term changes that were proposed are all changes that can be implemented without needing many resources. Although the changes themselves are not radical changes in terms of routine or processes done, it may still be the case that after a while the department thinks the changes did not actually do much. It is therefore important to keep on reminding them why the changes are being implemented. For example, if the department has said that using a second monitor is not convenient for them, they can be reminded that it may increase their working satisfaction. One method is to implement the changes for a period of time. Once that period is over, feedback can be received on whether the changes actually led to a reduced work pressure and more satisfying work. When the change is implemented and received well it is time to go to the next step.

Refreeze

Once the changes have been implemented and received with good feedback, it is time to set the changed process as the new standard, or refreeze them. During this phase it is important to prevent the department from falling back to the old habits. Something that the company proposed is to have a happiness survey every week, which states whether the department was satisfied with their work in that week. This could be implemented before the changes are implemented, so that the progress over time can be compared. This then shows that the implemented changes have worked and relieved work pressure.

5.3 Monitoring

The final phase of the BPM cycle is the monitoring phase. The performance of the bookkeeping department has not been measured before this research. Therefore, this research will not only set up metrics regarding the proposed changes, but also metrics that the company can use to see what the performance of certain processes is. The main thing the company wants to see in the metrics is how busy the department is. This also connects with the work that was done up to now in this research. By comparing the before and after data of this type of metric it can be seen whether the implemented changes have helped. During this phase the dataset on invoices is again being used to see what kind

of metrics can already be found, combined with the baseline measurement in Section 4.2. Power BI was used to make a dashboard with this data. This program was chosen because the company uses this program for all of their dashboards, so it aligns with their current tools. A big advantage of Power BI is that it can be connected to an excel file to transfer the data. When the excel file is updated, the updates will automatically be transferred to the dashboard, meaning that a single excel file can be used to create and update the dashboard.

Firstly, some processes were eliminated from selecting metrics. This is because these processes did not have any data on them or are processes that are not done frequently. The reasons are explained below.

- Tasks that need to be done once per month are not considered for measurement, with the exception of the month-end closure. The monthly tasks usually take a couple of hours per month and there is not much that can be measured on these tasks. This includes filing the tax returns, registering new assets and the payment of wages.
- The incidental tasks are tasks that can come in at any moment and will always be done as soon as possible. These tasks have to be done and usually do not take up a lot of time. Filing the damage claims is a new task, so again there is not much that can be measured.
- The debtor management is also chosen to not be investigated further. Sending the payment reminders will be digital in the future, so a change is already planned. Matching invoices with payments is a process that would be good to measure. Something that can be measured is the error rate, so the number of mistakes that need to be corrected. However, the system does not currently record this data and it is difficult to collect this data at the moment.

The processes that are left over are the handling of supplier invoices and the month-end closure. Together with the debtor management these are the processes that take up most of the working time. Furthermore there either is already data available on these processes or it can be easily collected. This makes them good candidates as processes to set metrics for.

5.3.1 Preliminary design

At first a dashboard was made containing metrics on how the bookkeeping department is performing regarding the throughput time. The thought behind the metrics was that it could show whether implementing the changes brings the throughput time down. This dashboard contained the following metrics:

- Average number of days an invoice is in the workflow. This means the average time between uploading an invoice to the workflow up to the moment it is approved and sent to Coda. What this metric shows is the time it takes for an invoice to be approved.
- Average number of days between receiving an invoice and paying the invoice. This shows how long an invoice is in the system on average.
- Average number of days paid late. This metric is useful to get insight into the fact that many invoices are paid late. It would be useful to reduce this number in order to improve relations with the suppliers.
- Days it takes to close a month. This metric has been suggested by quite some sources, such as by Belotindos (2019) and Simplestudies (2021). Since this is a process that takes up a lot of time it would be very good to note exactly how many days it takes each month. If it is a consistent line it means that the process is done in a systematic way. However, if there is a lot

of variation then it means that the process is sometimes performed less efficiently or there could be other reasons why it takes longer in some months.

5.3.2 Final metrics

When the proposed metrics were presented to the company, the biggest issue was that the metrics do not actually show how busy the department is. The company wants to see what is being done by the department on a certain day. Therefore it was chosen to show the following metrics on the dashboard. The chosen metrics give a mixed overview of both the performance of the approval process and the busyness of the department. An example of the dashboard with instructions on how the metrics can be created in PowerBI can be found in Appendix B.

1. Average number of days paid late for each Emons company. This metric is still chosen because it shows whether the implemented changes result in invoices being paid more on time. The metric also shows whether the process is efficient enough, since paying earlier and on time means that approvals are being received timely. It is calculated by subtracting the due date from the payment date for each invoice, grouping them per company and taking the average for each company. Bringing this number down is important to improve relationships with suppliers and prevent payment reminder from coming in.

2. The second metric shows the average processing time per invoice divided by company. The processing time of an invoice is the time between receiving an invoice and getting approval for the invoice (Beanworks, 2020). It is calculated by subtracting the invoice date from the final date an invoice is in the workflow and averaging it per company. This metric shows whether invoices are timely approved and should be as low as possible. It is therefore also an indicator of how efficient the invoice approval system is. The difference with the metric in the preliminary design is that this metric actually shows how long the approval takes.

   It also makes more sense to measure the processing time, because once an invoice is approved it will be put on the payment advice list and is paid in the next batch. Therefore some variation is taken out because of invoices being approved on different days, thus sitting on the payment advice list waiting to be paid. For example, if an invoice was approved on Monday it sits on the list for three days, while an invoice approved on Wednesday is only on it for one day. The reason that the average for each company is taken for the first and second metric is to see what the performance per company is and whether there are companies that could be more efficient.

3. The third metric is the number of invoices processed per day. With the previously estimated processing time of 5 minutes per invoice, it means that for example on the 11th of May, over 4.5 hours were spent on processing invoices, since 55 invoices were processed. The metric is created by grouping the dates on which an invoice first entered the workflow by each date in the month and then the number of invoices on each day were counted. The thought behind this metric is that the day on which an invoice first entered the workflow is the day on which an invoice is checked and sent to an approver. Therefore it gives the most accurate image of how many invoice were processed on a certain day.

4. The fourth metric is the number of invoices paid per day. Again it was created by counting the number of invoices, but this time grouped per payment date. This metric is interesting, because invoices are normally paid once per week in a batch. It could be useful to see why there are some days in between where some invoices are paid. If those invoices are also paid in the batch with the rest of the invoices instead of separately, some time can be saved. Ideally, this metric should consist of four evenly spread out bars, meaning that there is only one day in the week on which invoices are paid.

5. The final metric is the number of days it takes to close a month as discussed before. This metric can be a start to research on the month-end closure by seeing what the performance of this process is over time. It is quite easy to collect the data, every month after finishing the month-end closure the days are noted down next to the correct month in an excel file. Then in Power BI the days to close are plotted against the months in the form of a line chart. This then shows the progress over time. The chart in Appendix B on this metric is made up of imaginary data, since no previous data was collected.

For the first two metrics data of any period of time can be used since they show averages. The average over a year, quarter or month can all be found. The third and fourth metric show daily numbers, so it is advised to show one month per graph in order to not clutter them too much. The last metric is a line chart and thus can be constantly updated over time.

Since the excel file needs to be created and cannot be exported automatically, it is important to set some rules on how the dashboard can be as accurate as possible. An advantage of the metrics that were chosen is that they use dates which cannot be changed anymore. For example, once an invoice is entered into the workflow or paid, the date cannot be changed anymore. A problem that arises is that when extracting the data there will be invoices that have not been paid yet. Also many invoices are not booked in a certain month yet because they are not approved at the moment of extraction. For example if an invoice was received in April but not yet approved, it will automatically be booked on the first day of the next month. This means that every time the dashboard is used, new data has to be extracted from the systems, instead of copy pasting the new data under the existing data. This is needed to prevent double entries.

The solution is to extract the dataset when the dashboard is to be used. A good moment to update the dashboard is after a month is closed. This means that no more invoices can be booked on that month, but it is still recent data. Another solution could be to rebuild the dashboard with the datasets in the form that they are extracted from the systems. By doing this the step of having to create the dataset manually is eliminated. An excel file containing two sheets can be bound to the Power BI model: one sheet containing the workflow and Coda data and a sheet containing data on the days to close the month. The data that is extracted can then be copied into the file that is bound to the Power BI file so that the dashboard shows accurate information without taking too much time to build. Certain columns can contain premade formulas which are needed to create the graphics, which automatically activate whenever there is data. An example can be seen in Table 6, where the final three columns and the ‘days in wf’ column are created by formulas. Then when the data is pasted into the existing file, these columns will automatically calculate the new numbers based on the new data.

5.4 Conclusion

This chapter described the remaining three phases of the BPM cycle. The first research question was answered by making up a list of proposed changes to the current processes. Concerning the second question, Lewin’s change model was indeed a good model to implement changes. It is especially useful when optimising processes, so making them more efficient than they already are, which is the case for the bookkeeping department. Finally, the third question was answered by proposing a list of metrics and how the data within the company can be used to set these metrics.

6 Evaluation

In this chapter the results and findings of the research will be evaluated. Section 6.1 will give a conclusion containing an answer to the research question and core problems. In section 6.2 the final recommendations towards the company will be given. After that in Section 6.3 the scientific contribution of this paper will be discussed. Lastly, in Section 6.4 the limitations of this research will be discussed with notes for further research. The question that will be answered is *'What are the main findings of this research?'*.

6.1 Conclusion

In this section an answer is given to the research question this research tried to answer. The goal was to get more insight into the tasks of the bookkeeping department at Emons. Furthermore the research tried to find ways to better organise these tasks and measure the performance of the department. The research question that was posed was:

"How to get insight into the current tasks of the bookkeeping department and how can the tasks be organised in a better way?"

Different sub questions were set up and answered in Chapters 2 to 5. In order to answer the main question, the Business Process Management cycle was used. This cycle is used to systematically improve processes within a company and consists of five phases, of which four were performed during this research. Different tools to execute the phases were found with the help of literature, such as BPMN in the form of flowcharts, Lewin's change model and performance measurement using process metrics.

The first phase that was executed is the discover phase. During this phase the employees were observed and interviewed to get as much information on the tasks and processes as possible. Flowcharts and descriptions were made on the processes. Furthermore a baseline measurement of the current performance was presented. This phase mainly solved the first research goal of getting more insight into the tasks and processes.

After that the remaining three phases were executed; redesign, implement and monitor. During the redesign phase, changes to the current processes were proposed and discussed with the company. Then a plan of approach was written to implement the new changes using Lewin's model. These two phases solved the core problem of organising the tasks in a better way. Finally, ways to measure the performance of the department were considered. This phase finalised the problem of getting more insight into the processes of the department.

Overall the research question can be answered by following the steps of the BPM cycle. The discover and monitor phases gave insights into the department. It showed what the work of the department entails and how it performs on these processes, thus solving the first core problem. The redesign phase can be used to organise tasks in a better way. However, by just redesigning the tasks they are not implemented yet. Therefore the implement phase is also needed and finishes this second part of the research question and also solves the second core problem.

6.2 Recommendations

Based on the findings of this research, the final recommendations to the company will be noted below. They were taken from Section 5.1.4 where they are explained in more detail, but are summarised in a concrete list here. Firstly recommendations on changes to the processes are given in order of importance and effect. After that the recommended metrics to be used are given.

Short term changes to processes

These recommended changes can be implemented at a short notice and need little resources.

Improvement	Specification	Effect	Comments
5	Set a threshold on when to send an invoice to an approver of €100.00.	This will free up an estimated four working days per month.	Threshold can be changed based on data. This change should have the biggest effect.
1	Make use of a dual monitor setup.	Can increase satisfaction.	Easy to implement and try out.
10	Standardise process of contacting customers after missing a due date for a payment.	This will make it clear for everyone which customer has been contacted.	Keep a log on which customers have been contacted and how many times
2	Set a limit on checking the email to twice a day.	This will reduce stress.	Number can be adjusted based on feedback.

Longer term changes to processes

The recommended changes below take more time to implement and will need more resources.

Improvement	Specification	Effect	Comments
6	Automatically approve frequent and similar invoices.	Less invoices need to be approved	Possibly set a limit to prevent high amounts from slipping through.
7	Implement a system where purchase orders are being collected.	Invoices do not need to be checked by an approver anymore.	The purchase orders can be matched with invoices, order requires a reference to purchaser.
3	Automatically divide email.	Less time spent browsing email.	Can be divided by type of email or by supplier.
11	Automate invoice-payment matching software more.	Less time spent correcting mistakes.	Requires coding to improve software.
10	Digitalise sending of payment reminders to customers.	Can save a lot of time creating reminders.	Requires Coda update.

Process metrics

The first two metrics show how efficient the invoice approval system is. The last three metrics show how efficient the bookkeeping department is working and how busy the department is.

- Average number of days paid late for each Emons company.
- Average processing time per invoice for each Emons company.
- Number of invoices processed per day.
- Number of invoices paid per day.
- Number of days it takes to close a month.

6.3 Scientific contribution

This research has used a combination of frameworks to successfully execute the BPM cycle. These frameworks could be used by other companies who want to improve certain processes within their company. For example, methods to map processes in a company have been described. Furthermore,

quite some changes to the tasks of a bookkeeping department have been proposed. Some of these changes could be useful for other companies to consider for their own department. The metrics that were thought of could be used by companies who are looking for similar performance measurements for their bookkeeping or accounts payable department.

6.4 Limitations and further research

In this section various limitations of this research are discussed. For some limitations further research is discussed which can be looked into.

Restricted time

The first limitation is that there was limited time. Because of covid it took a while before the observation sessions with the employees could be set up. Since there was limited time it was not possible to implement the proposed changes. Therefore the changes, implementation and metrics are all written in the form of a plan of approach and as recommendations. The process mappings, proposed changes and metrics have been validated with the company however, so in the end the discover, redesign and monitor phases have been completed.

Another limitation that had to do with time is that some processes have not been observed. There were some processes that have not been performed at the time of the research, like the year-end closure, damage claims and payment of wages. There were also processes that have not been observed because the periods in which they are executed are quite stressful. This is for example the case with the month-end closure. During this process the department would not have the time available to have someone observe them. Since the year-end and month-end closures have been noted as stressful processes, research could be done in these processes specifically to see how they can be made less stressful. However, one of the reasons that it is a stressful period is because the month-end closure is an extra process on top of the other processes. With the proposed changes the time needed for the other processes are reduced, so there will be more time for the month-end closure.

Dataset

There were also some limitations to the dataset that was used. The data used during this thesis only consisted of data on one month. This is for example a limited sample to think of a good threshold for approving invoices, as it could be the case that in this month there were less low amount invoices than usual or some exceptional invoices. By using more data, for example yearly, better decisions can be made. Furthermore, while for the baseline measurement it was assumed that this month is representative for other months, in reality much more data is needed from multiple months.

Another problem that arose was that quite some invoices were not paid yet. These invoices had to be removed because they would interfere with the correctness of the dashboard. This causes some of the graphics and statistics to be less accurate. Lastly, the dataset was created by combining outputs of several systems together into one excel file. This means that the dataset used is not readily available to be exported in the same format as was used for this research.

Invoice processing time

It is quite hard to say how long the department and approvers interact with a certain invoice (so the time that is spent on actually checking/reading/looking at them). It was assumed to be 5 minutes. Some invoices are processed easily, but others are more difficult and take more time. Something that could be used to do more research into this topic is process mining. This would require the dataset to be more detailed, having information on every single step that is done for every invoice. Some extra information that is required is when an invoice was clicked on in the workflow to check it and when it

was closed, for both the bookkeeping department and the approver. Similarly, the time it took to check the invoice in FCI is needed. When a better processing time per invoice is found, a more accurate image can be shown.

Implementation method

It is possible that there is a better way to implement the changes. In this research two models were discussed and one model was elaborated on. However, there may be other models that could work better for the company.

Analysis of tasks

The tasks and processes have been analysed based on how they are currently being performed. It is possible that in the future the tasks change or are done differently. The company will implement a new company-wide system, which could influence some of the tasks of the bookkeeping department as well. Therefore it is important to keep the flowcharts up to date, so that they will represent the processes accurately.

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8 Appendices

8.1 Appendix A: Flowcharts of processes

In this appendix the different flowcharts that were made as part of this research can be found. The flowcharts can be used by the company to see the processes of the bookkeeping department. Furthermore, they can be added to the database the company is currently building which contains all kinds of processes done within the company.

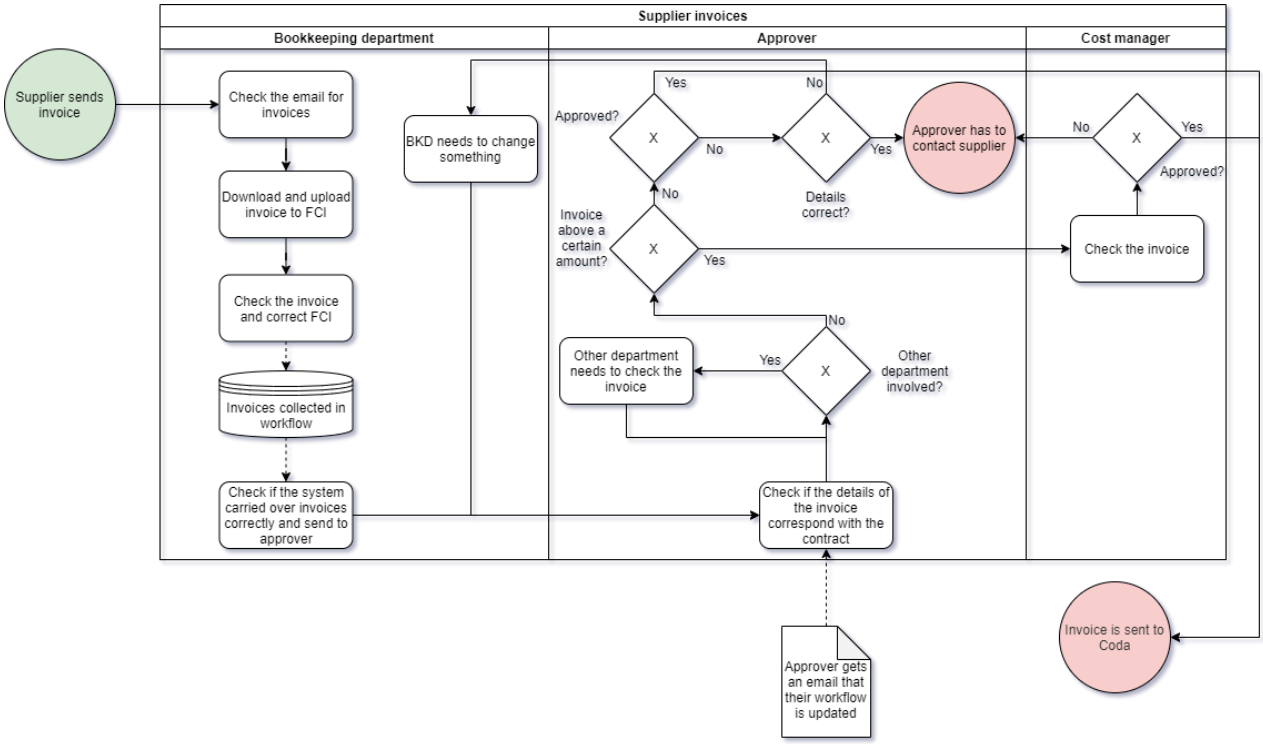

Figure 6: Flowchart of the approval process of supplier invoices

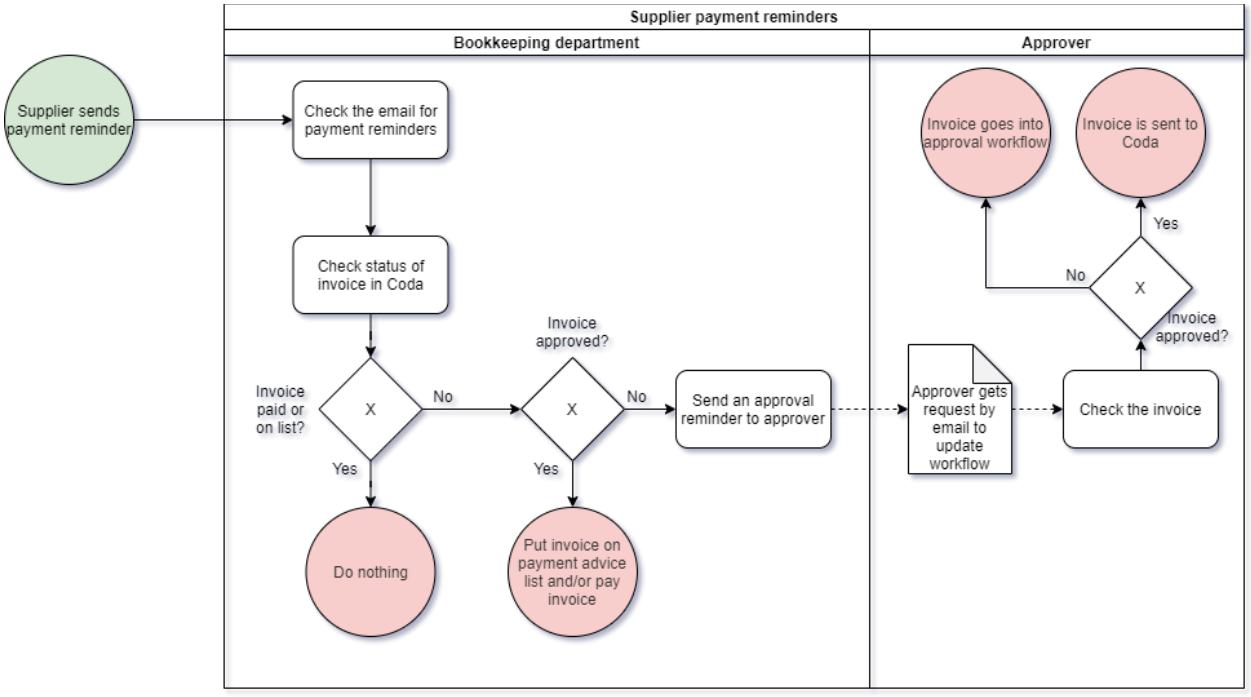

Figure 7: Flowchart of process 'handling supplier payment reminders'

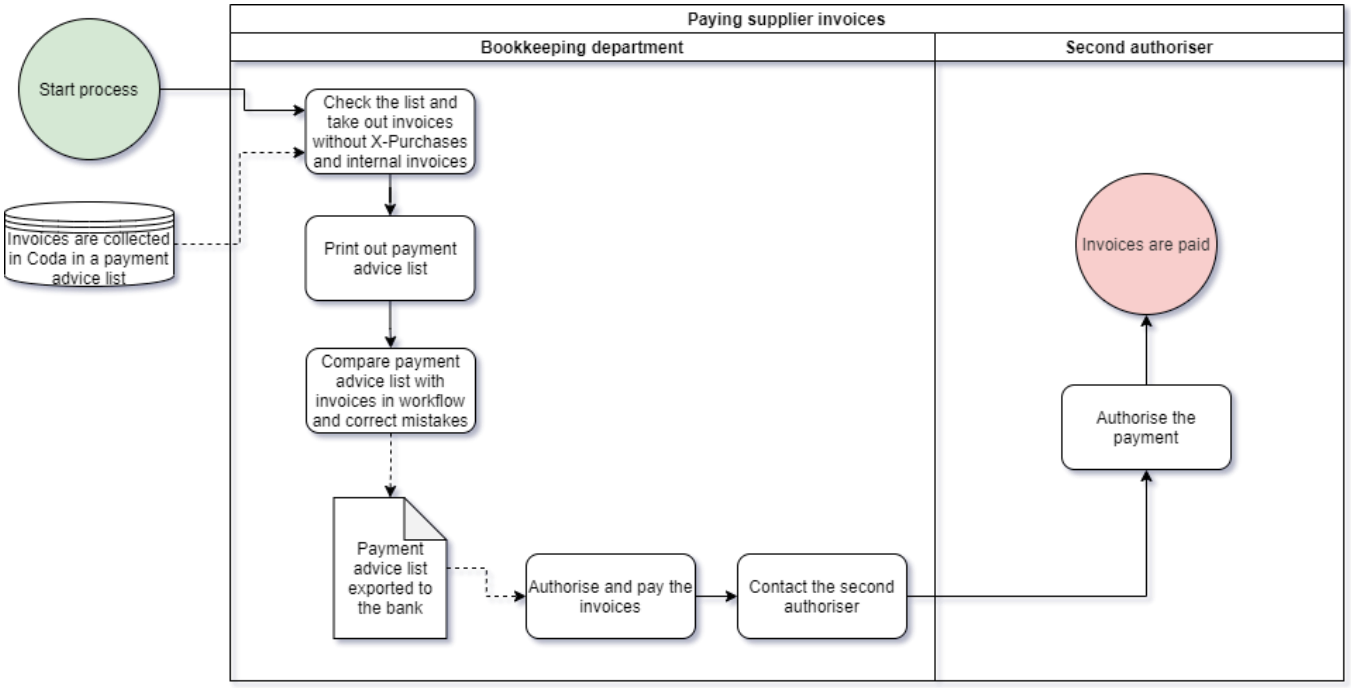

Figure 8: Flowchart of process 'paying supplier invoices'

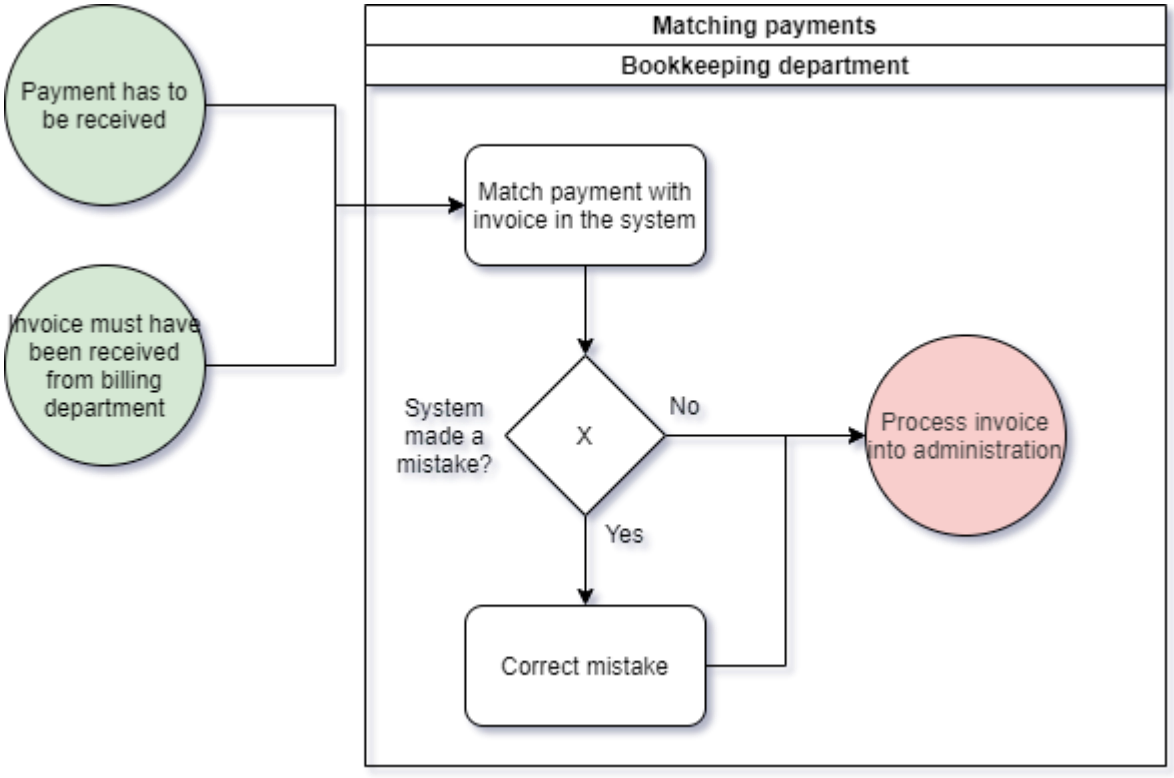

Figure 9: Flowchart of process 'matching customer payments with invoices'

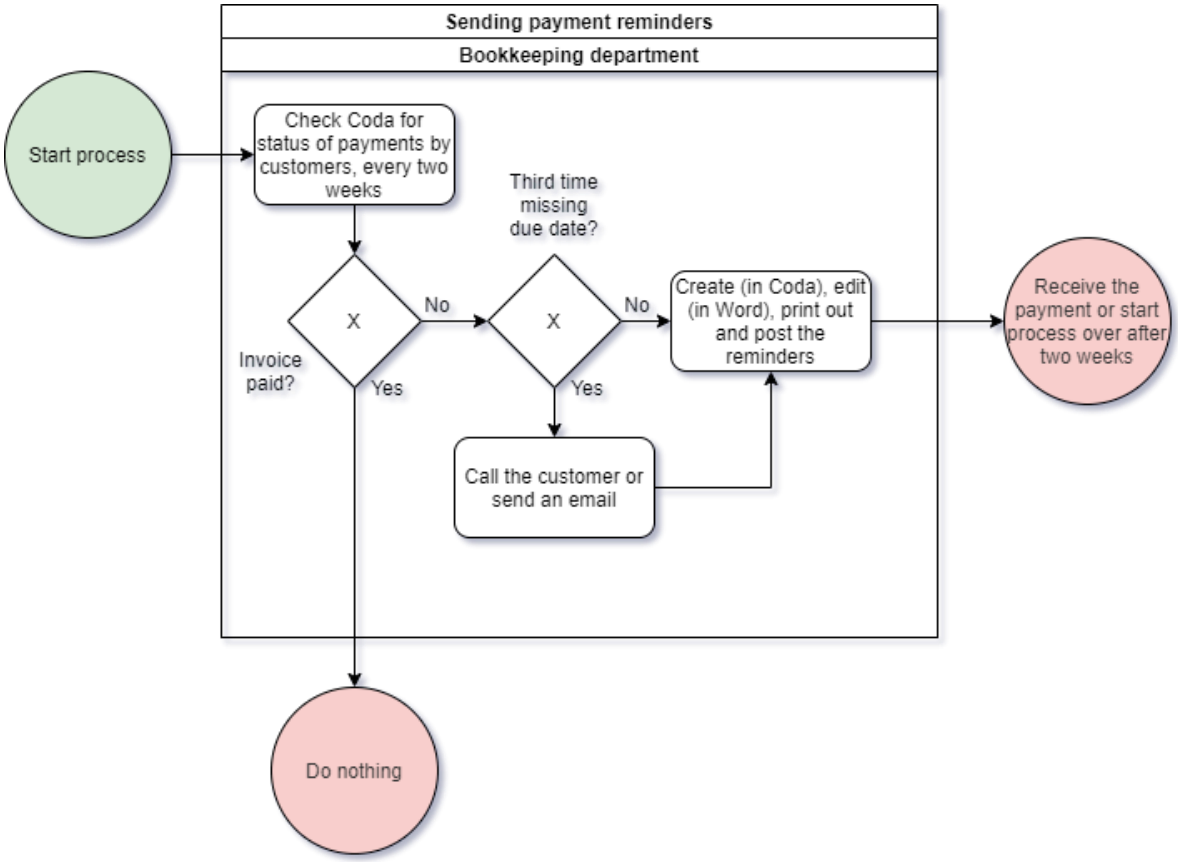

Figure 10: Flowchart of process of sending payment reminders to customers

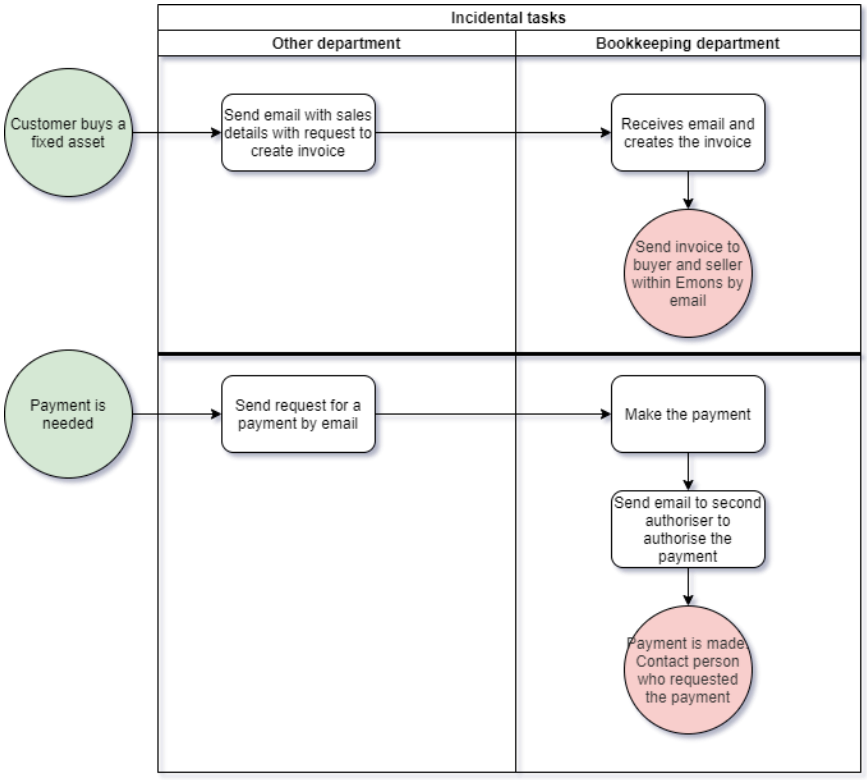

Figure 11: Flowcharts of incidental tasks 'creating an invoice' and 'making an internal payment'

8.2 Appendix B: Dashboard design

Instructions on the dashboard can be found on the next page.

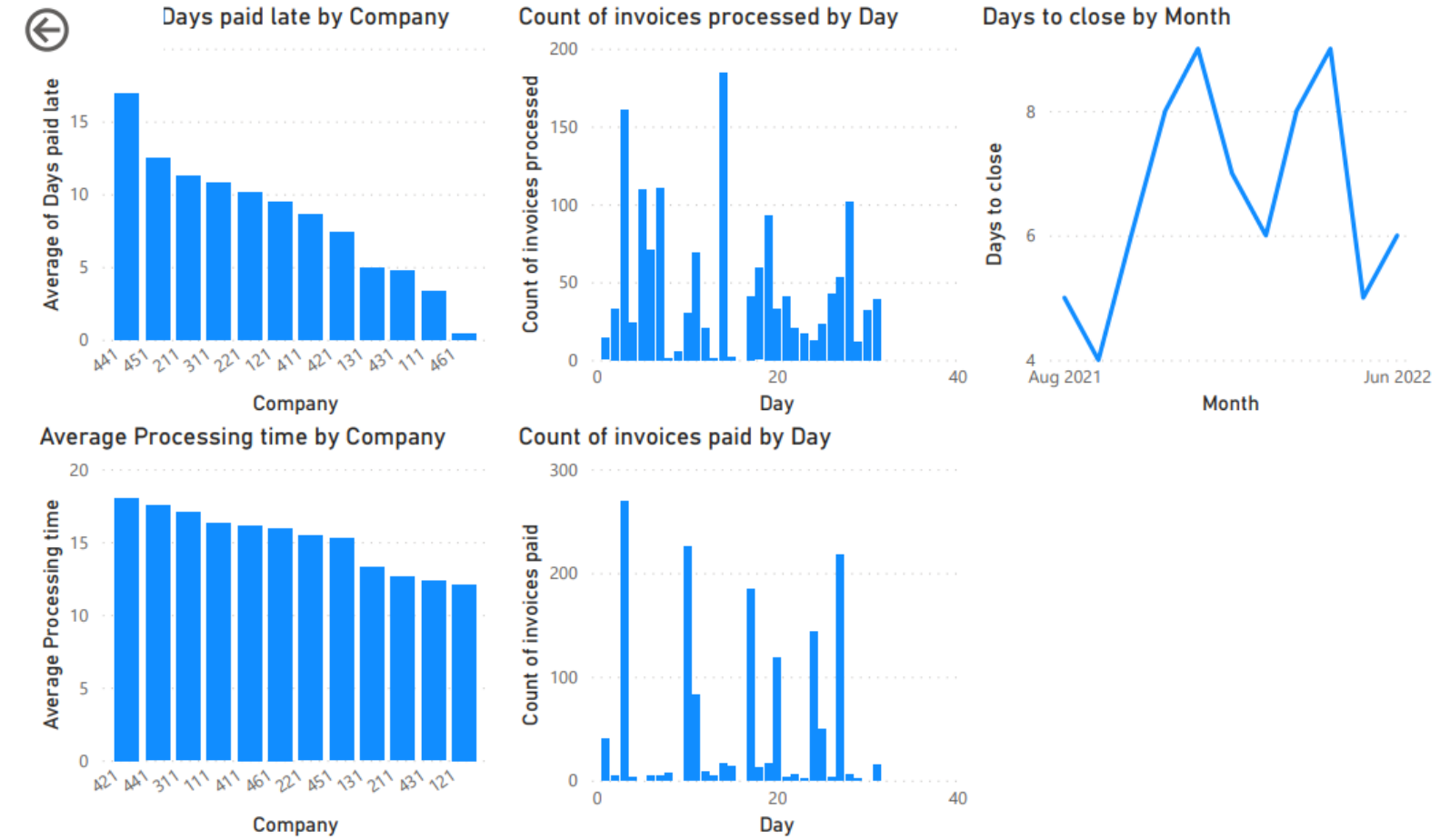

Figure 12: Dashboard design

In Figure 12 the dashboard that was created during the monitor phase can be seen. It shows the five metrics that were set and what the performance on these metrics was during the month of May (except for the 'days to close' metric, which uses imaginary data). The first graph 'days paid late by company' is called like this because on average invoices for all companies are paid late. Once the bars start to become negative it means that invoices are being paid on time. Below will concretely be explained how each graph was created.

First the companies need to be grouped by their respective company codes. This is done by right clicking Company Code under Fields, then select New group. Here Group type should be set to List, then for each company code the code has to be clicked and then click on Group. Once there are no more codes under Ungrouped values, click on OK. A new data field should appear with this icon in front of it:  .

Days paid late by company

First a new column has to be created in excel, which is called 'Days paid late'. This column is created by subtracting the 'matching date' column from the 'Due date' column. It is then applied to every row (so every invoice) in the dataset. In Power BI a Stacked column chart is added. The grouped companies go on the Axis and Days paid late goes under Values. Right click Days paid late under the Values and change from sum to average.

Average processing time by company

Another column has to be created in excel, called 'Processing time'. This column is created by subtracting the 'org. Invoice date' column from the 'lastdate' column and applying it to every row again. In Power BI a stacked column chart is added. The grouped companies go on the Axis and Processing time goes under Values. Right click Processing time under the Values and change from sum to average.

Count of invoices processed by day

Add a Stacked column chart. Put firstdate under Axis and remove Year, Quarter and Month until only Day is left. Put db2easyid under Values.

Count of invoices paid by day

Add a Stacked column chart. Put matching date under Axis and remove Year, Quarter and Month until only Day is left. Put db2easyid under Values.

Days to close by month

Add a Line chart. From the Month-end close sheet, put Month under Axis and Days to close under Values.

Dashboard

The column that is put under Values can be right clicked to change the name that appears on the graph. For example, for the 'count of invoices processed by day' metric, under Values right click 'Count of db2easyid' and click Rename for this visual. Then the value can be renamed to 'Count of invoices processed' so that the right title will appear.

It is also possible to see how many invoices have been processed for a certain company on a certain day by clicking on the bar of the respective company in the 'days paid late' or 'average processing time' metrics charts.

Dataset

Below in Table 6 and Table 7 parts of the (anonymized) dataset that is needed to create the dashboard can be seen. In Table 6 the final three columns are the newly created columns. The table containing data on the days to close a month is a separate sheet where this information is updated every month.

Table 6: Anonymised extract of edited dataset

Document date	Year/period	Home value	Due date	matching date	firstdate	lastdate	days in wf	org. Invoice date	Days paid late	Days in system	Processing time
3/5/2021	2021/5	-0.75	24/5/2021	3/6/2021	5/5/2021	10/5/2021	5	30/4/2021	10	34	11
1/5/2021	2021/5	-0.76	8/5/2021	31/5/2021	3/5/2021	10/5/2021	7	30/4/2021	23	31	11
1/5/2021	2021/5	-1.37	11/5/2021	11/5/2021	3/5/2021	10/5/2021	7	30/4/2021	0	11	11
1/5/2021	2021/5	-2.03	30/5/2021	3/6/2021	3/5/2021	10/5/2021	7	1/5/2021	4	33	10
1/5/2021	2021/5	-2.50	27/4/2021	11/5/2021	21/4/2021	10/5/2021	19	28/4/2021	14	13	13
10/5/2021	2021/5	-2.50	25/5/2021	3/6/2021	17/5/2021	10/5/2021	-7	23/4/2021	9	41	18
1/5/2021	2021/5	-3.15	30/5/2021	2/6/2021	4/5/2021	10/5/2021	7	3/5/2021	3	30	8
12/5/2021	2021/5	-5.47	22/5/2021	27/5/2021	14/5/2021	10/5/2021	-5	3/5/2021	5	24	8
1/5/2021	2021/5	-5.50	20/5/2021	17/5/2021	9/4/2021	10/5/2021	31	3/5/2021	-3	14	8
1/5/2021	2021/5	-5.50	19/6/2021	14/6/2021	7/5/2021	10/5/2021	3	3/5/2021	-5	42	8
14/5/2021	2021/5	-6.10	4/6/2021	11/6/2021	27/5/2021	10/5/2021	-18	1/4/2021	7	71	40
1/5/2021	2021/5	-6.30	15/5/2021	28/5/2021	18/5/2021	10/5/2021	-9	26/4/2021	13	32	15
6/5/2021	2021/5	-7.21	27/5/2021	27/5/2021	14/5/2021	10/5/2021	-5	30/4/2021	0	27	11

Table 7: Dataset example days to close a month

Month	Days to close
Aug-21	5
Sep-21	4
Oct-21	6
Nov-21	8
Dec-21	9
Jan-22	7
Feb-22	6
Mar-22	8
Apr-22	9
May-22	5
Jun-22	6

8.3 Appendix C: Dashboard of tasks

In the figures below the dashboard with all the tasks can be seen. In the view of Figure 13, a certain department can be clicked to see an overview of all the tasks belonging to that department. This then leads to the view as seen in Figure 14.

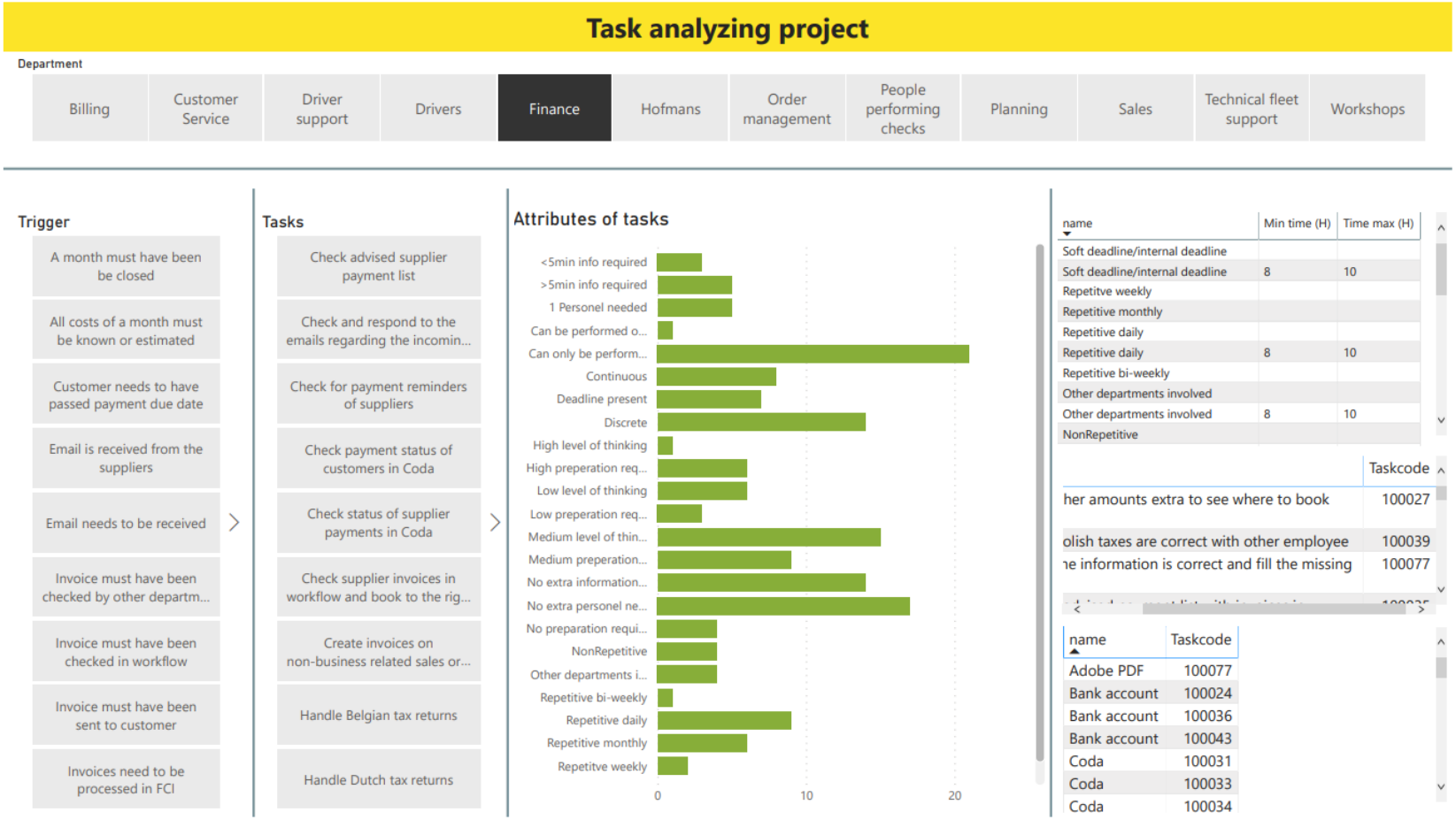

Figure 13: Overview of all the departments followed

In the view as seen in Figure 14 a certain task has been selected. On the top of the screen the department that performs this task can be seen. On the left side the trigger which is needed to start the task is shown. In the middle the attributes that belong to this task can be seen. For example the selected task in Figure 14 is repeated daily and requires a medium preparation. Finally in the right-bottom corner the software system that is used for the task can be seen.

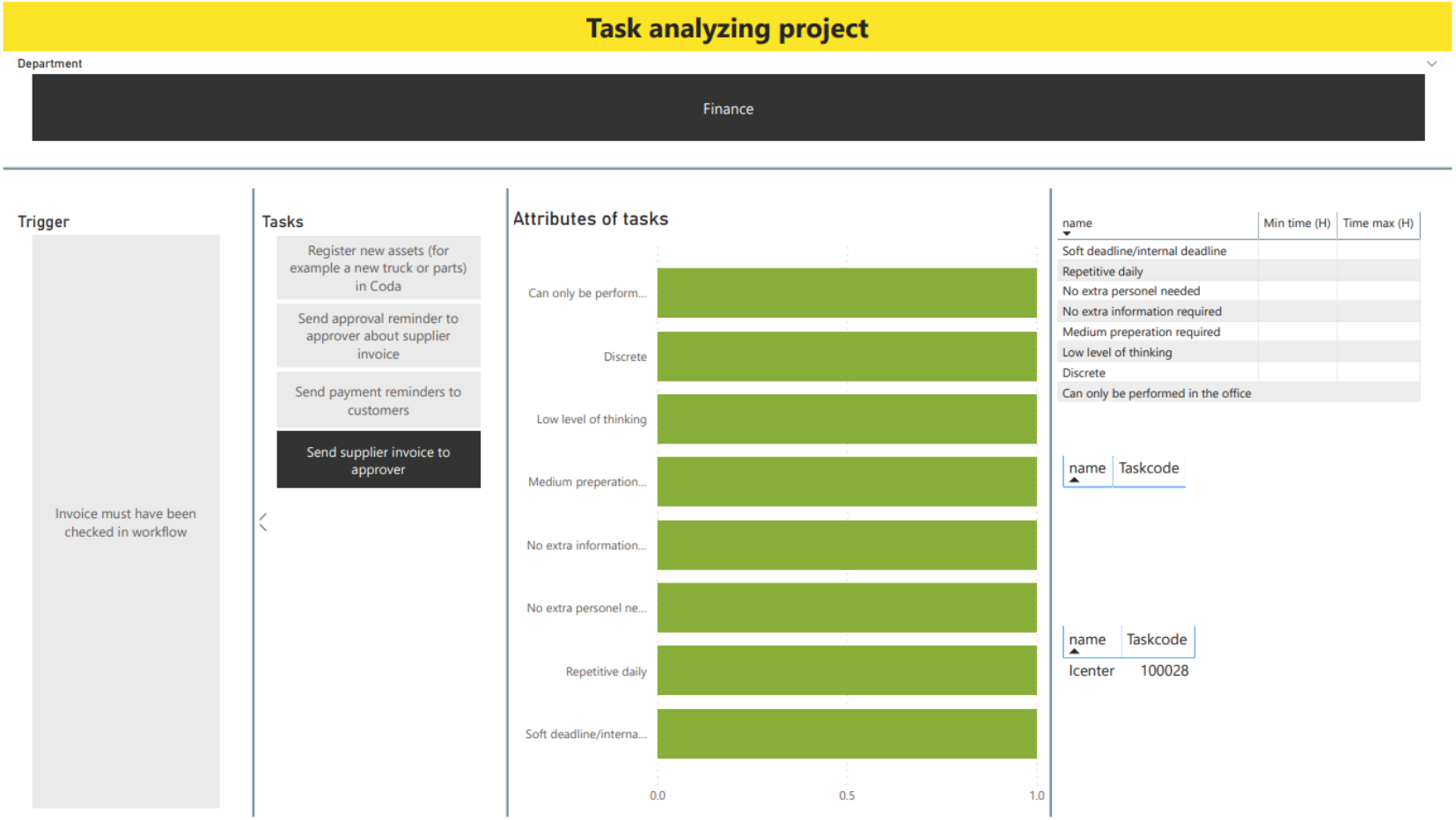

Figure 14: View of a certain task

8.4 Appendix D: Proposed changes

Table 8: Proposed changes first round

Improvement	Specification	Effect	Cost	Impact	Final comments
1	Dual monitor setup	1	0-1	2	Department thinks there are easier ways than having a second screen
2	Reduce frequency of checking email	1	0	1	Could be useful for everyone
3	Separate email automatically	2	1-2	2	Uncertain whether it is technically possible
4	Assign FCI to someone else	1	0	1	Current way is done on purpose
5	Threshold on when to approve an invoice	3	1	1	Risky, but could be implemented
6	Let bookkeeping department approve frequent invoices	2	1	1	Only for invoices that are exactly the same on regular intervals
7	Use purchase orders as verification	3	3	3	This would require a big overhaul of systems, something for the future
8	Negative assurance	0	3	3	Would be misused, not a good idea
9	Change rechecking of invoices	1	0	1	Not discussed
10	Digitalise sending payment reminders	3	1-2	2	This requires an update of Coda
11	Automate matching of invoices and payments more	2	2-3	3	Needs coding to better optimise the system

Table 9: Scales table once more for ease of reading

Effect	1	Small effect on ease of work
	2	Would free up time
	3	Would free up a large amount of time
Impact	1	Can easily be implemented
	2	Needs a change in working routine and/or software
	3	Needs an overhaul of systems

8.5 Appendix E: Transcripts of interviews and observations

In this appendix transcripts of the different interviews and observations will be displayed. Before the observation sessions, some interviews were held in which the tasks were mentioned and some of the problems that were experienced. These are essentially all mentioned below, so will not be repeated.

Session 1

These are the notes on the observations done during the first session.

- The day started with checking the bank accounts. After that the invoices sent to customers were matched with payments. The system does this automatically, but does not find everything, so the remainder should be done manually. This must be done for every Emons company.
- Invoices need to be entered into the workflow. First the email needs to be opened, the invoice has to be downloaded and saved in a special folder so that it can be processed into the workflow.
- Payment reminders need to be checked, which arrive by email, and the employee has to check in Coda what the status of an invoice is, whether it is already paid or not.
- In the workflow an invoice has to be checked to see whether all the information is correct, like amounts and codes. Then the invoice is sent to the person who knows the details of the invoice (the approver). When it is approved the invoice is sent to Coda, where it is put on a payment advice list. This list is check and then imported to the bank where it is paid in a batch (once a week). A second person is needed to authorise the payment. If an invoice is rejected it has to be checked again.
- When there is an invoice of a new supplier, a new rule must be created in the workflow on where to book the invoice.
- Filing tax returns for Germany, need to be filed once per month.
- Payment reminders need to be sent to customers. This is done once every two weeks for each Emons company. First the employee needs to check whether the customers have already paid, then they will not get a reminder. After sending three reminders the employee will send an email to the customer. Reminders are created and automatically sent to word, where they are edited and then they are sent per post. This will soon be online.

Session 2

- Filing tax returns for Poland. This is done in the Polish currency (zloty). A VBA program is used to calculate certain percentages. These percentages then need to be compared to another list to see if they are the same. When a percentage is not right the invoice has to be found. The total process took around 35 minutes.
- Create invoices on non-revenue related sales or internal sales (between Emons companies). An example is the sale of a truck. When a request to make the invoice comes in it will be done as soon as possible, usually within 2 to 3 days. After that it is sent by email to the customer. It takes between 10 and 20 minutes to make one invoice.
- Invoices for three Emons companies are paid. The internal payments to other Emons companies are taken out. The payment advice list is printed out. This list is then compared with the invoices in the workflow to see if the amount and bank account correspond and whether any credit notes managed to slip through.
  This has been checked multiple times before, also by other employees, but there can be mistakes, such as booking a credit note as a debit note or mistakes in currencies.

Check if all suppliers need to be paid, it should mention X-PURCHASES, otherwise they should be taken out. Every supplier in the payment advice list must be clicked on to see if it says X-PURCHASES. Coda then groups the invoices per supplier/bank account. Every invoice is then matched with the payment advice list. Payment of invoices for three companies took around 1.5 hours.

- Payment of separate invoices or requests, for example to other Emons companies or an urgent invoice. These arrive by email.

Session 3

- Updating the workflow. When an invoice is checked in the workflow and sent to the approver, this approver will get an email and will get the invoice in their workflow. Every supplier has a rule which decides, by means of a code, to who the invoice must be sent. This could be multiple approvers, for example when multiple departments were involved with the purchase. For high amounts a limit can be imposed until which a certain approver can approve. The remainder must be approved by someone higher in the organisation (cost manager). When an invoice is rejected, the purchasing department must contact the supplier to resolve the issue. Once the invoice has been approved by everyone it will be sent to Coda. The invoice automatically moves from one approver to another/the cost manager.
  Higher amounts are check extra to see where they should be booked.
- The taxes for Belgium need to be filed.
- The new parts that have been purchased need to be registered so that they can be written off on. This is to spread the costs instead of having all the costs in one month, while the parts are used for longer. It is also noted in excel for their own administration. The parts need to be manually entered into Coda. This process took around one hour and needs to be done once per month.
- Taxes for the Netherlands are filed. Taxes need to be filed before the end of the month. The taxes need to be found in Coda. There they are printed out so that they can be compared with an excel file which contains the information. This process takes between 60 and 90 minutes.
- A process that was not observed is the payment of the wages. This must happen before the 25th of every month.

Interview

During the third session, a short interview was held to clarify certain things and get more information on the tasks and problems.

What are the busiest days in the month/year?

The busiest weeks are the first two weeks of the month, during this time the previous month is closed for all twelve Emons companies, both in the Netherlands and those in other countries. Colleagues and also foreign colleagues have to deliver information. When this goes well it can be done quickly, they have done it in six days last week. Normally it takes around ten days to close all companies.

Most of the time is spent on the workflow, the payment of invoices (half a day per week per employee). One employee handles the damage claims and debtor management (correspondence with customer, answering questions, sending payment reminders and calling when a customer does not pay). It is uncertain how much time goes into this, but estimates are 1.5 days for each process.

The biggest companies take up most of the time, which are two foreign companies. The administration and payment of wages must be done by the department which takes up quite some time. The bigger

a company is, the more supplier invoice that company receives, so those companies take up more time.

The due date is the only deadline for sending or approving an invoice, but this date is not always taken into account. There is no internal deadline, when an invoice is not paid the payment reminders will come automatically.

There are not many deadlines, only the taxes need to be filed before the end of the month and wages need to be paid before the 25th.

Other problems that are experienced are the high work pressure, slow or not responding systems. High work pressure is mostly experienced because of the many tasks in combination with certain deadlines. The first two months of the year are the busiest, as in these months there is extra work in the year-end closure. Closure of the first month usually takes the longest as well, so other tasks are delayed. After that there is a relatively less stressful period. From December until the end of May there is a lot of work. During the holidays there are less people, so there is again more work. A major part of the year there is a lot of work.

During the first month the costs that apply to the whole year need to be spread out over the twelve months. After that this is fixed for the rest of the year. These costs came from the budget and have to be entered into Coda, which happens at the beginning of the year. Some invoices only come once per year, for example halfway the year. These costs need to be spread out over the year, which happens in the first month. After that these costs are still being monitored.