



# **Bachelor Thesis**

**Bachelor Industrial Engineering and Management**

## **Process Optimization for the Order Management Department at Emons Group B.V.**

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# **UNIVERSITY OF TWENTE.**



## Preface

Dear Reader,

This thesis has been written to conclude my study program Industrial Engineering and Management at the University of Twente and to obtain my Bachelor degree. It was my pleasure to perform this thesis for Emons Group B.V. and specifically their Order Management department.

Firs of all, I would like to thank everyone at Emons for their hospitality and generosity. And on top of them Marcel Wouterse, Thomas Massop, and Kim Keurkens, I want to thank them for their help, support, and guidance throughout the period of conducting this thesis. I would not have been able to do this thesis without their input. I felt welcomed at the company whenever I was there and everyone was nice and helpful, and all the available data needed for this thesis was provided.

Last but not least, I would like to thank Sebastian Piest, my supervisor from the University of Twente, and Ipek Seyran Topan, the coordinator of the thesis preparation module from the study program and my second supervisor, for their continuous valuable feedback, guidance, and support since the start of module 11 of the study program. This thesis would not have been conducted without the time and effort they provided throughout the whole period.

It was a positive overall experience for me and I learned a lot from it. I am now looking forward towards the next stage of my life after graduation.

Mohamed Elsafty

Enschede, August 2021



## Management Summary

This thesis started as part of a project for process optimization for the Order Management department at Emons Group B.V. In order to aim for process optimization and improving the efficiency of the department you first need to know where does the performance currently stand. So, the first step is to measure the performance of the department, which is currently not being done by Emons and that is why the core problem chosen for this research was *not measuring the performance of the department* and from this followed the main research question:

*How to measure the performance of the Order Management department at Emons?*

The research goals are to provide means for Emons to measure and assess the performance of the Order Management department and to act as a basis for future projects regarding process optimization and improving the efficiency of the department and the company overall. It also helps Emons towards reaching their goal of connecting and linking together the different departments within the company since their respective tasks are interconnected and this will improve the company's overall efficiency.

The solutions and deliverables decided for the case of Emons are developing KPIs which will be used to measure the performance of the department, an employee scorecard card to measure and monitor the daily performance of the employees at the department, a flowchart with an overview of all the tasks with their respective start and end triggers, a RACI matrix, SIPOC diagrams, and an excel sheet containing all the tasks with their respective attributes, sub-tasks, start triggers, departments involved, average time needed to perform the tasks, and programs used for the tasks.

The deliverables are presented in the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, and 9<sup>th</sup> sections of the thesis. The evaluation, recommendations, and conclusion are presented in the 7<sup>th</sup> section.

The main overall KPIs chosen for the department are:

- 1- Cost per order:
- 2- Order fulfilment accuracy rate:
- 3- Order fulfilment cycle time:
- 4- Perfect order rate:
- 5- On-time delivery rate:
- 6- Overall Vehicle Effectiveness (OVE)
- 7- Overall Transport Effectiveness (OTE)

And the main individual KPIs chosen for the employee scorecard are:

- 1- Total number of emails responded to /day

This KPI will not provide useful insight if it was reported as only the total number of emails responded to /day without classifying those emails because there are different



categories for emails and each category requires different handling so, this KPI is reported by category and the categories are the following:

- Reporting loading/unloading times
  - New orders
  - Reporting license plates
  - Incidents
  - Delays
  - Requesting documents
  - Fleet managers emails
- 
- 2- Number of incidents solved /day
  - 3- Number of Brexit issued handled /day
  - 4- Number of incidents registered /day
  - 5- Number of customers handled /day

The future research direction is a follow-up 6-months case study that is described in detail in the 7<sup>th</sup> section of the thesis, the “Evaluation and recommendations” sub-section.

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## List of acronyms

OM: Order Management, of Emons.

KPI: Key Performance Indicator.

MPSM: Managerial Problem Solving Method.

RACI: Responsible, Accountable, Consulted, Informed.

SIPOC: Suppliers, Inputs, Processes, Outputs, Customers.

KAM: KPI Assessment Methodology.

UT: University of Twente.

AHP: Analytical Hierarchy Process.

OVE: Overall Transport Effectiveness.

OTE: Overall Vehicle Effectiveness.



## 1. Introduction

Emons Group B.V. is a private Dutch transportation company which consists of other sub companies. They existed for over 75 years in the European transport market, and now after Brexit they deal with transportation from/to the United Kingdom as well. There are 5 students from the University of Twente contributing to graduation projects with Emons this year, the Emons Improvement Squad. Each student is responsible for one of 5 departments: Order Management, Technical Fleet Support, Planning, Finance, and Billing. This research will be for *Process Optimization for the Order Management department at Emons Group B.V.*

### 1.1 Problem cluster and identification of core problem and action problem

According to Emons (based on their assumptions and intuition), their Order Management department is facing a problem with inefficiency and is currently underperforming. If we use the 5 whys approach and go 5 steps backwards, as shown in the problem cluster in figure 1, this will lead us to the core problem: *Not measuring the performance of the Order Management department*. Emons have not taken any steps before regarding standardization and optimization of processes. And mostly all the tasks and data entries are done manually so they are prone to human errors. Moreover, none of the processes are automated and all the tasks requires supervision or double checking by employees. There are currently no KPIs present for the department and the internal performance. The only KPIs present are for the customers, and even this is not standardized, every customer has their own KPIs sheet that is also filled manually on a weekly basis. And because of the lack of KPIs or any other means of measuring the performance, there is no tangible reality to be judged upon regarding the performance. And therefore, there is no clear view for the management of Emons about the department and whether it is inefficient or underperforming as they claim or not.

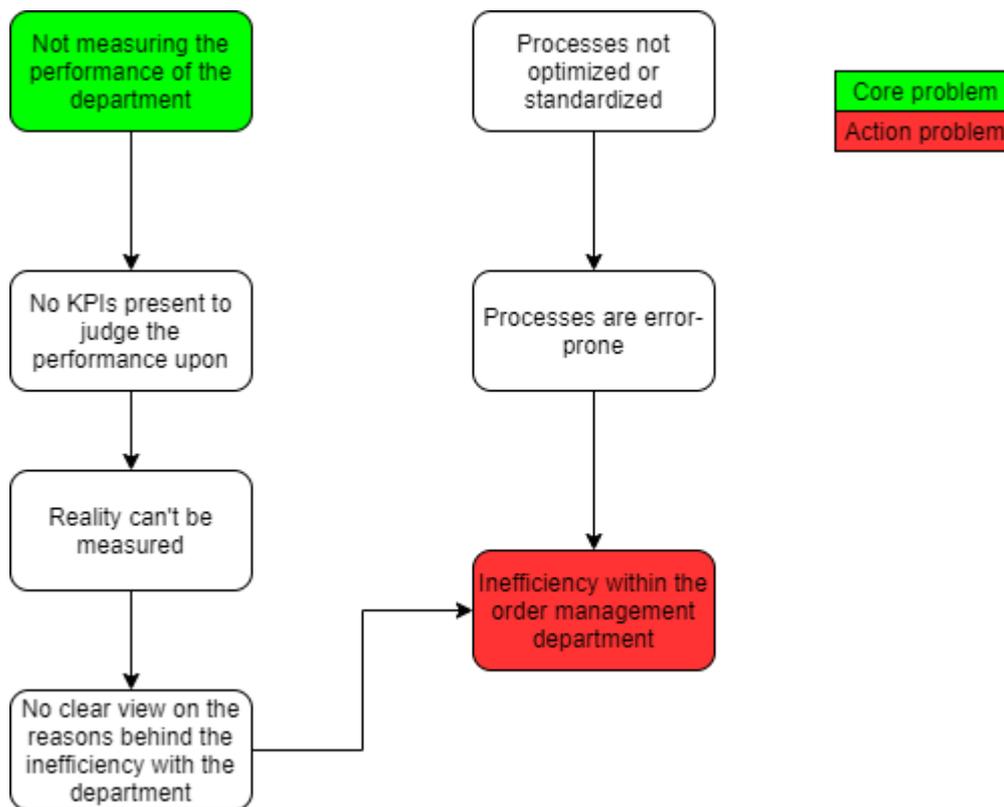


Figure 1 Problem Cluster

The Order Management department at Emons currently do not measure the internal performance of the department. The problem cluster, displayed in figure 1, shows reasons behind the inefficiency within the department. In order to evaluate the efficiency of a department and aim for process optimization within the department, you must be able to measure the performance of the department in the first place. That’s why the focus of this research will be on measuring the performance of the Order Management department at Emons. After this is achieved, the performance of the department will not be a blind spot any more from the management of Emons’ perspective and they will have proper insight that can be used in making decisions for the sake of optimization, improvement, and efficiency of the department. That’s the goal of this research and the motivation behind it. The limitation of this research is that a follow-up study of 6 months is required to monitor and analyse the data for 6 months and recognize weekly and monthly patterns, and this will be used as well to further evaluate the solutions used for measuring the performance and see how well it works and whether improvement and refinement is needed. This is the future research direction, which may also include building a dashboard for monitoring and measuring the performance of the department and link it to the performance of other departments and the whole company overall. The limitations and future research direction are discussed in more detail in the sub-section “scope and limitations”.

## 1.2 Stakeholder analysis

The main stakeholders involved in this research are the author (me), the UT's supervisor, Emons' supervisor, and the OM employees. Table 1 below shows the stakeholders with their respective roles, power/influence scores, and their interest score.

*Table 1 Stakeholders*

Stakeholder	Role	Power/Influence score	Interest score	Comment
Author (me)	Researcher/Author of the thesis	9	10	The research has a direct major influence on the author's study progress/bachelor graduation and personal life. The author is the one responsible for collecting information, carrying out the research, and writing the thesis.
UT's supervisor	Supervisor on the thesis	9	4	The supervisor provides feedback and assessment on the thesis. The university's supervisor is usually not affected personally by the research but in this case the supervisor is also part of the company and hence he may have more interest in the research.
Emons' supervisor	Guide/ Contact person/ Information provider/ Receiver of solutions	10	8	The supervisor from the company is the main contact person and he is the one that puts me in contact with or refer me to people from

				different departments in the company based on the needs of the research. He also guides us on the “right track” from his and the company’s perspective since they started this research in the first place and want to benefit from it.
OM employees	Information providers	5	5	They provide the information that acts as a basis for this research. And the solutions implemented will personally affect them and their jobs.

The power/influence score and the interest score was assessed on a scale from [0-10]. For the power/influence score, the higher the score the more power/influence the stakeholder has on the research. For the interest score, the higher the score the more interest the stakeholder has in the research. The comments section in table 1 justifies the scores given for each of the stakeholders and these scores are used for the stakeholders matrix shown in figure 2 below.

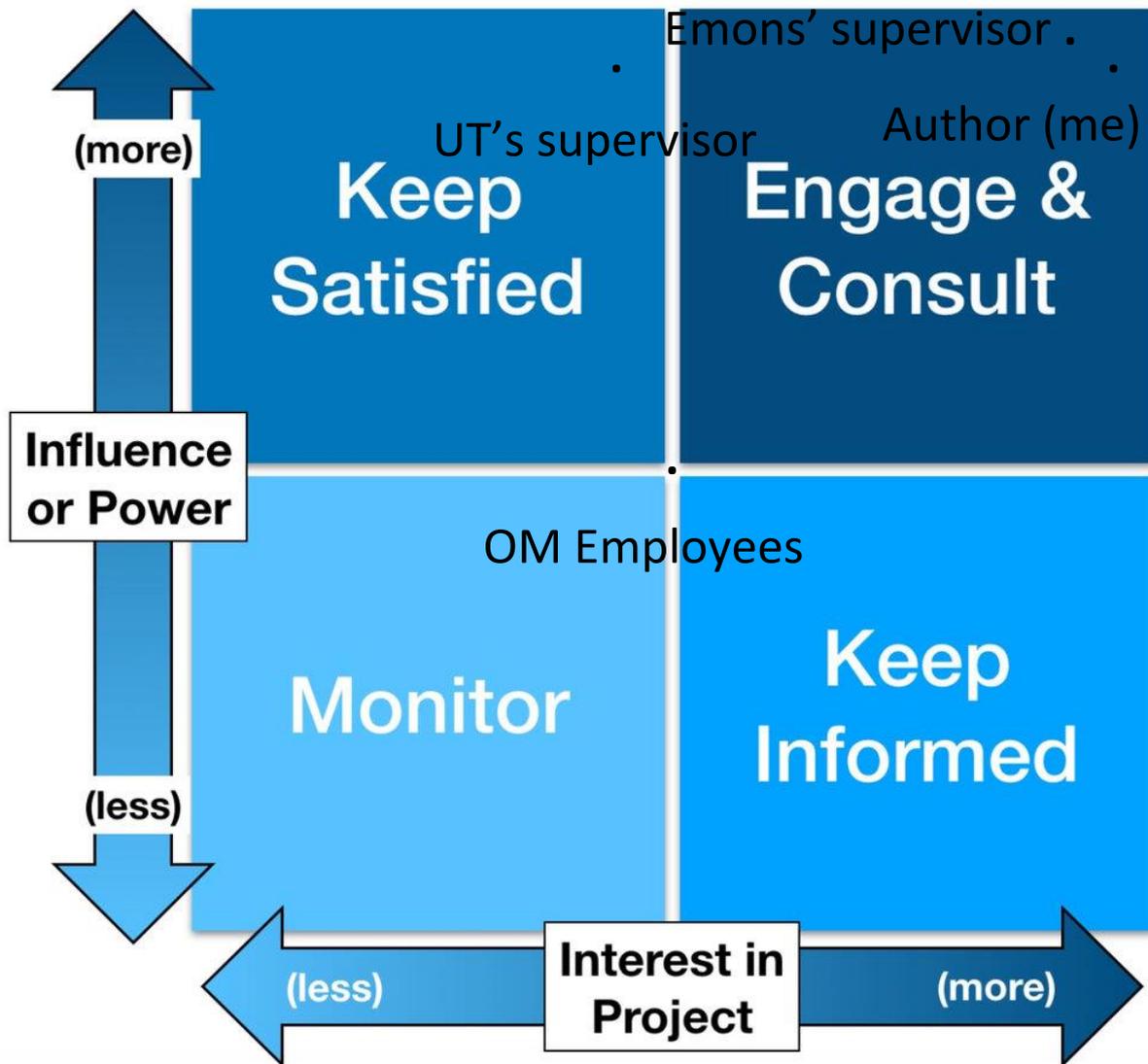


Figure 2 Stakeholders matrix. Template source: <https://www.theprojectmanagementblueprint.com/blog/stakeholder-management/stakeholder-power-interest-grid>

### 1.3 Measurement of norm and reality

There is no current way of measuring reality, as shown in the problem cluster. But now this research has provided means for measuring the performance of the Order Management department using the KPIs presented and the employee scorecard. The reality is not measured in this research but the research question: “How to measure the performance of the Order Management department at Emons?” is answered and the employees of the department can use the outcome of this research and they have the time and the data needed to measure the reality. The norm can also now be measured and set. My proposal was that the goals and target values be set for each KPI as well as deadlines for each target to be achieved and these targets and deadlines for each of the KPIs are going to be estimated by the stakeholders and this will be the norm. I tried to establish this within the research but time was not sufficient



and the stakeholders wanted to decide this later after the research is done. Also this can be set after 3 months of the 6-month follow up case study to monitor the performance since then there will be a clearer view into the performance and patterns would have emerged so, it will be a logical time to define goals and target values that are feasible within a specific time frame.

The variables for this research are the KPIs. There will be 2 types of KPIs set: KPIs for the employees and KPIs for the department as a whole. The values of the KPIs will be used to assess and monitor the performance of the employees in the employee scorecard, and the performance of the department.

### 1.3 Problem solving approach

The problem solving approach that is going to be used in this research is the Managerial Problem-Solving Method defined by Heerkens & van Winden (2017) in their book, Solving Managerial Problems Systematically. The Managerial Problem-Solving Method is abbreviated as MPSM.

The MPSM consists of 7 stages:

- 1- Defining the problem
- 2- Formulating the approach
- 3- Analysing the problem
- 4- Formulating (alternative) solutions
- 5- Choosing the solution
- 6- Implementing the solution
- 7- Evaluating the solution

The research is an exploratory research and the research subjects are Emons Group B.V. and their Order Management (OM) department. The first step is to conduct a few interviews with the leader of the department and other employees in the department to make a list of all the tasks and processes that are being done within the department and understand them thoroughly. After that, make a flowchart to get a clear overview of all the tasks and processes that are being done within the department. The next step is developing KPIs for the OM department and for the employees, that will be used to measure and monitor the performance of the employees and the department. The KPIs for the employees will be used to make an employee scorecard to measure the daily performance of the employees. Then, a RACI matrix will be made and will include the main tasks of the department. Last but not least, SIPOC diagrams will be made. After that, the last step is the evaluation of the solution and the recommendations to the company. The limitations and the future research direction after this project is done are discussed further in the sub-section “scope and limitations” in the research design section, as mentioned earlier.

## 1.4 Deliverables

The deliverables are a flowchart (the preliminary version can be found in appendix A and the final version can be found in appendix B), list of KPIs, Employee scorecard, RACI matrix, and a SIPOC diagram. More elaboration on the deliverables and the purpose they serve is provided in the “theoretical framework” sub-section of the literature review section and their relative sections. There is also another deliverable required by the company: an excel sheet including all the tasks of the department and subtasks and triggers, which can be found in appendix C.

## 1.5 Defining research question and knowledge problems

The main research question: *How to measure the performance of the Order Management department at Emons?*

Knowledge questions and further research questions can be defined for each of the 7 stages of the MPSM approach:

For stage 1:

- How can we evaluate the efficiency of the department?

For stage 2:

- Which theoretical frameworks best suit this research?
- What tools can be used for this research?

For stage 3:

- What are the current tasks of the department?
- Who are the stakeholders?
- In what level of detail should the tasks within the department be included?

For stage 4, 5, and 6:

- What KPIs can be defined to measure the performance of the department?
- What KPIs can be defined to measure the daily performance of the employees?
- How can the KPIs be selected and how the values for all the KPIs can be obtained?

For stage 7:

- What are the main findings and recommendations?
- How can the validity and reliability of the findings be assessed?

For the questions of stages 1 and 2 literature research needs to be done. Stage 3 questions requires the output from the interviews. The questions for the other stages of the approach requires both literature research and the output from the interviews and discussions with the stakeholders of the project. More information on the knowledge and research questions can be found in table 3 and table 2, respectively, in the data gathering methods sub-section.



## 1.6 Research design

### 1.6.1 Research objectives

The broader objective of this research is process optimization for the order management department at Emons, as mentioned in the title of the project. But this is a very broad objective that can be achieved in many ways and has a lot of steps to it. The focus of this research and its main objective is to do the very first step towards achieving this bigger objective, which is having a way to measure and evaluate the performance of the department in the first place. This will act as a basis for more projects to come in the future to build for the bigger objective mentioned earlier and continuous improvement for the department and Emons as a whole.

### 1.6.3 Data gathering methods

For this research two main data gathering methods will be used, interviews and research. The main 5 people that will be interviewed or invited for meetings/discussions throughout the research are Business Analyst for Emons, Director at Emons, Team leader for the Order Management department at Emons, Employee at the Order Management department at Emons, my supervisor from the University of Twente. The interviews will not be published in this research. The interviews will not be limited to specific questions and during the meetings the people will have more freedom for explanation and taking initiative for sharing all the information that they believe will prove helpful later. More meetings, other than the planned ones, may be conducted if necessary. The interviews will be used to answer some of the knowledge questions as explained earlier. Moreover, follow-up questions or further discussions after the meetings will take place via emails. This point will be discussed in the ‘scope and limitations’ sub-section below.

As for the other knowledge questions, research will be used. In table 2 below, the knowledge questions mentioned earlier for the 7 stages of the MPSM problem solving approach are shown along with their respective research type and research method. In table 3 below, the same is done for the knowledge questions. The research types included in this research are exploratory, and descriptive. And the research methods included are literature research, interviews, and data analysis.

*Table 2 Research questions and their respective research type and research methods*

Research question	Research type	Research method
How can we evaluate the efficiency of the department?	Exploratory	Literature Research
Which theoretical frameworks best suit this research?	Exploratory	Literature Research
What tools can be used for this research?	Exploratory	Literature Research

What KPIs can be defined to measure the performance of the department?	Exploratory	Literature Research
What KPIs can be defined to measure the daily performance of the employees?	Exploratory	Literature Research
How can the KPIs be selected and how the values for all the KPIs can be obtained?	Exploratory	Literature Research, interviews
What are the main findings and recommendations?	Exploratory	Literature Research, deductive approach
How can the validity and reliability of the findings be assessed?	Exploratory	Literature Research, interviews, evaluation form

Table 3 Knowledge questions and their respective research type and research methods

Knowledge question	Research type	Research method
What are the current tasks of the department?	Descriptive	Interviews
Who are the stakeholders?	Descriptive	Interviews
In what level of detail should the tasks within the department be included?	Descriptive	Interviews

#### 1.6.4 Scope and limitations

Regarding the scope of this research, it is addressing an order management department of a logistics company specialized at transportation within Europe/UK and focusing on performance measuring/management of their Order Management department. And currently this was not addressed by Emons so, this research is a cornerstone for the company regarding this scope that they will be able to build on it in the future with projects regarding the larger scope of process optimization and improving the performance and efficiency of the department and the company overall. For the 10 weeks I will be involved in with the company my main contribution with this research will be on the core problem of having no insight on the performance of the department and not measuring it in any way. This research provides means to get insight and measure the performance of the department and acts as a basis for future projects addressing the larger scope discussed.

The main limitation of this research is the time as mentioned earlier. The evaluation stage for this research consists of an evaluation form filled in by the team leader of the Order Management department but in a different scenario with less limitations and more time this stage requires a further case study for 6 months to measure and monitor the performance within those 6 months and perform data analysis on this data to deduct weekly/monthly

patterns and compare with the norm. Further actions, solutions, and improvements will follow up from this study. This research will be done in only 10 weeks so, it is just the beginning for bigger steps to be taken afterwards for the sake of process optimization. The other limitation is the COVID restrictions and working online because of the pandemic. Because the interviews and meetings are mostly online it is sometimes hard to arrange them or get an answer via email. This process sometimes takes longer than it should and the lead time for receiving a response on an email is sometimes high. In a different scenario with normal circumstances (the absence of this pandemic) we would have been in the same place every day in the company. And then the process of getting to speak to people from the department would have been easier and more accessible. When I visited the company in Milsbeek, the employees of the department were sitting on desks right next to each other and communicating easily all day, they can just speak to each other with no need for sending emails to each other and wait for responses. Another limitation is the holidays. Sometimes the employees are on holidays which makes it harder to schedule meetings and increases the lead time for obtaining information or data that is required for example.

#### 1.6.5 Validity and reliability

As mentioned by Middleton (2019), reliability and validity are concepts used to evaluate the quality of research. They indicate how well a method, technique or test measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. (Middleton, 2019). The validity of the research will be assessed via interviews with the stakeholders while the reliability will be assessed with the 6 months case study mentioned earlier. The stakeholders are the ones that judge on the accuracy and the 6 months case study will show the consistency/inconsistency of the results.

#### 1.7 Current situation and preliminary research

As mentioned earlier, Emons currently does not measure the performance of the Order Management department in any way. Multiple interviews have been conducted to get an overview of the tasks that are being done within the Order Management department and after multiple modifications the preliminary flowchart, that can be found in appendix a, has been reached. Furthermore, in cooperation with my 4 colleagues that are performing different graduation theses for Emons, we defined attributes for all the tasks, and this can be found in the excel sheet displayed in appendix c. It is important to note that the excel sheet displayed is only my contribution which concerns the Order Management department only. The data presented in the excel sheet in appendix c was merged with similar excel sheets done by my other colleagues for the other departments and the combined excel sheet was used to make a Power BI model. This was a deliverable requested by the company and it is an important part of our work since it is going to contribute to other future projects and the company's goal of linking the departments together and improve the overall efficiency within the company. At this point, the start triggers and the end triggers of the tasks are clear and the preliminary flowchart is inaccurate in showing all the tasks in a continuous flow, which is not the reality. So, after the excel sheet was finished the flowchart was edited, the final version of the



flowchart can be found in appendix B, and now the overview of the tasks is clearer and shows the start and end triggers of each task.

## 2. Literature Review

### 2.1 Systematic Literature Review

The first step of performing a systematic literature review is to formulate the research question, which was formulated earlier as: *How to measure the performance of the Order Management department at Emons?*

#### 2.1.1 Search strategy

First of all, the databases that will be used are: Scopus and the University of Twente thesis repository. And two theses made by previous students at the University of Twente will be considered, based on the suggestion of my supervisor. Two researches will be chosen from each of the two databases. So, a total of 6 articles will be chosen.

Key words:

- “Performance measurement/measuring/management”
- “Order Management”

#### 2.1.2 Inclusion/exclusion criteria

Articles in the fields: Engineering, Business, Management, and Supply Chain are included.

Articles in the fields: Computer Science, Environmental Science, Medicine, Energy, Social Sciences, Mathematics, and others are excluded.

Since Emons is a transportation/logistics profitable organization, articles relating to companies that have operations in transportation, supply chain, distribution, and order-to-delivery processes are included. While articles relating to the public sector are excluded.

#### 2.1.3 Search results

After applying the inclusion and exclusion criteria, the next step is to review articles to choose 6 articles. The top searches with the most relevant names are open in order and reviewed because sometimes the title is deceiving. The title may sound relevant and the paper may seem one that can inspire the research but after reviewing its chapters and content it may not prove useful after all. So, after applying this approach 6 articles were chosen. All of them are fit, relevant, and match the criteria. The 6 articles were chosen carefully after being reviewed so, no duplicates exist.

*The University of Twente Theses Repository:*

The choosing method of articles from the university’s thesis repository is to check the titles of the theses and choose six relevant titles from the most recent theses (2020 and 2021). Then review them and choose the most relevant two. The two chosen articles from this database are:

- Baalbergen, M.M. (2020) Monitor KPIs with a performance dashboard.
- Yağci, I.T. (2021) Performance measurement by implementing Key Performance Indicators for the Gemeente Enschede.

*The articles recommended by supervisor:*

The two articles recommended by the supervisor have been reviewed and deemed worthy of the inclusion in the final list of 6 articles. The two added articles to the list are:

- Westerik, L. (2020) Improving performance personnel department at Company X.
- Iankoulova, I. (2012) Measuring the performance of a transportation network sharing cooperation between logistics companies.

Scopus:

The articles search through Scopus was done using the key words mentioned in the search strategy. The inclusion/exclusion criteria were used at the process of refining and reviewing the articles. And the scope was set to “Title, Abstract, Key”. The two chosen articles from Scopus are:

- Torabizadeh, Mohammadehsan E.; Noordin, M.Y.; Awaluddin, M.S. (2013). Performance Measurement System for Sustainable Supply Chain Management.
- Sundström, P. & Tollmar, K. (2018) Measuring Performance of an Order-to-Delivery Process.

This article: *Voltolini A.O., Pinheiro De Lima E., & Gouvea Da Costa S.-E. (2016). Performance measurement for supply chain management: A systematic literature review* is an example of an article that has a matching and attractive title that may sound relative at a first glance. But after reviewing it, it appears to be irrelevant and does not match the criteria.

#### 2.1.4 Conceptual matrix

The conceptual matrix, refer to tables 4 and 5 below, shows the connections between the chosen articles and also serve to establish which articles involve which concepts and research themes.

The concepts chosen are the following:

- 1- Performance measurement
- 2- Developing KPIs
- 3- Evaluating KPIs
- 4- Building a dashboard

*Table 4 Conceptual matrix (part 1).*

Article title and number	Publication year	Author(s)	Concept(s)
1- Monitor KPIs with a performance dashboard.	2020	Thijs Baalbergen	1, 2, 3, 4
2- Performance measurement by implementing Key	2021	I.T. Yagci	1, 2, 3

Performance Indicators for the Gemeente Enschede.			
3- Improving performance personnel department at Company X.	2020	Lars Westerik	1, 3
4- Measuring the performance of a transportation network sharing cooperation between logistics companies.	2012	Iliana Iankoulova	1, 2, 3, 4
5- Performance Measurement System for Sustainable Supply Chain Management.	2013	M. E. Torabizadeh, M. Y. Noordin, M. S. Awaluddin	1
6- Measuring Performance of an Order-to-Delivery Process.	2018	Philip Sundström, Klara Tollmar	1, 2, 3

Table 5 Conceptual matrix (Part 2).

<i>Article number</i>	<i>Methodology</i>	<i>Key Findings</i>
1	Data collection, data analysis.	Building a performance dashboard to monitor the performance and have more insight and be able to evaluate and improve.
2	Data collection, data analysis.	Using flowcharts for visualization. Developing KPIs. Offering advice to implement the KPIs using a dashboard (Does not build the dashboard).
3	Data collection, data analysis.	Use of flowcharts, process mining, Gemba Walk, Kotter's 8 step change model, lean, and six sigma.
4	Data collection, data analysis, case study.	Use of BI. Overall Transport Effectiveness (ETA) framework and dashboard. Measurement frameworks.

5	Data collection, data analysis.	Brief explanatory paper with guides. Balanced scorecard approach.
6	Data collection, data analysis	Benchmarking. Use of SCOR model. Balanced scorecard vs Dashboard comparison.

## 2.2 Theoretical framework

### 2.2.1 Effectiveness & efficiency

Companies today self-evaluate their performance in order to boost processes and ensure operational excellence in a variety of areas. Effectiveness and efficiency are two terms that are frequently used discussing a company's performance. Although the two terms are frequently used interchangeably in organizations, their meanings are distinct. As a result, it is critical to define the two concepts in order to communicate effectively.

*Effectiveness* frequently refers to doing the correct things, i.e. focusing on producing demanded output that aligns with strategic goals. The ability of a corporation to achieve the desired results in accordance with its goals, missions, and aspirations is referred to as effectiveness. It's all about achieving a goal and observing how the process's outputs influence the social and economic environment. Effectiveness can be viewed from a broad viewpoint, in which all employees in a workplace collaborate to produce high-value outputs that influence an organization's overall effectiveness. Commitment can be used to evaluate a company's effectiveness. Commitment can be measured in a variety of ways, such as the staff-management relationship or how well employees identify with the company. Managers should concentrate on creating a good environment, improved communication, and overall effective leadership in order to improve organizational effectiveness. Outsourcing and benchmarking, for example, are tools for effective management. (Sundström & Tollmar, 2018)

The phrase *efficiency* frequently refers to executing things correctly, i.e. in the most perfect manner possible. This does not imply that the proper procedures are followed. The term "efficiency" refers to the relationship between inputs and outputs, as well as the degree to which the conversion from inputs to outputs have been successful. This could be in terms of time, money, or other contributors like waste. To reach the target output, waste must be eliminated in order to maximize resource utilization. It's worth noting that a process can be carried out perfectly according to best practices, yet it may not be the best process for achieving strategic goals. If this is the case, the benefits of efficiency are being overlooked.

The ultimate goal is to be both effective and efficient at the same time so that high-level results can be achieved. (Sundström & Tollmar, 2018)

The matrix in figure 3 shows how success can be achieved by companies being both efficient and effective.

<b>Effective</b>	Right things according to goals but NOT in the most optimal way	Right things according to goals and in the most optimal way
<b>Ineffective</b>	Wrong things according to goals and NOT in the most optimal way	Wrong things according to goals but in the most optimal way
	<b>Inefficient</b>	<b>Efficient</b>

Figure 3 Effectiveness and efficiency described in a matrix. Source: (Sundström & Tollmar, 2018)

### 2.2.2 Performance management

In the book “How to Create and Deploy Effective Metrics” Eckerson (2009) emphasizes the following. Organizational change can be aided by using performance metrics. It's true that "what gets measured, gets done." Companies that define objectives, set goals, track progress, recognize accomplishments, and publicly display the results can boost productivity and gracefully shift an organization in a new direction. Executives use performance metrics to define and communicate strategic goals that are specific to each individual and role within the company. They're used by managers to spot underperforming individuals or teams and help them get back on track. Employees use performance metrics to help them focus on what matters most and achieve the goals outlined in their individual performance plans.

Performance metrics, on the other hand, are a double-edged sword. The incorrect metrics can have unintended consequences, such as disrupting organizational processes, demoralizing employees, and lowering productivity and service levels. The organization will fail if the metrics do not accurately translate the company's strategy and goals into concrete actions that employees can take on a daily basis. Employees will put in long hours but receive no reward for their efforts, leaving everyone exhausted and frustrated. In other words, the business will be productive but ineffective. Performance metrics are an important part of performance management, which is the discipline of aligning performance with strategy. Performance management makes use of information technology to keep track of how well a company's strategy is being implemented and to help it achieve its objectives. Performance management, as shown in Figure 4, is a four-step virtuous cycle that includes developing strategy and plans, monitoring their execution, and adjusting activity and objectives to meet strategic

goals. The four steps are: Strategize, plan, monitor/analyze, and act/adjust. The integrated data and metrics that provide a measurement framework for gauging the effectiveness of strategic and management processes are at the centre of this four-step wheel. (Eckerson, 2009)

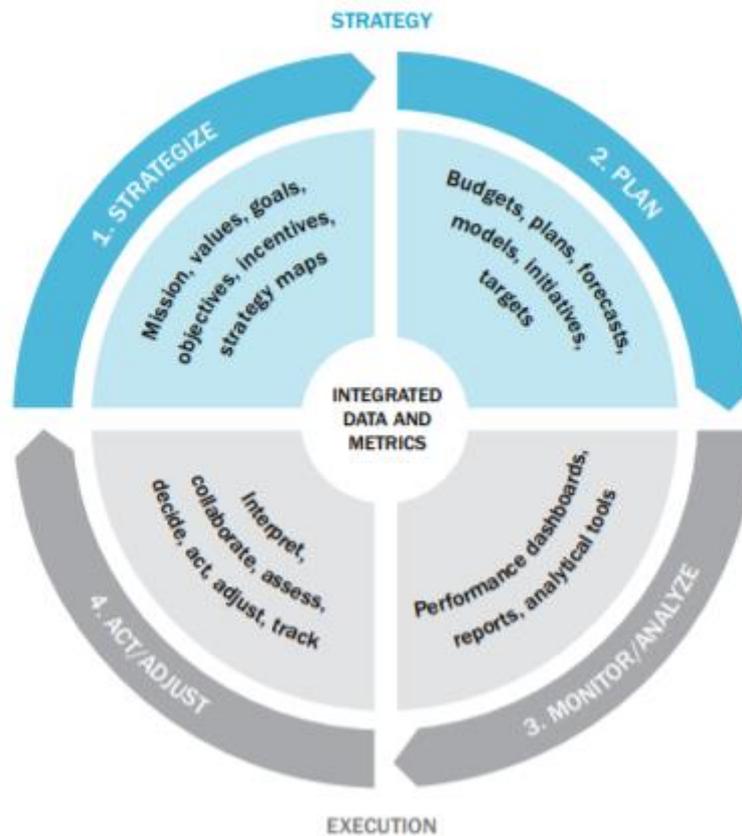


Figure 4 The performance management cycle. Source (Eckerson, 2009)

### 2.2.3 Performance measurement and KPIs

Businesses require effective performance management. It assists them in aligning their employees, resources, and systems to meet their strategic objectives through both formal and informal processes. It also serves as a dashboard, alerting managers to potential problems and letting them know when they need to make changes to keep the business on track. When it comes to performance management, organizations that get it right become formidable competitive machines. Despite this, the performance-management system in far too many businesses is slow, shaky, or downright broken. These organizations, at best, aren't as efficient or effective as they could be. Changes in technology, markets, or competitive environments can render them unable to respond in the worst-case scenario. The simple principle of “what gets measured gets done” underpins effective performance management, as mentioned before. A business should create a cascade of metrics and targets from its top-level strategic objectives down to the daily activities of its frontline employees in an ideal



system. Managers keep a close eye on those metrics and meet with their teams on a regular basis to discuss progress toward meeting the goals. Good performance is rewarded, while poor performance prompts corrective action. (Carpi, Douglas, and Gascon, 2017)

A Key performance Indicator (KPI) is a measurable metric that shows how well a company is performing in relation to its key business objectives and priorities. The ability to measure the right Key Performance Indicators (KPIs) is critical to a company's health and success. Effective KPIs are critical metrics for ensuring that any business objective is met. They help in demonstrating and getting an understanding of a company's performance and health so critical adjustments to the execution can be made in order to meet the strategic objectives. Knowing and measuring the appropriate KPIs assists in achieving faster and better results. They can also be used to recognize patterns over time and take advantage of opportunities. (Wishart, 2021)

#### 2.2.4 Differences between indicators

There is a lot of confusion between the main types of indicators and a lot of companies are using the wrong indicators for their measures (Parmenter, 2015). In the following table 6, a summary of the main indicators and their differences are shown by Parmenter (2015). Key performance indicators (KPIs) are the ones that will be used in this research.

Table 6 Summary of indicators. Source: Parmenter (2015).

Terminology	Characteristic	Description	No. of measures	Frequency
<b>Result Indicator (RI)</b>	Financial and non-financial	<ul style="list-style-type: none"> <li>Summarizes how teams collectively are producing results</li> <li>Difficult to indicate what actions are needed to improve the result</li> </ul>	Around 80 (not more than 150)	Hourly, Daily, Weekly, Monthly, Quarterly
<b>Key Result Indicator (KRI)</b>	Financial and non-financial	<ul style="list-style-type: none"> <li>Give an overview of the organizations past performance</li> <li>Do not indicate what actions are needed to improve the result</li> <li>Suitable measures to present to board</li> </ul>	Up to 10	Monthly, Quarterly
<b>Performance Indicator (PI)</b>	Non-financial	<ul style="list-style-type: none"> <li>Shows what the teams are delivering</li> <li>Not critical for the overall strategy</li> <li>Indicates what actions need to be taken</li> </ul>	Around 80 (not more than 150)	Hourly, Daily, Weekly, Monthly, Quarterly
<b>Key Performance Indicator (KPI)</b>	Non-financial	<ul style="list-style-type: none"> <li>Evaluates how well the overall process is performing</li> <li>Corresponds to critical success factors</li> <li>Indicates what actions can improve the performance drastically</li> </ul>	Up to 10	Hourly, Daily, Weekly

## 2.2.6 Tools for performance management/measurement

### *Flowcharts*

Flowchart is a known tool used for visualizations and making overviews of process flows in a graphical representation. It is mostly used for purposes of process optimization.

### *RACI Matrix*

“RACI” stands for responsible, accountable, consulted, and informed, respectively. The matrix shows the involvement of different roles within an organization to the completion of tasks, processes, and projects. It is mostly used for purposes of process optimization and standardization.



### *SIPOC Diagram*

It is a Six Sigma tool that has a main function of documenting business processes. It involves Suppliers, Inputs, Process, Outputs, and Customers, that's what "SIPOC" stands for. It can also be referred to as a visualization documenting a business process from the start to the end.

### *Employee scorecard*

The employee scorecard includes personal KPIs for every employee along with the general company KPIs that the employee is contributing to. It is a significant tool for companies that helps in monitoring and measuring the performance of each and every employee within the company.

### *2.2.7 Integration of theory and conclusion*

We can observe that there are a lot of methods/tools/metrics/theory presented for performance measuring and performance management in general, and each one of the papers presented used a different combination of tools and metrics. We can see the difference in the key findings section in the conceptual matrix (part 2) in table 4. This research will also include a different combination of tools and metrics. This combination will include all the tools presented in the previous section, "Tools for performance management/measurement", along with developing KPIs. We can deduct from the literature that optimally a complete dashboard can be used for performance measuring but time is scarce so, that is the future research direction and this research will not provide a complete dashboard.

### 3. Developing KPIs

There is a few methods found in literature for selecting KPIs. For example, the Analytical Hierarchy Process (AHP), the winning KPI methodology defined by Parmenter (2015), the matrix method, the Delphi method, and the KPI Assessment Methodology defined by Hester et al. (2017). Elaboration on those methods and how to perform them is discussed in this section. The methods are discussed first then the KPIs selected are elaborated on the last subsection "Chosen KPIs" which also shows which methods were eventually implemented.

#### 3.1 The Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a mathematical tool of problem solving that has become popular amongst management personnel in the late 1990's and early 2000's (Juneja, 2011). It is commonly used to compare different alternatives based on weighted criteria. Those alternatives can be KPIs. The AHP method consists of six steps. The first step involves defining the alternatives (KPIs) that needs to be evaluated against each other and the criteria, and making a hierarchy of goals. The second step is a pairwise evaluation for the purpose of weights derivation for the criteria. This is done through developing a pairwise comparison matrix. The following step is concerned with coming up with an estimate for the relative weights of the KPIs regarding each criterion. The fourth step is checking the consistency. This is an important step, the decision making process should not be made based on an inconsistent model. All the criteria must be proportionally consistent, for example if the weight of criterion X is twice the weight of criterion Y and the weight of criterion Y is half the weight of criterion Z, then the weight of criterion X must be equal to the weight of criterion Z, and if that is not the case then the model is inconsistent. The fifth step is merging the results of step two and step three. The overall priority of each KPI is calculated through multiplying its weight regarding each criterion (from step 3) by the weight of the respective criterion (from step 2). The KPI with the highest value for its overall priority is ranked as the best KPI. And then the rest of the ranking is done in the same manner. An additional sixth step is carrying out a sensitivity analysis. In other words, changing the weights of the criteria and monitor the change in the results. This step gives insight into the robustness of the decision taken on the optimal choices.

#### 3.2 The winning KPI methodology

Before the six-stages process of the winning KPI methodology defined by Parmenter (2015), the original process for his method was a 12-step process. This 12-step process was included in his first two editions of his book, "Key performance indicators: Developing, implementing, and using winning KPIs". The original 12 steps defined by Parmenter (2015) are the following:

- Step 1: Senior management team commitment
- Step 2: Establishing a "winning KPI" project team
- Step 3: Establishing a "just do it" culture and process

- Step 4: Setting up a holistic KPI development strategy
- Step 5: Marketing KPI system to all employees
- Step 6: Identifying operational critical success factors
- Step 7: Recording of performance measures in a database
- Step 8: Selecting team performance measures
- Step 9: Selecting organizational winning KPIs
- Step 10: Developing the reporting frameworks at all levels
- Step 11: Facilitating the use of "winning KPIs"
- Step 12: Refining KPIs to maintain their relevance

Parmenter (2015) simplified this process further in the third edition of his book and the new method contains only six stages. Figure 5 shows an overview of the new model that merged the original twelve steps into only six stages.

Stage	Steps		Project weeks											
			Prework	1	2	3	4	5	6	7 to 11	12 to 16	Post		
1	1,4	Getting the CEO and senior management committed to the change	█	█			█		█					
2	2,3	Up-skill in-house resources to manage the KPI project			█	█	█	█	█	█			█	█
3	5	Leading and selling the change	█	█	█	█	█	█	█	█	█	█	█	█
4	6					█	█							
5	7,8,9					█	█	█	█	█	█	█	█	█
6	10,11,12	Get the measures to drive performance											█	█

Figure 5 Twelve steps merged into a six-stage process. Source: Parmenter (2015)

Stage 1: Getting the CEO and senior management committed to the change. This one is similar to the first step in the original 12-step process. Parmenter (2015) explains that the senior management team must be dedicated to designing and operating the KPIs (key performance indicators) that belong to the organization and all balanced scorecards that includes them to monitor and support the organization's overall strategy. Furthermore, time is everything. This project has to identify an appropriate time frame in which the senior management team has time to engage in the process of transformation.

Stage 2: Up-skill in-house resources to manage the KPI project. A KPI project will succeed if project employees who have been allocated to the KPI project work full time on it (Parmenter, 2015). Parmenter (2015) discusses the significance of choosing an individual

inside the company to head the KPI team, an in-house chief measurement officer and mentioned that if an external recruit heads up the project, it will be “doomed to fail”. Parmenter (2015) sets 16 weeks for a complete KPI project. My research is only 10 weeks.

Stage 3: Leading and selling the change. Even while leading and selling the change aren't necessary to successfully execute every project, almost all large-scale projects are profoundly influenced by the outcomes of leadership and marketing. Parmenter (2015) highlights John Kotter’s model for leading change, shown in figure 6, and the significance of using emotional drivers for selling to the desired target groups.



Figure 6 John Kotter’s 8-step model for leading change. Source: <http://www.dr-glennhole.org/how-we-used-kotters-eight-step-model-for-change-and-succeed-within-a-turnaround-case-of-a-nordic-bpo-suppliers/>

Stage 4: Finding your organization’s operational critical success factors. In this stage Parmenter (2015) outlines that critical success factors (CSFs) are operational problems or elements that must be handled effectively by the organization's personnel on a daily basis and argues that they are a missing link in management theory. Organizations usually have five to eight CSFs, which are the root for all performance measures (Parmenter, 2015).

Stage 5: Determining measures that will work in your organization. A faulty procedure is often the reason behind the generation of performance metrics. Many methods, such as the balanced scorecard, seem to merely state that the measurements are a by-product of the process. Often, the job of selecting measures is completed at the last minute by employees who have no idea what goes into developing a measure that would elicit the desired

behavioural response (Parmenter, 2015). Organizations need to develop feasible and relevant measures that does not provide misleading results.

Stage 6: Get the measures to drive performance. It is essential to create a reporting structure at all levels of the business to be able to obtain improved performance metrics. The last stage of refining KPIs keeps them relevant and serve to remove redundancies.

### 3.3 The matrix method

The matrix method proposed by Volodymyr et al. (2019) highlights three main rules for developing process indicators. First of all, a set of indicators should contain the minimum required number of them to ensure the full management of the business process (Volodymyr et al., 2019). Secondly, all indicators included must be quantifiable. And the third rule is that the cost of measuring the indicator should not exceed the managerial effect of the use of this indicator (Volodymyr et al., 2019).

The development of objectives or a "KPI matrix" is used to develop key performance indicators for each employee for the purpose of evaluation. Only a few indicators from the KPIs library are chosen in this matrix. At different levels on the hierarchy of the company, a different number of KPIs are suggested. Around six or seven KPIs are often suggested for managers while four or five KPIs are suggested for employees. The reality is that KPI matrices come in many shapes and sizes. Developing matrices in this manner is challenging, since they must be simple and clear for workers while still providing enough information for establishing objectives and performing assessments. Additionally, matrix techniques and methods are very simple to automate, which becomes advantageous when dealing with huge quantities of collected information. (Volodymyr et al., 2019)

### 3.4 The Delphi method

The Delphi method, a consensus building tool, can be described as “a method used to obtain the most reliable consensus opinion of a group of experts by a series of intensive questionnaires interspersed with controlled feedbacks” (Hasson and Keeney, 2011). It is an iterative process that takes place for 3 rounds. When applying the Delphi method a facilitator is chosen and a group of experts is identified. In the case of a thesis the facilitator is usually the one conducting the research. The next step is identifying the problem as the group of experts or the stakeholders needs to understand the depth of the problem they are contributing to and answer questions for. Then 3 rounds of questions take place. The questions can be asked through interviews or surveys. The first round is for general questions to get a broad view from the stakeholders on the set of KPIs chosen. The second round is for follow-up questions for the questions asked during the first round. The questions of this round seek deeper, clearer, and more specific understanding on the stakeholders’ view on the KPIs. At the end of this round the results are refined and summarized. By the end of the third round of questions, a consensus should be reached. So, the questions of this round focuses on what the stakeholders have agreed on and backing up decision making. After this process is over a conclusion can be drawn, the set of KPIs can be validated from the agreement of the

stakeholders, and unnecessary or irrelevant KPIs can be removed from the set of KPIs. A final draft for the set of KPIs to be used can be reached and even ranked, if necessary.

### 3.5 KPI Assessment Methodology by Hester et al. (2017)

The method proposed by Hester et al. (2017) highlights the KPI cycle shown in figure 7. The method is mainly used for manufacturing processes but it can be adapted to fit non-manufacturing organizations as well.

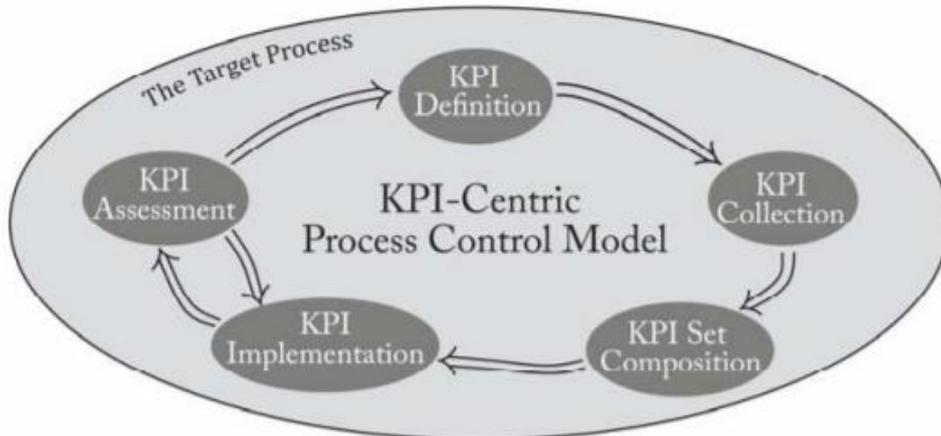


Figure 7 KPI life cycle. Source: Hester et al. (2017).

The proposed KPI assessment methodology (KAM) consists of two main phases, namely KPI characterization and KPI alignment and balance. Figure 8 below shows the 11 step procedure to successfully perform KAM.

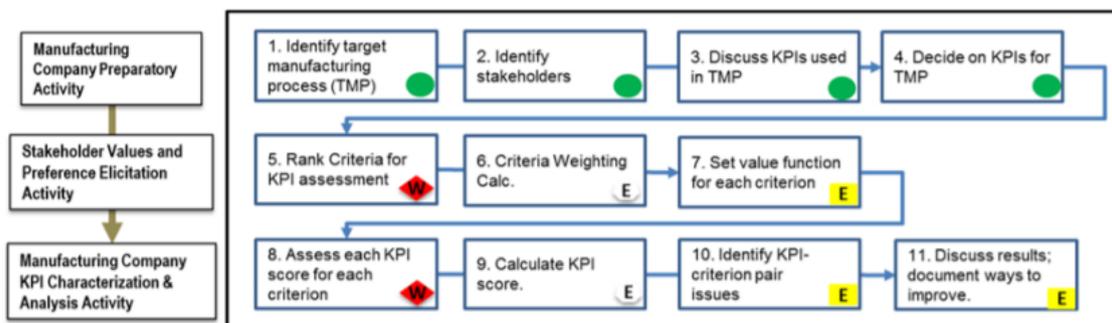


Figure 8 KPI Assessment Methodology (KAM). Source: Hester et al. (2017)

First to explain the symbols on figure 4 (the green circle, the red rhombus, the white hexagon, and the yellow rectangle), the green circle symbol means this step consists of a preparatory activity. The red rhombus stands for individual stakeholder activity, the white hexagon stands for a model calculation, and the yellow rectangle stands for a group activity. Secondly to explain the letters, the “W” stands for a web-based program used for calculation, and the “E” means that these calculations can be done through an Excel sheet as well.

Step 1: Identify the targeted process.

Step 2: Identify the stakeholders.

Step 3: Discuss the KPIs.

Step 4: Decide on the KPIs.

Step 5: Rank criteria for KPI assessment.

Horst and Weiss (2015) originally defined 20 criteria for KPI assessment. Hester et al. (2017) reduced this list to only 14 criteria, which can be found in table 7 below.

*Table 7 KPI assessment criteria and their definitions. Source: Adapted from Horst and Weiss (2015)*

Criterion	Definition
Quantifiable	The degree to which the KPI's value can be numerically specified.
Relevant	The degree to which the KPI enables performance improvement in the target operation
Predictive	The degree to which the KPI is able to predict non-steady-state operations and is accompanied by a record of the past performance values for analysis and feedback control.
Standardized	The degree to which a standard for the KPI exists and that standard is correct, complete, and unambiguous; also, the more broad the scope of the standard, the better, for example, plant-wide is good, corporate-wide is better, and industry-wide is best.
Verified	The degree to which the KPI can be shown to be true and correct with respect to an accepted standard and has been correctly implemented Note: The verified criterion is zero if no standard exists, but this is an indication that a KPI used without a standard can be a costly problem.
Accurate	The degree to which the measured value of the KPI is close to the true value.
Timely	The degree to which the KPI is computed and accessible in real-time, where real-time depends on the operational context, and real-time means the updated KPI is accessible close enough in time to the

	occurrence of the event triggering a change in any metric affecting the KPI.
Traceable	The degree to which the steps to fix a problem are known, documented, and accessible, where the particular problem is indicated by values or temporal trends of the KPI.
Independent	The degree to which the KPI collection, transfer, computation, implementation, and reporting are performed independently from process stakeholders.
Actionable	The degree to which a team responsible for the KPI has the ability and authority to improve the actual value of the KPI within their own process.
Buy-in	The degree to which the team responsible for the target operation are willing to support the use of the KPI and perform the tasks necessary to achieve target values for the KPI.
Understandable	The degree to which the meaning of the KPI is comprehended by team members and management, particularly with respect to corporate goals.
Documented	The degree to which the documented instructions for implementation of a KPI are up-to-date, correct, and complete, including instructions on how to compute the KPI, what measurements are necessary for its computation, and what actions to take for different KPI values.
Inexpensive	The degree to which the cost of measuring, computing, and reporting the KPI is low

Step 6: Criteria weighting calculation.

Hester et al. (2017) defines the rank sum method (shown in figure 9) as the best method for generating weights.

$$w_i = \frac{K + 1 - r_i}{\sum_{j=1}^K K + 1 - r_j}$$

Figure 9 Rank Sum Method. Source: Hester et al. (2017)

Where  $r_i$  is the rank of the  $i^{\text{th}}$  criterion,  $K$  is the total number of criteria, and  $w_i$  is the normalized ratio scale weight of the  $i^{\text{th}}$  criteria.

Step 7: Set value function for each criterion.

Step 8: Assess each KPI score against each criterion.

In this step each stakeholder make their own independent distinct rating for each of the KPIs against each one of the criteria. It is important to note that performing this activity is time consuming and may result in decision fatigue (Baumeister & Tierney, 2011). That is another reason why appropriate KPIs needs to be chosen early on during the first steps of any of the given methods. A sample of the results from this step can be shown in figure 10 below.

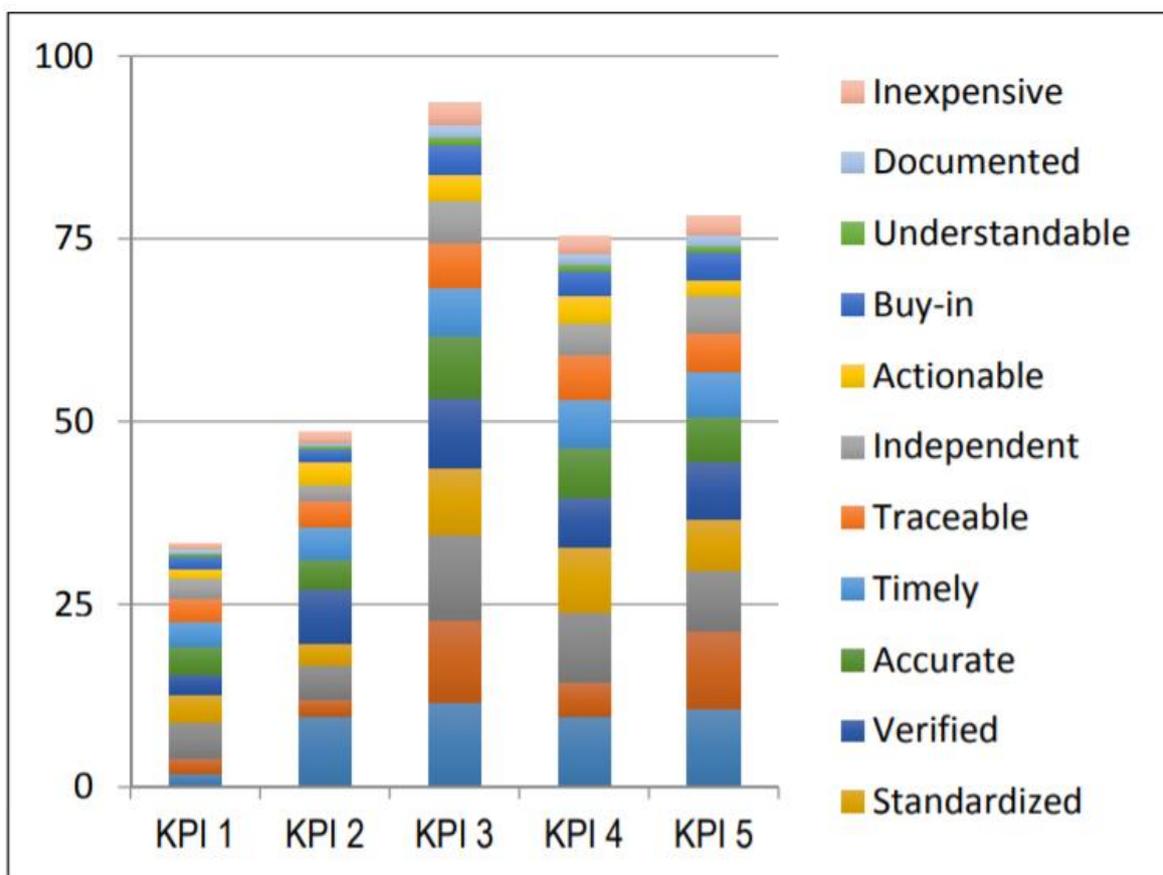


Figure 10 KPI criteria characterization. Source: Hester et al. (2017).

Step 9: Calculate KPI score.

At this step all the stakeholders have finalized their scores for each KPI against the criteria so, an overall score for each KPI can be determined for each stakeholder. This is done using the following formula shown in figure 11.

$$v_{ik} = \frac{\sum_{j=1}^M \overline{w_j} v_{ijk}}{\sum_{j=1}^M \overline{w_j}}$$

Figure 11 Equation for KPI score calculation. Source: Hester et al. (2017)

Where M is the number of criteria,  $v_{ik}$  is the  $i^{\text{th}}$  KPI score from the  $k^{\text{th}}$  stakeholder.  $v_{ijk}$  is the  $i^{\text{th}}$  KPI score, from the  $k^{\text{th}}$  stakeholder, for the  $j^{\text{th}}$  effectiveness criterion. The stakeholder average weight of the  $j^{\text{th}}$  criterion is given by  $\overline{w_j}$ .

Step 10: Identify KPI-criterion pair issues.

Step 11: Discuss results and document ways to improve.

### 3.6 Chosen KPIs

Viewing different relevant methods and exploring diverse options is important before making informed decisions. After considering all the methods above and doing a literature research on the most relevant KPIs commonly used in “Order Management”, “Logistics”, and “Transportation” and discussing the findings with the stakeholders we decided on 7 KPIs to use. Those KPIs were validated through interviews with the stakeholders. The last two KPIs, overall transport effectiveness and overall vehicle effectiveness, are adapted from the master thesis of Iankoulova (2012). The thesis of Iankoulova (2012) was suggested by my supervisor from the University of Twente and incorporating those 2 KPIs along with the other 5 KPIs will serve the purpose of this research and will be of value to the transformation phase taking place at Emons. The seven KPIs chosen are the following:

1- Cost per order:

**Definition:** Total cost for fulfilling an order.

**Formula:** The total costs for fulfilling the total number of orders ÷ the total number of order

**What it means:** This KPI shows the costs included for fulfilling an order. The lower this value, the more efficient the order fulfilment process is.

2- Order fulfilment accuracy rate:

**Definition:** The rate at which orders are processed accurately (without mistakes).

**Formula:** Accurately completed orders ÷ the total number of orders



**What it means:** It is a ratio that shows how accurate the order fulfilment process is. The higher this ratio is, the more efficient the order fulfilment process is. If this ratio is low this means change needs to be done and it proves inefficiency.

3- Order fulfilment cycle time:

**Definition:** The average length of time it takes from when a customer places an order until they receive it.

**Formula:** Time the order was received by customer – Time the order was placed

**What it means:** Usually this KPI involves warehouses but that's not the case for Emons since Emons do not produce a physical good. For Emons' case it involves the effectiveness of using their trucks to fulfil the customers' orders. This KPI is important for Emons plan of making a collective dashboard linking all the departments together because this KPI does not involve the order management department but it also involves the billing department, the planning department, the finance department, and the technical fleet support department. All these departments participate and directly affect the order fulfilment cycle. The shorter this cycle is, the more responsive the company is.

4- Perfect order rate:

**Definition:** The percentage of orders that are delivered without incidents (for example damaged goods) or mistakes.

**Formula:** Orders completed without incidents ÷ Total orders placed

**What it means:** This KPI provides a measure of how many orders do not encounter incidents and is received by the customer in the expected conditions with no damages. Handling incidents is part of the job description of the Order Management department's employees. The lesser the number of incidents, the better for the employees and for Emons. This is one of the things that needs to be measured currently at Emons since the employees of the department have a feeling that they attend to a high number of incidents. Measuring this KPI and monitoring it on longer periods will provide useful insight for potential use and decision making by the management of Emons. If the perfect order rate proved to be low, immediate intervention by the management is required. It is Emons' responsibility to ensure the customers receive their goods in the manner promised when signing a contract with Emons.

5- On-time delivery rate:

**Definition:** The ratio of orders that were delivered on or before the agreed upon delivery date against the total number of orders.

**Formula:** Orders delivered on time or earlier ÷ Total number of orders shipped

**What it means:** This KPI provides insight onto how efficient the order fulfillment and delivery process is. If the on-time delivery rate is low, this means that orders are not being picked and delivered in an acceptable amount of time. Having a low on-time delivery rate

risks customer dissatisfaction and losing customers, and hence losing a lot of money. It is one of the most important aspects in this field and one of the main things the customers look for when they sign a contract with a company to handle its transportations.

#### 6- Overall Vehicle Effectiveness (OVE)

Simons et al. (2004) defines 5 main “big losses” in the transportation process, which are: Driver breaks, excess load time, fill loss, speed loss, and quality delays. Additionally, Simons et al. (2004) also defines three value adding activities, which are transportation, loading, and unloading. A breakdown of the 5 waste activities in road transportation and the 3 value adding activities can be found in figure 12 below.

VALUE ADDING ACTIVITIES IN ROAD TRANSPORTATION	
<b>Transportation</b>	Main activity.
<b>Loading</b>	Both loading and unloading are considered as critical steps in a supply chain configuration as they allow product consolidation and assembly at various points between production and consumption. By setting world class loading and unloading standards, the value adding time spent on those activities can be set (e.g., 1 minute per pallet).
<b>Unloading</b>	
WASTE ACTIVITIES IN ROAD TRANSPORTATION	
<b>Driver breaks</b>	Statutory breaks taken during a journey are considered loss. If taken at the end of the journey or when someone else loads/unloads it is not a loss. This would encourage the planning of trips such that local runs terminate inside the 4-hour break interval.
<b>Excess load time</b>	A standard time is allowed to load and unload a vehicle; when loading/unloading time exceeds the standard time this is considered a loss.
<b>Fill loss</b>	Ideally the vehicle will be full (either by weight or volume whichever is the smallest constraint). Fill loss occurs when the vehicle is not fully loaded. This measure could lead to heavies drop to be done last which is not the most cost-effective solution. Therefore, this measure should be used after the best route is identified.
<b>Speed loss</b>	The difference between the max attainable speed and the average speed is the speed loss. The max attainable speed is the maximum legal speed on a given road. This would encourage avoidance of busy times of the day.
<b>Quality delays</b>	Delays from internal quality failures. Driver losing his way, vehicle break downs, goods damaged in transit or poor/invalid paperwork are examples of quality delays.

Figure 12 OVE value adding and waste activities in transportation. Source: Iankoulova (2012) and adapted from Simons et al. (2004)

The overall vehicle effectiveness (OVE) is calculated after first calculating the availability, performance, and quality. The four equations used for the calculations can be found in figure 13 below.

$$Availability = \frac{Plan - (Breaks + ExcessLoad)}{PlanTime} * 100$$

Equation 1: OVE availability

$$Performance = \frac{Available - (Fill + Speed)}{AvailableTime} * 100$$

Equation 2: OVE performance

$$Quality = \frac{Performance - QualityDebys}{PerformanceTime} * 100$$

Equation 3: OVE quality

$$OVE = Availability * Performance * Quality$$

Equation 4: OVE measure

Figure 13 the 4 equations used for calculating the OVE availability, OVE performance, OVE quality, and OVE, respectively. Source: Iankoulova (2012)

## 7- Overall Transport Effectiveness (OTE)

The overall transport effectiveness (OTE) defined by Iankoulova (2012) is “a lean measure analogous to the OVE defined by Simons et al. (2004)” (Iankoulova, 2012). The main difference between the OVE and the OTE is that the OTE include more factors that affect the availability, performance, and quality. When both (OVE and OTE) are calculated the difference can be noticed and this gives insight into the real effect of the extra factors included in the OTE. Figure 14 below shows the different 9 levels for the OTE framework and the formulas for the availability, performance, quality, and OTE.

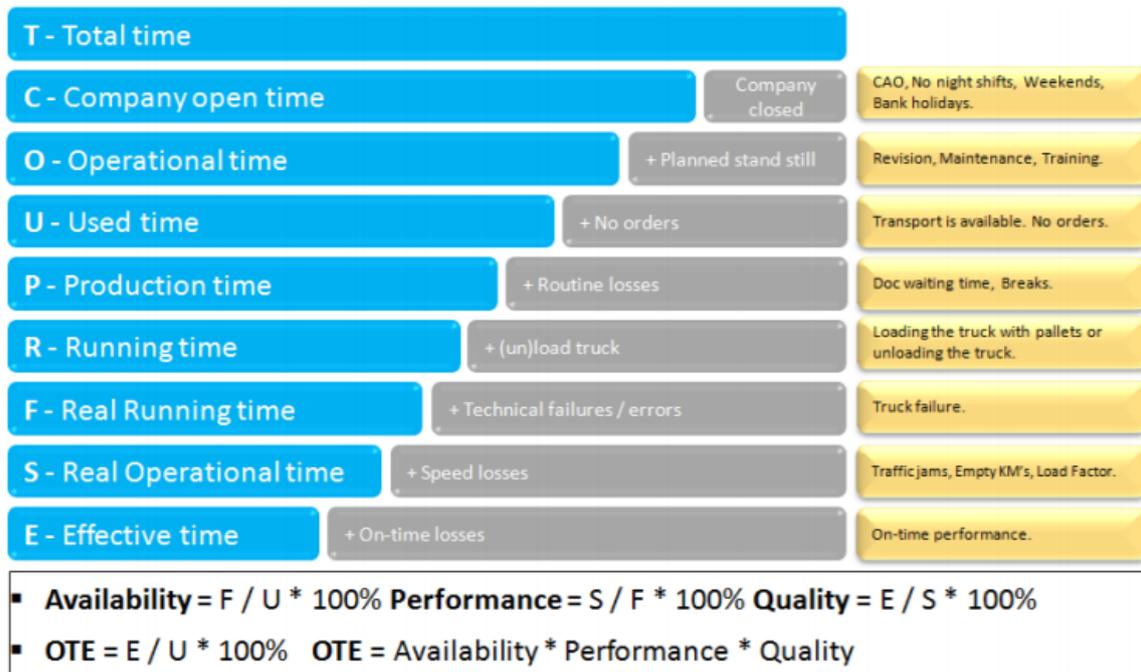


Figure 14 Overall transport effectiveness (OVE) framework. Source: Iankoulova (2012).

The nine types of losses are cumulative, and as one goes down the levels all other previous losses are added as well so in this way, the top most level (T-Total time) incorporate all the losses and the lowest level (E-Effective time) is pure added value time without any wastes (Iankoulova, 2012). Figure 15 below shows all the formulas for the calculations for the different 9 levels. After this is calculated the availability can be calculated using the equation in figure 16, the performance can be calculated using the equation in figure 17, and the quality can be calculated using the equation in figure 18. Finally, the OTE can be calculated using the equation in figure 19.

$$\begin{aligned}
 C : \text{CompanyOpenTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} \\
 O : \text{OperationdTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{PlannedRevisionsTime} \\
 &\quad - \text{MaitenanceTime} - \text{TrainingTime} \\
 U : \text{UsedTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{PlannedRevisionsTime} \\
 &\quad - \text{MaitenanceTime} - \text{TrainingTime} - \text{NoOrdersTime} \\
 P : \text{ProductionTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{NoOrdersTime} \\
 &\quad - \text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} \\
 R : \text{RunningTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{NoOrdersTime} \\
 &\quad - \text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} \\
 &\quad - \text{ExcessLoadingTime} - \text{ExcessUnloadingTime} \\
 F : \text{RealRunningTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{NoOrdersTime} \\
 &\quad - \text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} \\
 &\quad - \text{ExcessLoadingTime} - \text{ExcessUnloadingTime} - \text{TruckFailureTime} \\
 S : \text{RealOperationalTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{NoOrdersTime} \\
 &\quad - \text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} \\
 &\quad - \text{ExcessLoadingTime} - \text{ExcessUnloadingTime} - \text{TruckFailureTime} - \text{TrafficSpeedLossTime} \\
 &\quad - \text{EmptyKmTime} - \text{LoadFactorLosses} \\
 E : \text{EffectiveTime} &= T : \text{TotalTime} - \text{CompanyClosedTime} - \text{NoOrdersTime} \\
 &\quad - \text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} \\
 &\quad - \text{ExcessLoadingTime} - \text{ExcessUnloadingTime} - \text{TruckFailureTime} - \text{TrafficSpeedLossTime} \\
 &\quad - \text{EmptyKmTime} - \text{LoadFactorLosses} - \text{NotOnTimePerformanceTime}
 \end{aligned}$$

Figure 15 OTE levels' formulas. Source: Iankoulova (2012).

$$\text{Availability} = \frac{U : \text{UsedTime} - (\text{PlannedRevisionsTime} - \text{MaitenancæTime} - \text{TrainingTime} - \text{DocWaitingTime} - \text{BreaksTime} - \text{ExcessLoadingTime} - \text{ExcessUnloadingTime} - \text{TruckFailureTime})}{U : \text{UsedTime}} * 100$$

Figure 16 OTE availability formula. Source: Iankoulova (2012)

$$Performance = \frac{F : RealRunnigTime - (TrafficSpeedLossTime - EmptyKmTime - LoadFactorLosses)}{F : RealRunnigTime} * 100$$

Figure 17 OTE performance formula. Source: Iankoulova (2012)

$$Quality = \frac{S : RealOperationalTime - (NotOnTimePerformanceTime)}{S : RealOperationalTime} * 100$$

Figure 18 OTE quality formula. Source: Iankoulova (2012).

$$OTE = \frac{U : UsedTime - (PlannedRevisionsTime - MaintenanceTime - TrainingTime - DocWaitingTime - BreaksTime - ExcessLoadingTime - ExcessUnloadingTime - TruckFailureTime - TrafficSpeedLossTime - EmptyKmTime - LoadFactorLosses - NotOnTimePerformanceTime)}{U : UsedTime} * 100$$

= Availability \* Performance \* Quality

Figure 19 OTE formula. Source: Iankoulova (2012).

While the OTE is defined as an effectiveness metric, it also evaluates the efficiency to some extent. This can be seen more in the “Performance” measurement. An insight on the utilization of resources is provided by the amount of vacant kilometres and the load factor. An increase in the number of empty kilometres, or a reduction in the load factor, indicates lesser efficiency.

A list of the 7 KPIs can be seen in table 8 below.

Table 8 List of KPIs

KPI number	KPI
1	Cost per order
2	Order fulfilment accuracy rate
3	Order fulfilment cycle time
4	Perfect order rate
5	On-time delivery rate
6	OVE
7	OTE

A list of KPI assessment criteria adapted from Horst and Weiss (2015) will be used to assess the 7 KPIs chosen. This assessment can be shown in table 9.

Table 9 KPIs assessment criteria (part 1)

KPI number	Quantifiable	Predictive	Accurate	Timely	Traceable
1	✓	✗	✓	✓	✓
2	✓	✗	✓	✓	✓
3	✓	✗	✓	✓	✓
4	✓	✗	✓	✓	✓
5	✓	✗	✓	✓	✓
6	✓	✗	✓	✓	✓
7	✓	✗	✓	✓	✓

We can see that all the 7 KPIs do not fulfil the criteria “Predictive” since there are no previous data. But this will change later after the follow up 6 months study is carried on. Then all the 7 KPIs will be predictive.

Table 10 KPIs assessment criteria (part 2)

KPI number	Independent	Actionable	Buy-in	Documented	Inexpensive
1	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓
6	✓	✓	✓	✓	✓
7	✓	✓	✓	✓	✓

KPI 6 and 7 are the least inexpensive of the 7 KPIs but they are still relatively inexpensive. After discussion with the stakeholders we concluded that ranking and weighting the KPIs are not necessary for the case of Emons.

Furthermore, the employees of the Order Management department have been involved and included in choosing the KPIs. Multiple interviews have been conducted with them throughout the process of developing the KPIs, which aligns with the concepts of the Delphi method but the method is not fully applied. The AHP method was eventually not used since it was not needed.

#### 4. Employee scorecard

The Order Management department has four employees and all of them perform the same job and tasks and have similar job descriptions. We refer to them in the scorecard, shown in figures 20-23, as employee x, employee y, employee z, and employee w. Since they have similar job descriptions and perform the same tasks, the four sheets in the scorecard, respective to each employee, are exactly similar. Regarding the first KPI, total number of emails responded to /day, it would not have been a clear and appropriate KPI if it was not divided into categories. Because the employees in the Order Management department respond to different types of emails. Some of them are easy tasks and some of them are more complicated and may require more time. So for example, if one employee responded to 30 emails /day and another responded to 100 emails in the same day, this piece of information on its own is not a clear indication on the amount of work both of them did for instance. The 30 emails may have required more work hours than the 100 emails. So, we divided seven categories for the type of emails the Order Management department's employees respond to. The first category is emails from the customers reporting the loading/unloading times, which in return the employees register them manually on the system. The second category is the new orders received since the Order Management department receive orders by email and then the employees have to register them manually. The third category is reporting the license plates of the truck, which they receive from the customers when the trucks arrive, and also from the planning department if they changed the designated truck that is supposed to go the customer, and when this happens they have to send the new license plates to the customer and inform them about the change. The fourth category is emails about incidents, such as an incident about the customer receiving damaged goods for instance. The fifth category is emails about delays in deliveries. The sixth category is emails from the customers or customs agency requesting documents. The OM employees in this case have to fetch the requested document and send it back. The seventh and last category is emails from the fleet managers. A lot of communication take place back and forth between the OM employees and the fleet managers and this happen through emails. The OM employees does not have direct contact with the drivers so the communication between them and the drivers takes place through a middle man, a fleet manager. One more thing to highlight is having two different KPIs for number of incidents solved /day and number of incidents registered /day. Because not all incidents can be solved by the OM employees, their capabilities fall short to solve some incidents and when this happens they register those incidents through Trello and get the management involved. Since Brexit took place, it increased the work load on the employees of the OM department and a significant number of issues related to Brexit occur on a daily basis and the OM employees have to handle it so, it became a main part of their day jobs. That is the reason these type of issues were worthy of have a distinct KPI.

	A	B	C	D	E	F	G	H
1	Employee Scorecard							
2								
3	Total number of emails responded to /day (by category)							
4	Reporting loading/unloading times							#
5	New orders							#
6	Reporting license plates							#
7	Incidents							#
8	Delays							#
9	Requesting documents							#
10	Fleet managers emails							#
11								
12								
13	Number of incidents solved /day							#
14								
15	Number of Brexit relates issues handled /day							#
16								
17	Number of incidents registered /day							#
18								
19	Number of customers handled /day							#
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								

Figure 20 Employee scorecard (sheet 1)

## 5. SIPOC diagrams

A SIPOC diagram is a tool that a process improvement team uses to identify all important components of a process improvement project, and it helps in the definition of a complicated project that may not be properly scoped. It provides a general overview of a business process and assists people in understanding that process by visually summarizing the Suppliers, Inputs, Processes, Outputs, and Customers, which are what SIPOC stands for. Three SIPOC diagrams have been made for the most important scopes/processes carried out by the Order Management department at Emons which are: Getting the customs clearance done, booking loading/unloading times, and filling in KPI files. The three SIPOC diagrams are shown in figure 24, figure 25, and figure 26, respectively.

Process or Function Name: Order Management employees	Date:
Scope: Getting the customs clearance done	Notes:

### SIPOC Diagram

Suppliers	Inputs	Processes	Outputs	Customers
Who supplies the process inputs?	What inputs are required?	What are the major steps in the process?	What are the process outputs?	Who receives the outputs?
Customers	Paperwork from customers	Check if the right paperwork is received	License plates to customers	Customers
Planners	Export/import documents  License plates from planners	Inform the customers about the license plates  Announce shipments at customs agency for export/import  Check if the documents are correct	Announcement of shipments to customs agency	Customs agency

Figure 21 SIPOC diagram (Getting the customs clearance done)

Process or Function Name: Order Management employees	Date:
Scope: Booking loading/unloading times	Notes:

### SIPOC Diagram

Suppliers	Inputs	Processes	Outputs	Customers
Who supplies the process inputs?	What inputs are required?	What are the major steps in the process?	What are the process outputs?	Who receives the outputs?
Planners	The requested times	Check if the requested times are available  Book loading/delivery slots in customer portal if necessary	Emails with loading/offloading addresses	Customers

Figure 22 SIPOC diagram (Booking loading/unloading times).

Process or Function Name: Order Management employees	Date:
Scope: Filling in KPI files	Notes:

### SIPOC Diagram

Suppliers	Inputs	Processes	Outputs	Customers
Who supplies the process inputs?	What inputs are required?	What are the major steps in the process?	What are the process outputs?	Who receives the outputs?
	Times in Spits	Look up times in Spits	KPI files	Customers
	Times in Transics	Check if it is necessary to check times in Transics		
		Fill in times manually in Excel files		
		Send KPI files to customers		
		Report loading/offloading times in customer portal if necessary		

Figure 23 SIPOC diagram (Filling in KPI files).



## 6. RACI Matrix

The RACI matrix adds structure and clarity to the process of defining the roles that stakeholders perform in a project. It defines duties and guarantees that everything that needs to be done within a project is allocated to the right person to do it. This is an important part in process optimization and standardization. The easiest and most successful method for establishing and documenting project roles and responsibilities is to use a RACI matrix, knowing who is responsible, accountable, who needs to be consulted, and who needs to be kept informed at every stage can increase a project's chances of success considerably (Kantor, 2018). No matter how thorough and comprehensive a project plan is, misunderstanding or absence of participant roles and duties will result in significant issues and hence, a RACI matrix is important for the case of Emons and will prove to add value to the company since the different departments interfere for a lot of processes. The RACI matrix for the Order Management department at Emons is presented in figure 27 below.

RACI Matrix		Roles and Responsibilities									
		Responsible, Accountable, Consulted, Informed									
Order Management department, Emons		ROLES	Order Management employee	Customers	Planners	Fleet managers	Finance employees				
Deliverable or Task	Status										
<b>Processing email</b>											
Follow-up the email		R									
Check what it is about		R									
Take actions if necessary		R									
<b>Get the customs clearance done</b>											
Inform customers about the license plates		R	I	C							
Check if we received the right paperwork from the customer		R	C								
Announce shipments at customs agency for export/import		R									
Check if we received export/import documents		R	C	C							
Check if the documents are correct		R		C							
<b>Book loading/unloading times</b>											
Send email to loading/offloading addresses with the times we want		R	I	C							
Check if it is necessary to book loading/delivery slots in customer portal		R									
Check if the times requested are available		R									
Check with planning		R		C							
Book loading/delivery slots in customer portal		R									
<b>Fill in KPI files</b>											
Look up times in Spits		R									
Check if it is necessary to check times in transics		R									
Fill in times manually in the Excel files		R									
Send KPI file to the customer		R	I								
Check if it is necessary to report loading/offloading times in customer portal?		R									
<b>Updating customers portals</b>											
Accept orders in customer portals		R									
Book loading/delivery times in portals		R		C							
Add license plates		R		C							
Report loading/delivery times		R									
<b>Sales meeting</b>											
Update accountantlist		R									
Update action tracker		R									



Fill in OAM forecast										
Check for every customer in Lbase/Spits what they ordered for next week		R								
Check if the customers informed us about next week's plan		R	C							
Calls/visits with customers										
Collect KPI data		R								
Check if there were any issues		R								
Check with finance how invoicing goes		R						C		
Send instructions to fleet management										
Check if additional instructions are applicable		R								
Make an email and send it to the correct fleetmanager		R						I		
Manage incidents/damages										
Check what the incident is about		R								
Get all information together		R	C	C	C					
Register issues Trello		R								

D	Driver	Assists those who are responsible for a task.
R	Responsible	Assigned to complete the task or deliverable.
A	Accountable	Has final decision-making authority and accountability for completion. Only 1 per task.
S	Support	Provides support during implementation.
C	Consulted	An adviser, stakeholder, or subject matter expert who is consulted before a decision or action.
I	Informed	Must be informed after a decision or action.

Figure 24 RACI matrix

## 7. Evaluation, recommendations, and future research

### 7.1 Evaluation and implications

The solution was validated through interviews with the stakeholders and evaluation is done through an evaluation form, which can be found in appendix D. This evaluation form is filled in by the Order Management department team leader and the filled in form can be found in appendix D as well. The team leader of the department acknowledges the validity of the solutions and the deliverables. It is important to note that the versions presented of the deliverables are not the initial versions and have been edited multiple times throughout the course of conducting this research and after several discussions with the stakeholders and in the end those final versions have been reached. It can be noticed that the team leader is undecided on the effect of using the employee scorecard on the employees since it is “not yet automated” and the data for it have to be filled in manually, which has an implication on the employees and may increase their work load. On the one hand, the work load that may be added due to filling the scorecard manually by each employee on a daily basis is not significantly high and it is feasible. On the other hand, it is better if this process is automated.

### 7.2 Recommendations

A lot of data is filled in manually by the Order Management department’s employees during their usual day in the office, which is also something that needs to be attended to. There is a low degree of automation within the department and this makes some processes prone to human errors. It is understood that Emons are currently working on solutions for this and aims to increase the degree of automation throughout the whole company and not only the Order Management department, and a new system may be implemented in the near future. One further recommendation is concerning the process of filling in the KPI files for the customers. This process is currently not standardized and it needs to be standardized. Each customer has different KPIs and each of those KPI files are filled in manually on a daily basis. This is a time consuming process and it is recommended that an agreement needs to be reached with the customers to have a standard KPI file that can fit all the customers. This process can be automated as well and this may be achieved after the new system that is being prepared is implemented.

### 7.3 Future research

A further evaluation stage is recommended which consists of a follow up 6 months case study that was mentioned a few times earlier. This research provides means for measuring the performance of the department and a set of KPIs is presented along with their detailed descriptions, calculations, and the data needed to perform these calculations. These KPIs were validated by the stakeholders and the team leader believes that they will add value to the company and are worth investing the time and effort into carrying out the data collection and the calculations needed. But this was not tried out practically before. Emons currently does not collect the required data and the team leader mentioned in the evaluation form that they are undecided on whether these data will be easily obtained or not since they “didn’t work with the calculations yet”. This follow up case study will put this to the test and these



questions and hesitations will be answered in practice, and then Emons will have practical proof to further evaluate the solution provided. Also, as mentioned before, there is no current measure of the reality, even after this research so, this follow-up study will finally show the company the reality and how the department and the company overall are faring regarding all the aspects considered. To sum up what was mentioned earlier in the research regarding the study, the reason the time frame was decided into 6 months is to eliminate outliers from the results and be able to deduct patterns and form conclusions with a higher degree of certainty. During the first 3 months, no improvements need to be implemented or any interference from the management. Those months will be just calculating the KPIs on a daily and weekly basis. Then the reality is defined, patterns can be deducted, and data analysis can be performed and areas of improvements can be concluded. Then the norm can be set after a stakeholders discussion and feasible targets can be set within the time frame of the following 3 months and improvements can be implemented. After the 6 months are over, the data of the first 3 months (reality) can be compared with the data of the last 3 months (after implementing the improvements) and it can be seen if the norm is reached or not. From this on, new avenues are open to the management for continuous improvement and conducting further studies. The KPI set can be modified, a dashboard can be made, and the input from other departments can be merged. If the improvements within the OM department did not prove useful or affect the results of the KPIs, then the problem may be from other areas within other departments since the departments are connected and the KPIs are affected by other departments as well and not only the OM department. So, this follow-up study also helps in showing the connectedness between the department and helps in making the contributions of different departments and its effects tangible and can be differentiated. All factors can be fixed and only one factor can be changed, and if the results change then this effect can be traced back to this factor and its respective department. As mentioned earlier, the costs of measuring the KPIs and collecting the data required for the calculations are not known. The study will show the costs of applying the solution and by the end of it these costs will be known and the management can make an informed decision on applying the solution or modifying it.

## 8. Conclusion

From the evaluation form we can conclude that the research can be considered as a success and achieved its goals. The main research question was answered.

*How to measure the performance of the Order Management department at Emons?*

For measuring the performance of the Order Management department Emons now has a set of overall KPIs for the department and an employee scorecard with individual KPIs for each of the employees of the department.

The KPI set is as follows:

- 1- Cost per order:
- 2- Order fulfilment accuracy rate:
- 3- Order fulfilment cycle time:
- 4- Perfect order rate:
- 5- On-time delivery rate:
- 6- Overall Vehicle Effectiveness (OVE)
- 7- Overall Transport Effectiveness (OTE)

And the KPIs included in the employee scorecard for assessing the individual performance for each of the employees are as follow:

- 1- Total number of emails responded to /day

This KPI will not provide useful insight if it was reported as only the total number of emails responded to /day without classifying those emails because there are different categories for emails and each category requires different handling so, this KPI is reported by category and the categories are the following:

- Reporting loading/unloading times
- New orders
- Reporting license plates
- Incidents
- Delays
- Requesting documents
- Fleet managers emails

- 2- Number of incidents solved /day
- 3- Number of Brexit issued handled /day
- 4- Number of incidents registered /day
- 5- Number of customers handled /day

The remaining research questions and the sub-questions and the knowledge questions have been answered.

- What are the current tasks of the department?

The excel sheet shown in appendix C shows all the current tasks of the department along with their respective sub-tasks, attributes, triggers, departments involved, and programs used.

- Who are the stakeholders?

This is shown in the “Stakeholders analysis” sub-section in the introduction section.

- In what level of detail should the tasks within the department be included?

This was discussed with the stakeholders and the level of detail that was agreed upon can be shown in the flowcharts in appendix A and B.

- How can we evaluate the efficiency of the department?

This can be done through calculating values for the KPIs, monitoring the employee scorecard, and checking if the standard procedures provided in the RACI matrix and the SIPOC diagrams are being followed precisely. Any divergence from the procedures provided in the RACI matrix and the SIPOC diagrams can be considered an inefficiency.

- Which theoretical frameworks best suit this research?

A theoretical framework is presented in the “Theoretical framework” sub-section in the “Literature review” section.

- What tools can be used for this research?

The tools that were used in this research are RACI matrix, employee scorecard, and SIPOC diagrams.

- What KPIs can be defined to measure the performance of the department?

This is elaborated thoroughly in the section “Developing KPIs”.

- What KPIs can be defined to measure the daily performance of the employees?

This is shown in the section “Employee scorecard”.

- How can the KPIs be selected and how the values for all the KPIs can be obtained?

There are several methods for selecting KPIs, as discussed in the section “Developing KPIs” but they are not applicable as is for the case of Emons so, an adaptation is used. Also, the calculations to obtain values for all the KPIs can be shown in the sub-section “Chosen KPIs” of the same section, “Developing KPIs”.



- What are the main findings and recommendations?

This can be found in the “Evaluation, recommendations, and conclusion” section.

- How can the validity and reliability of the findings be assessed?

The validity and reliability was assessed through interviews with the stakeholders and an evaluation form that can be found in appendix D.

The RACI matrix, the flowchart, and the SIPOC diagrams all show the connectedness between the departments within Emons, which serves purpose for Emons since this was one of their goals going into this project of theirs of offering graduation theses to students to work on the different department and be able to integrate and connect their work at the end. This will help Emons regarding this target and can be used for more projects in the future.

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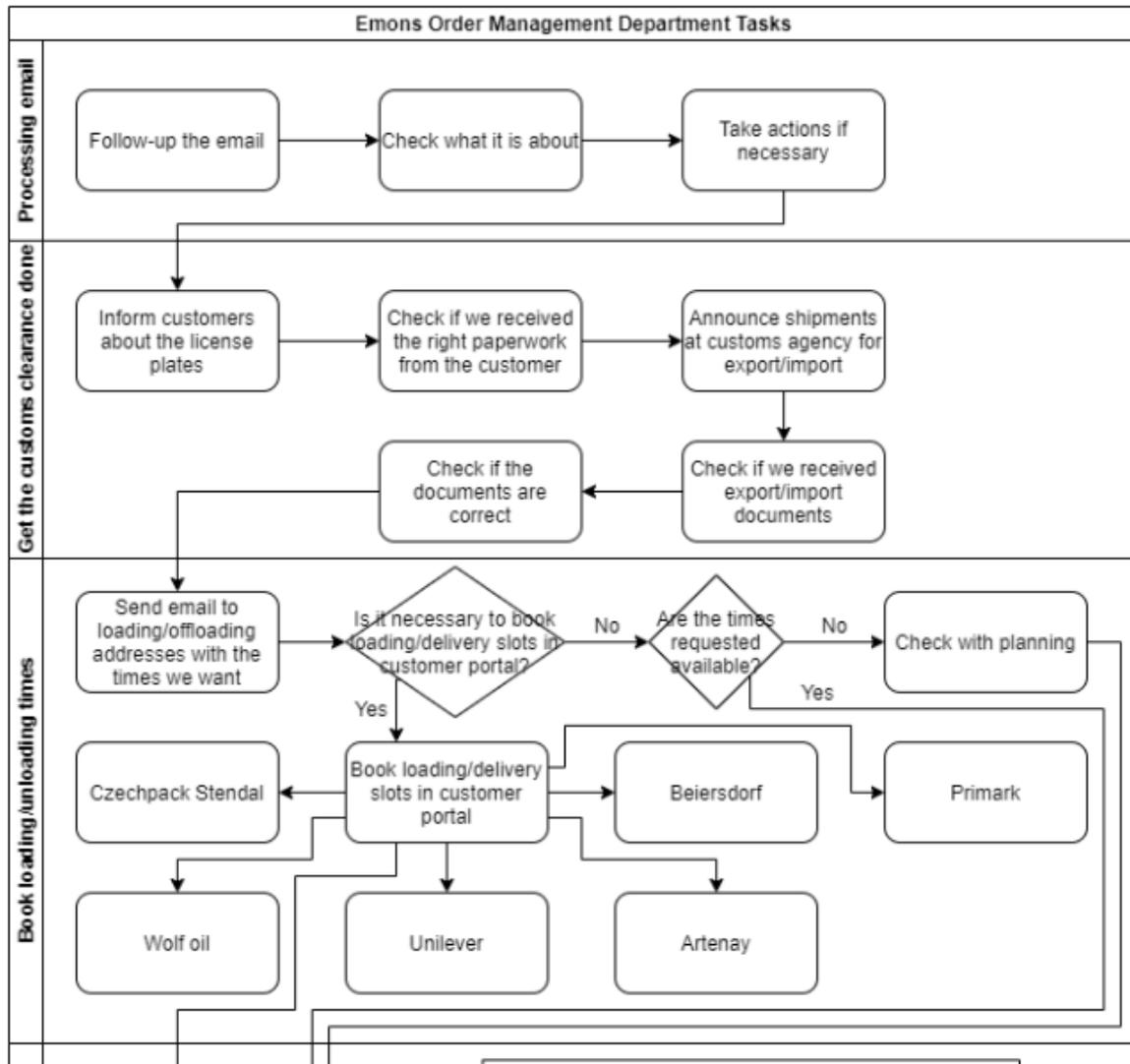
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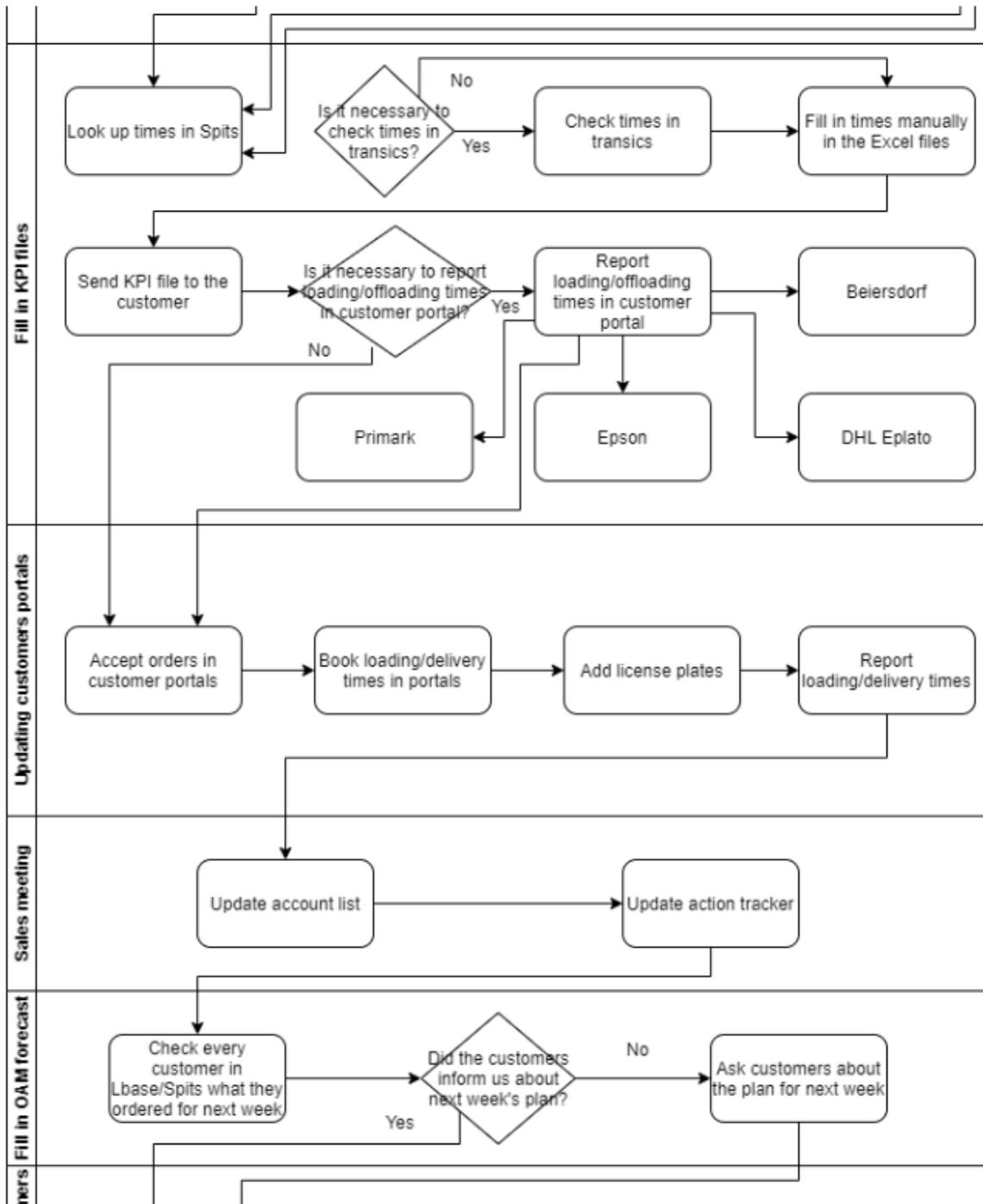
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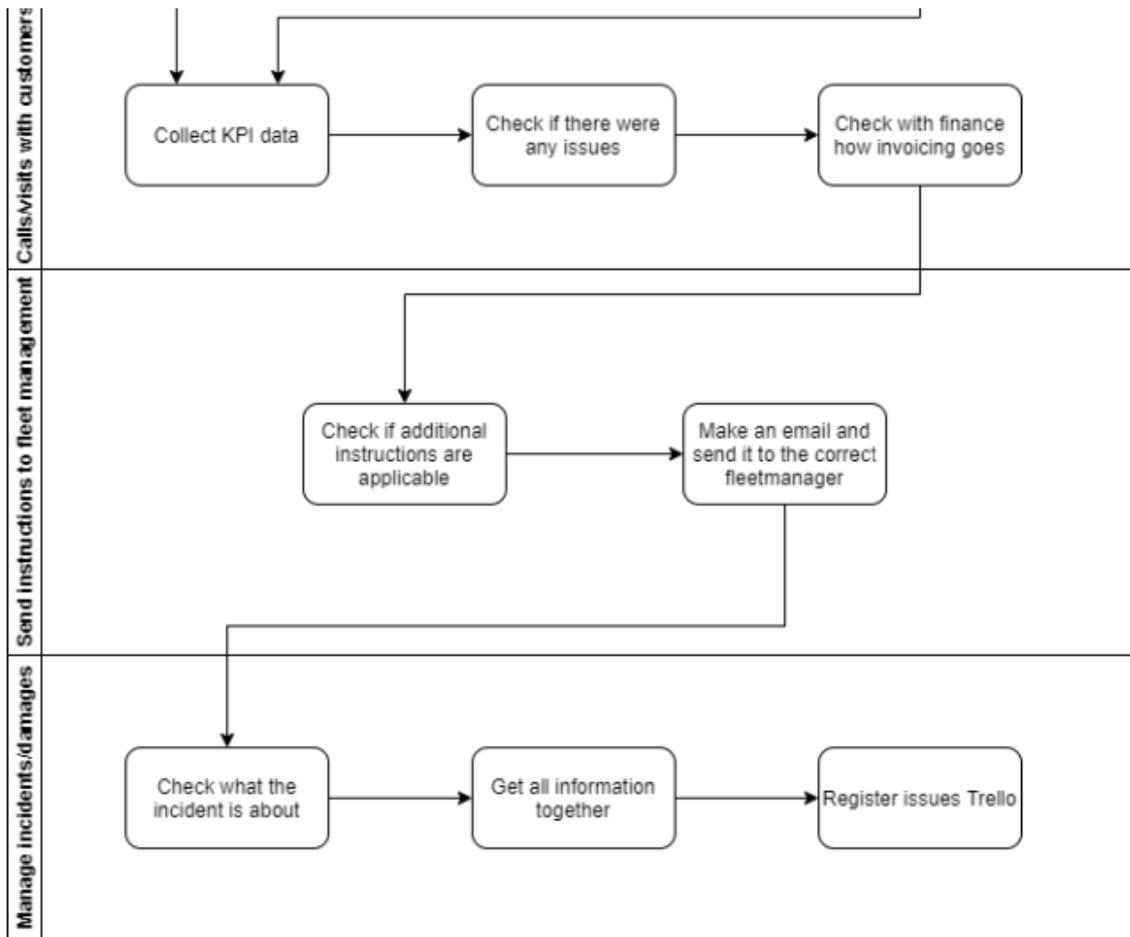
## 10. Appendices

### 10.1. Appendix A

This appendix shows the preliminary flowchart including an overview of all the tasks of the Order Management department at Emons.

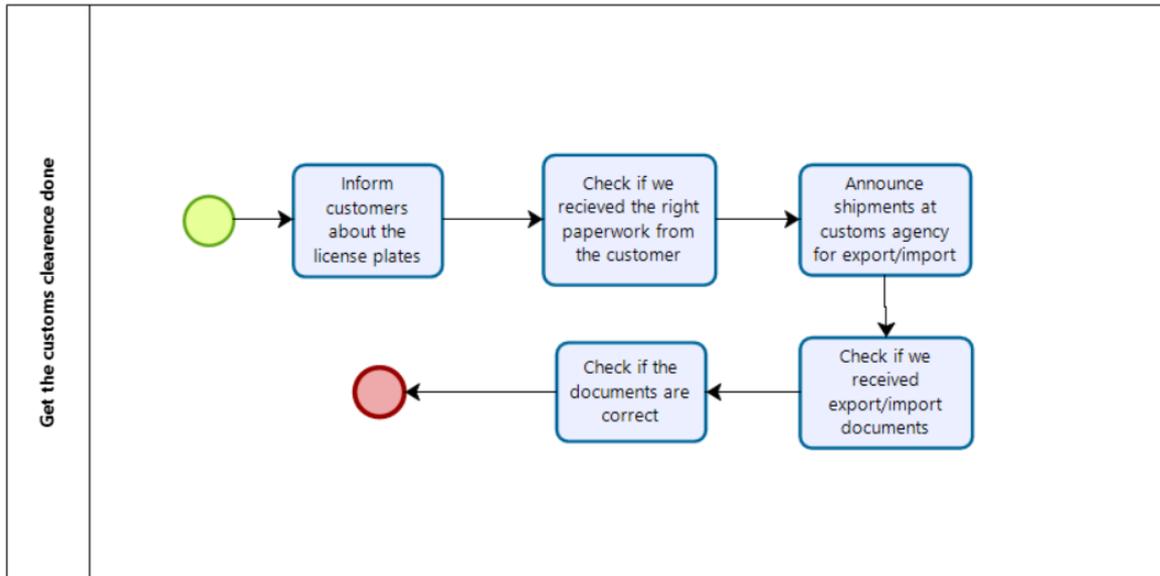
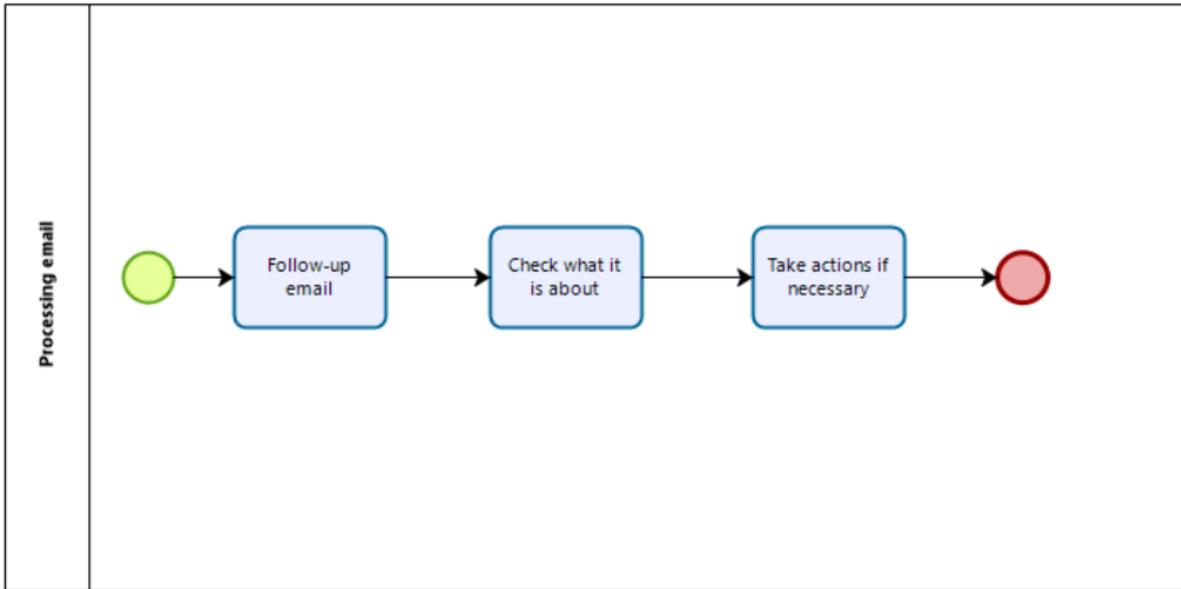


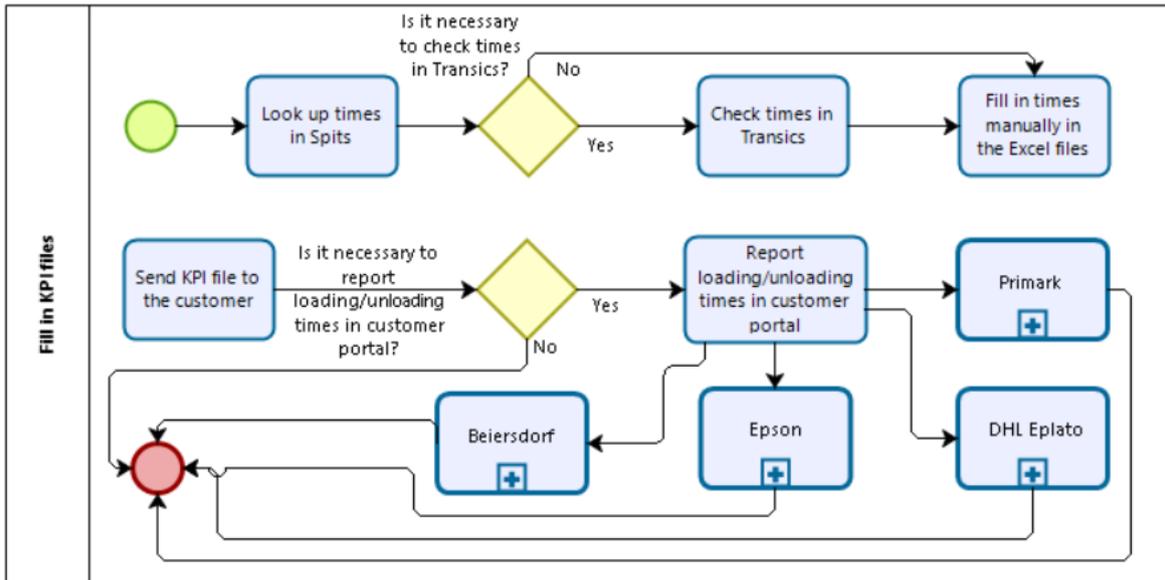
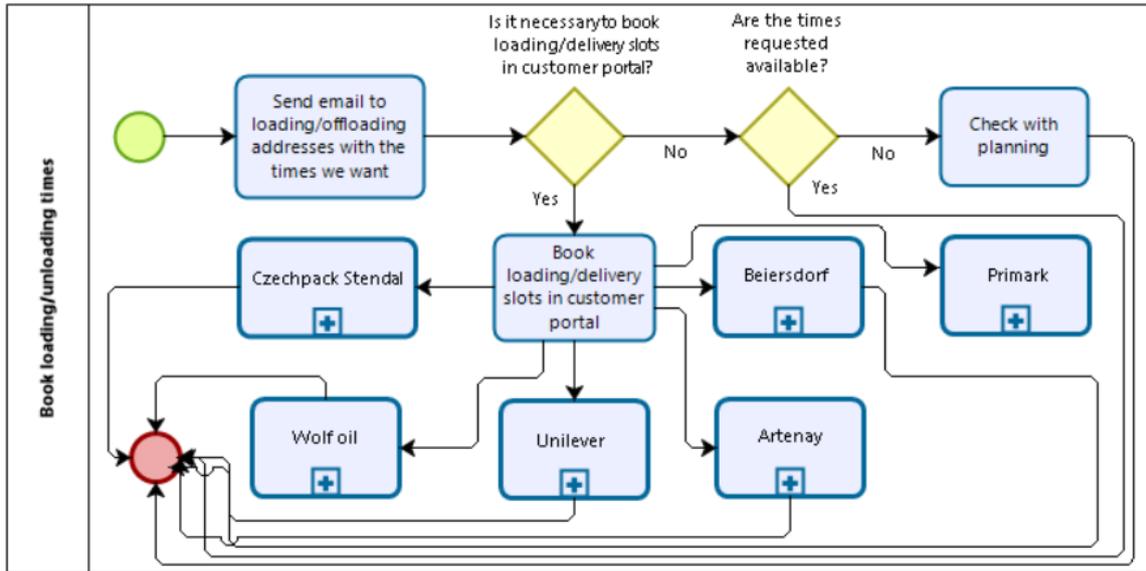


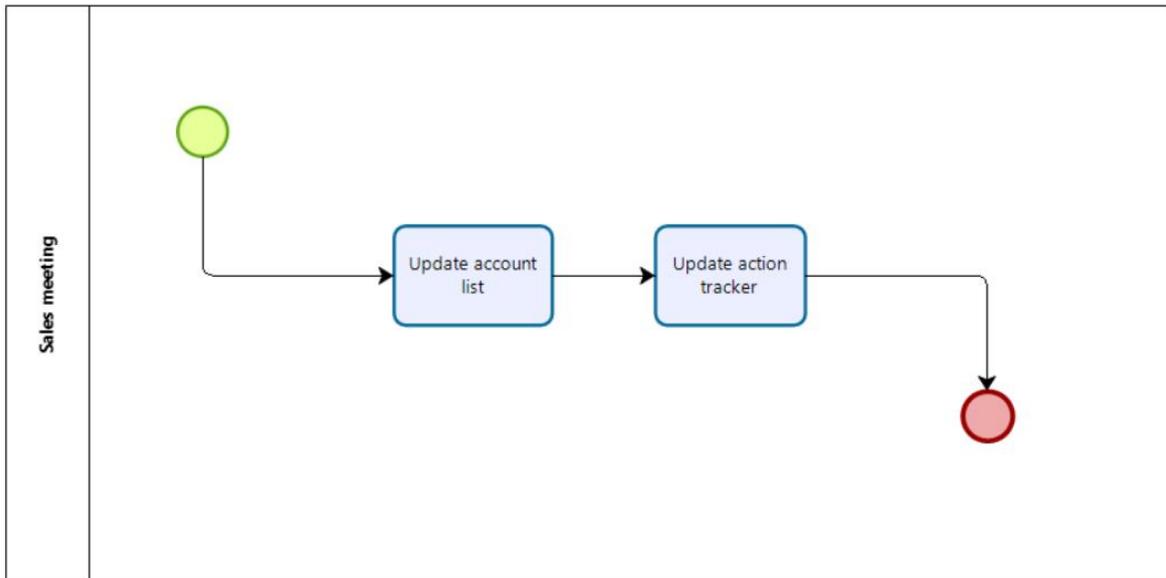
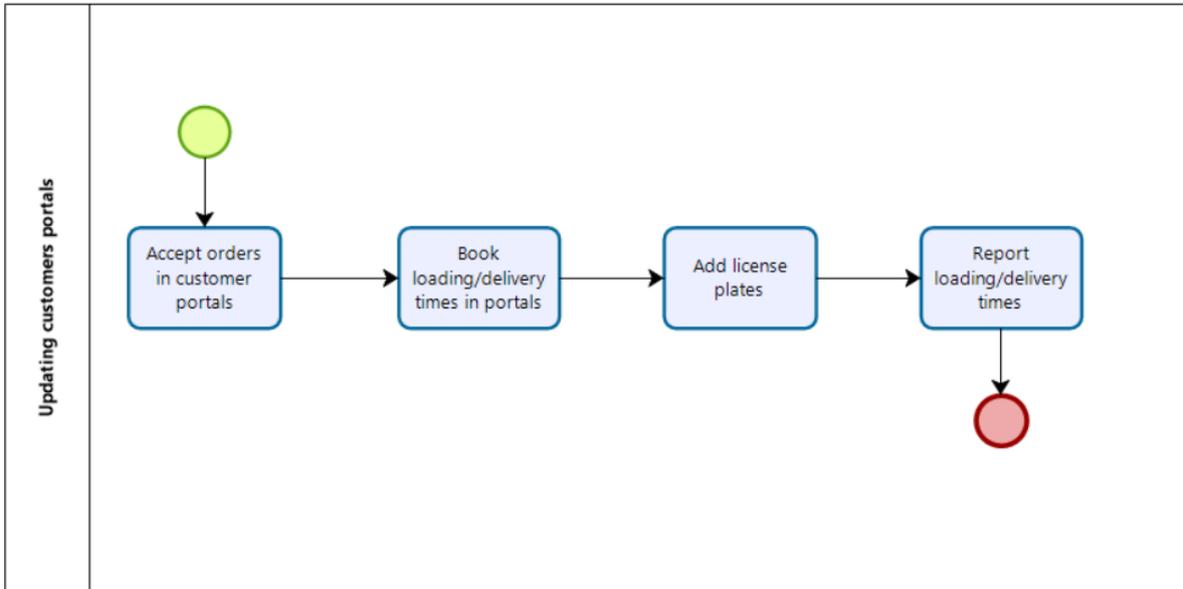


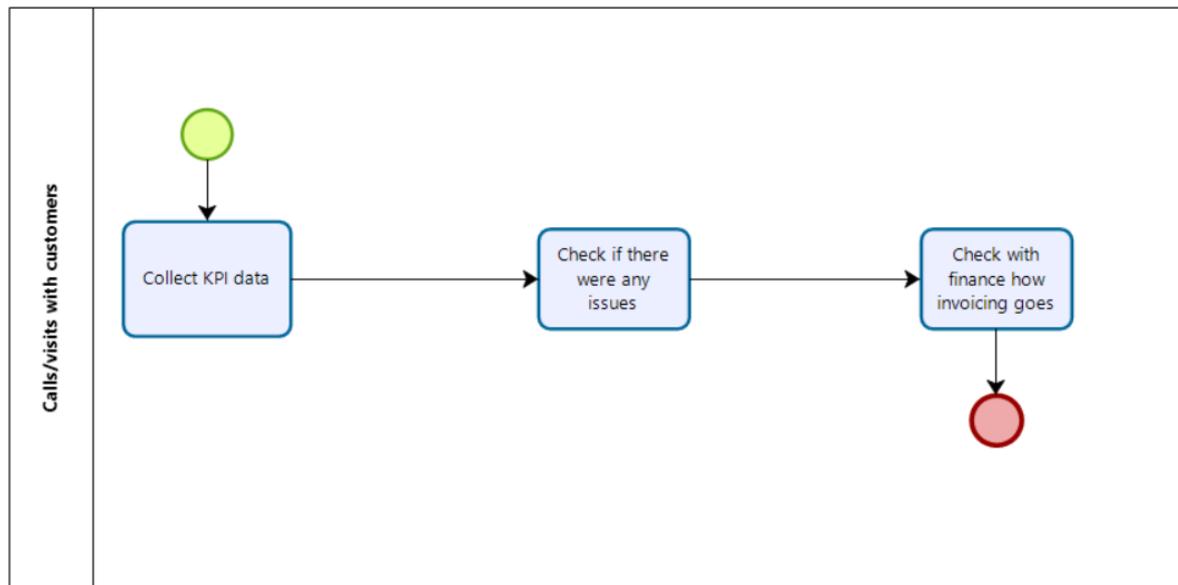
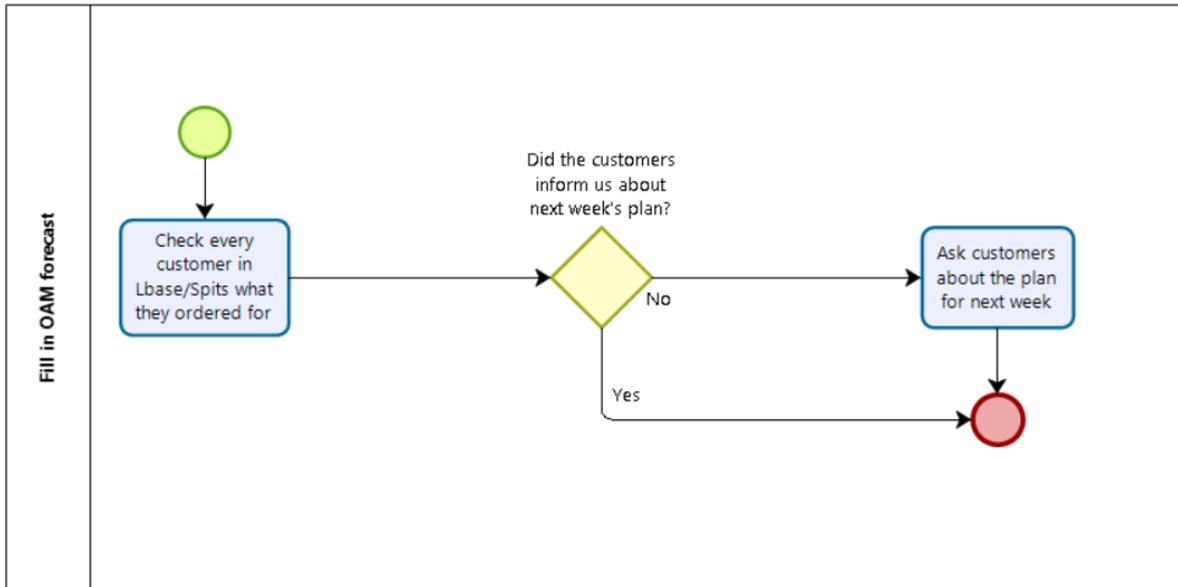
## 10.2 Appendix B

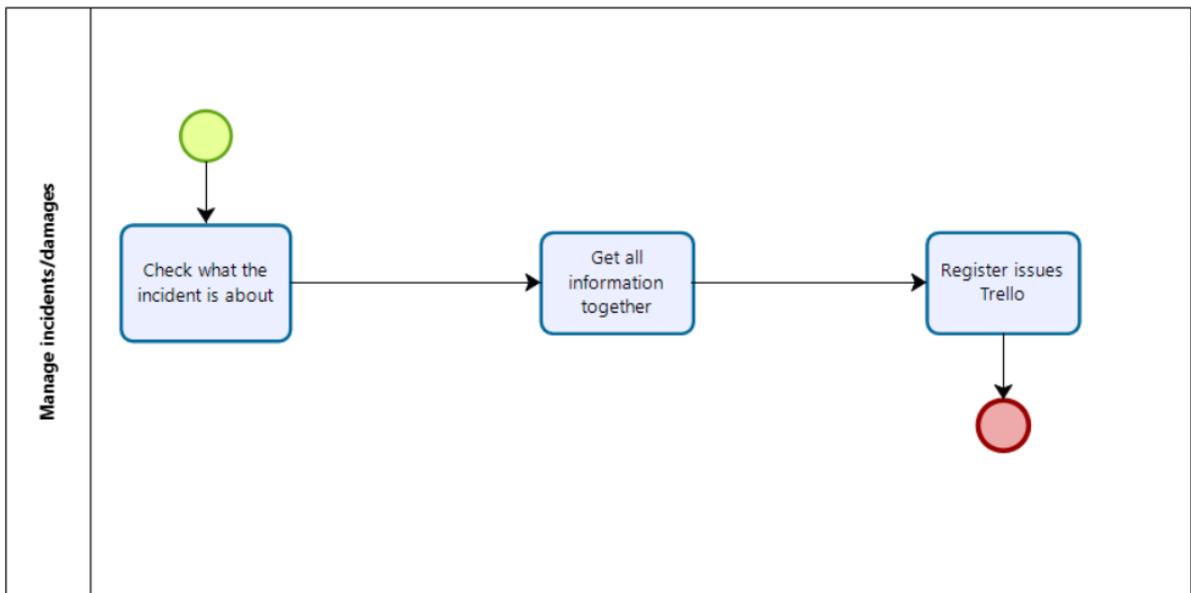
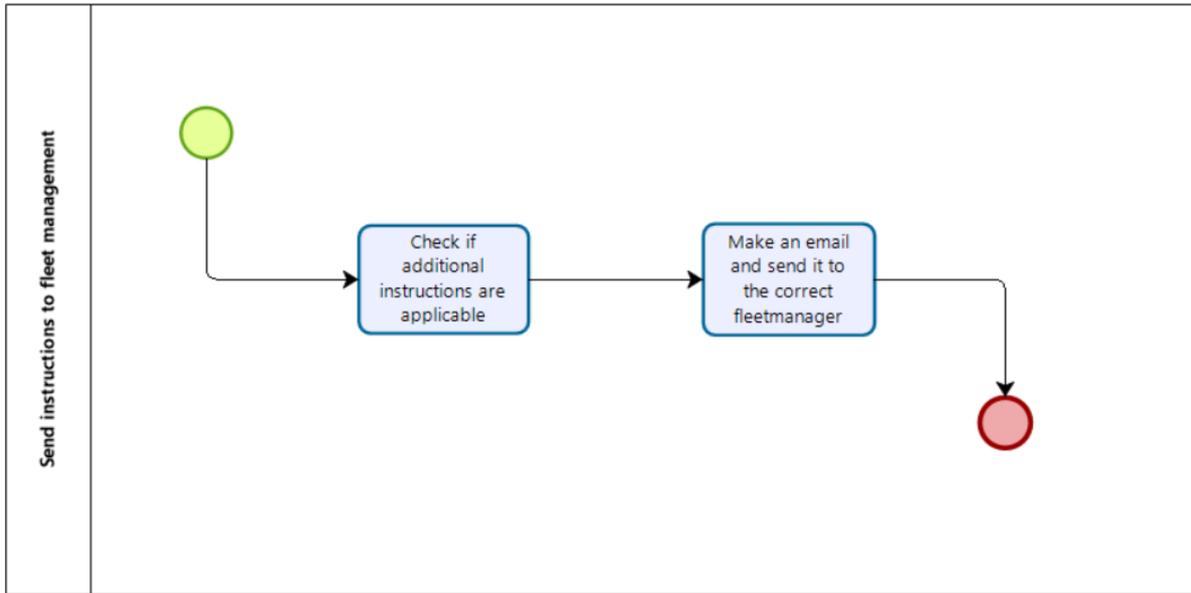
This appendix shows the final version of the flowchart, which is one of the deliverables of this research. This flowchart shows an overview of all the tasks that are being performed by the employees of the Order Management department at Emons along with their respective start and end triggers.













### 10.3 Appendix C

In this appendix screenshots are shown of the excel sheet that includes all the tasks of the Order Management department along with their respective attributes, subtasks, start triggers, departments involved, average time needed to perform the tasks, and programs used for the tasks. This excel sheet is going to be used by the company to create a Power BI model and a dashboard that includes input from all the departments of the company to link them together. There are four similar sheets involving the other four departments, namely finance, billing, planning, and technical fleet support. And all the five excel sheets will be integrated into one and exported to Power BI.

	A	B	C	D	E
1	Taskcode	Taskname	Taskdescription	Time min (minutes)	Time max (minutes)
2	100055	Receive order per mail		0	10
3	100056	Check with planning if it is OK.		0	10
4	100057	Put the order in Lbase		0	10
5	100058	Check if there is a rate in Lbase		0	10
6	100059	Receive email from Devauge there is a new load in SAP		0	10
7	100060	Check if the email is about a new load or an existing load which is ready for collection Existing order: check when it is planned for loading and take the time out if there is still 06:01 in		0	10
8	100061	it.		0	10
9	100062	Go to the V directory and take the week order file from last week		0	20
10	100063	Click on sheet 2 "1 week opschuiven".		0	20
11	100064	Check if the dates are moved to next week.		0	20
12	100065	Save as week X		0	20
13	100066	Save as week X CSV		0	20
14	100067	Drag CSV file into O directory		0	20
15	100068	Complete group shipments		0	20
16	100069	Tariff check on all loads		0	20
17	100070	Check orders using week order folder to make sure they are correct		0	20
18	100071	Receive loading plan Ceva Uniqlq in the mail		0	15
19	100072	Copy past the plan into Emons Voorbeeld and save file.		0	15
20	100073	Open order import file and make CSV Ceva		0	15
21	100074	Choose Emons Voorbeeld and choose right week number		0	15
22	100075	Drag the CSV file to O directory.		0	15
23	100076	Orders will be automatically generated in Lbase		0	15
24	100077	Tariff check on all loads		0	15
25	100078	Check plan if all leadtimes are OK.		0	15
26					
27					
28					
29					
30					
31					
32					

	A	B	C	D	E
1	Triggercode	Triggername	Description	Triggerstart	Triggerend
2	200020	Email received with order			
3	200021	Email received from De Vauge that there is a new load in SAP			
4	200022	Loading plan Ceva Uniqlq received in mail			
5	200023	Monday checklist			

	A	B
1	Attributecode	name
2	400001	Discrete
3	400002	Continuous
4	400003	Repetitive daily
5	400004	Repetitive weekly
6	400005	Repetitive twice/week
7	400006	Repetitive three times/week
8	400007	Repetitive four times/week
9	400008	Repetitive monthly
10	400009	NonRepetitive
11	400010	Low level of thinking
12	400011	Medium level of thinking
13	400012	High level of thinking
14	400013	1 Extra person needed
15	400014	2 Extra person needed
16	400015	3 Extra person needed
17	400016	No extra person needed
18	400017	Low preparation required
19	400018	Medium preparation required
20	400019	High preparation required
21	400020	No preparation required
22	400021	Other departments involved
23	400022	<5min info required
24	400023	>5min info required
25	400024	No extra information required
26	400025	Deadline present
27	400026	Soft deadline/internal deadline
28	400027	No deadline present
29	400028	Can be performed outside office
30	400029	Can only be performed in the office
31	400030	Repetitive bi-weekly
32		

	A	B	C	D	E	F
1	Taskcode	Attributecode				
2	100055	400001				
3	100055	400021				
4	100055	400020				
5	100055	400027				
6	100055	400023				
7	100055	400016				
8	100055	400028				
9	100055	400003				
10	100056	400001				
11	100056	400021				
12	100056	400020				
13	100056	400027				
14	100056	400024				
15	100056	400016				
16	100056	400028				
17	100056	400003				
18	100057	400001				
19	100057	400021				
20	100057	400025				
21	100057	400024				
22	100057	400016				
23	100057	400028				
24	100057	400003				
25	100058	400001				
26	100058	400021				
27	100058	400027				
28	100058	400023				
29	100058	400016				
30	100058	400028				
31	100058	400003				
32	500021	400003				
33	500021	400001				



	A	B
1	Subtaskcode	name
2	500021	check DTM if there is a rate for his order
3	500022	Put the rate manual in Lbase
4	500023	ask accountmanager to make a rate and put it in Lbase + DTM
5	500024	Do tariff check

◀ ▶ | Tasks | Triggers | Attributes | Attributes of tasks | **Subtasks** | Departments |

Ready

	A	B	C	D
1	Departmentcode	name		
2	600001	Planning		
3	600002	Workshops		
4	600003	Drivers		
5	600004	Technical fleet support		
6	600005	Bookkeeping		
7	600007	Order Management		

◀ ▶ | Tasks | Triggers | Attributes | Attributes of tasks | Subtasks | **Departments** |

Ready



	A	B	C	D
1	Programcode	name	description	
2	700001	Spits		
3	700002	Ultimo		
4	700003	Excel		
5	700004	Mail		
6	700005	Phone		
7	700006	Crescendo	For matching invoices with actual money transfer	
8	700007	FCI	Used to process invoices, to highlight important data	
9	700008	(Finance) workflow		
10	700009	Coda		
11	700010	Word		
12	700011	Post/Letters		
13	700012	Bank account		
14	700013	Lbase		
15	700014	iCorp	For generating invoices	
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				

Tasks Triggers Attributes Attributes of tasks Subtasks Departments **Programs**

	A	B	C	D	E	F	G	H
1	Probsolvcode	Problem solving name	Problem solving description					
2	800001	Programming						
3	800002	Clustering						
4	800003	Standardizing						

Tasks Triggers Attributes Attributes of tasks Subtasks Departments Programs **P.solv.methods**

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Taskcode	Triggerstartcode											
2	100062	200023											
3	100063	200023											
4	100064	200023											
5	100065	200023											
6	100066	200023											
7	100067	200023											
8	100068	200023											
9	100069	200023											
10	100070	200023											

Tasks Triggers Attributes Attributes of tasks Subtasks Departments Programs P.solv.methods **Triggerstart of tasks**

Ready



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Taskcode	Subtaskcode											
2	100058	500021											
3	500021	500022											
4	500021	500023											
5	100060	500024											

Ready

Tasks Triggers Attributes Attributes of tasks Subtasks Departments Programs P.solv.methods Triggerstart of tasks Triggerend of tasks **Subtasks of tasks**

	A	B	C	D	E	F	G	H	I	J	K	L
1	Taskcode	Departmentcode										
2	100055	600007										
3	100056	600007										
4	100056	600001										
5	100057	600007										
6	100058	600007										
7	100059	600007										
8	100060	600007										
9	100061	600007										
10	100062	600007										
11	100063	600007										
12	100064	600007										
13	100065	600007										
14	100066	600007										
15	100067	600007										
16	100068	600007										
17	100069	600007										
18	100070	600007										
19	100071	600007										
20	100072	600007										
21	100073	600007										
22	100074	600007										
23	100075	600007										
24	100076	600007										
25	100077	600007										
26	100078	600007										
27												
28												
29												

Ready

Programs P.solv.methods Triggerstart of tasks Triggerend of tasks Subtasks of tasks **Depts involved with task**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Taskcode	Programcode														
2	100055	700004														
3	100057	700013														
4	100058	700013														
5	100059	700004														
6	100060	700004														

Ready

Programs P.solv.methods Triggerstart of tasks Triggerend of tasks Subtasks of tasks Depts involved with task P.solv.methods of task **Programs of tasks**



## 10.4 Appendix D

### 10.4.1 Evaluation form

- The solutions provided will add value to the company.

- 1- Strongly agree
- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree

Comment: .....

- Investing time and effort into calculating the chosen KPIs will add value to the company.

- 1- Strongly agree
- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree

Comment: .....

- The data needed for calculating the KPIs are available or can be easily obtained

- 1- Strongly agree
- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree

Comment: .....

- The SIPOC diagrams are valid and accurate.

- 1- Strongly agree
- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree

Comment: .....

- The RACI Matrix is valid and accurate.

- 1- Strongly agree
- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree



Comment: .....

- The flowchart is accurate.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

Comment: .....

- The employees of the Order Management department will be comfortable using the employee scorecard.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

Comment: .....

I agree that my answers to this evaluation form can be shared.

Signature: .....



#### 10.4.2 Evaluation form filled in by the team leader of the Order Management department

##### Evaluation form

- The solutions provided will add value to the company.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

*Comment: It gives more insight in the process and the job. Still I think we need to investigate more as not all parts of the job are completely elaborated.*

- Investing time and effort into calculating the chosen KPIs will add value to the company.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

*Comment: Well thought about the chosen KPIs with explanation why we should take these.*

- The data needed for calculating the KPIs are available or can be easily obtained
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

*Comment: Didn't work with the calculations yet*



- The SIPOC diagrams are valid and accurate.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

Comment: .....

- The RACI Matrix is valid and accurate.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

Comment: .....

- The flowchart is accurate.
  - 1- Strongly agree

- 2- Agree
- 3- Undecided
- 4- Disagree
- 5- Strongly disagree

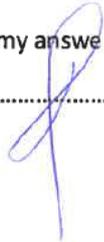
Comment: .....

- The employees of the Order Management department will be comfortable using the employee scorecard.
  - 1- Strongly agree
  - 2- Agree
  - 3- Undecided
  - 4- Disagree
  - 5- Strongly disagree

Comment: *The scorecard is completely new and not yet introduced. Also it is not yet something what is automatically generated so all data need to collected manually what is not workable.*

I agree that my answers to this evaluation form can be shared.

Signature: .....

A handwritten signature in blue ink, consisting of a large, stylized loop followed by a vertical line.

*In the beginning it was a bit difficult how to start and to understand what the job is we are doing. After some time and conversations it was getting clearer what to expect from each other. I think the thesis is good for us as a company to work with, it is not yet complete as more parts of the job need to be investigated (this needs more time) but this will help us a lot to get this done.*