BACHELOR THESIS

Measuring performance objectives of “Planning” department at Emons Group.

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EMONS

Bachelor thesis Industrial Engineering & Management

Measuring performance objectives at “Planning” department at Emons Group.

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I. Management summary

The research has been conducted for Emons Group B.V, which is a logistics company specialized in the transportation of different type of goods throughout the Europe. The main focus of the research is to design a model which makes possible the performance measurement at the planning department. Therefore, the main research question for this thesis is as follows.

"How can the performance be measured at the planning department at Emons group?"

For this thesis, the MPSM model was used. Firstly, a problem cluster was designed for the purpose of defining the core problem which resulted to be "*lack of measurement tools for improvements*". After that, a description to the research design is provided followed by all the research questions for every step of MPSM.

Context analysis provides the overview of how the planning department looks like. Theoretical perspective provides the potential KPIs and criteria that can be used to measure the performance indicators. Solution design provides KPI selection method and the resulted KPIs that were used for the planning department. Following with the implementation which provided how the selected KPIs will look like in a dashboard design using mock-up data and lastly, with the evaluation framework which gives Emons a better understanding of the model and provides the ways to evaluate it each year according to UTAUT model.

The results from this thesis contribute to Emons because of the overview that it provides for the planning department. If implemented correctly as stated in chapter 6, continuous measurements can be taken which can help the management team of Emons make decisions about what aspects to improve in the department. Considering the future research, it also provides the possibilities to implement new KPIs to the dashboard according to the strategic objectives that Emons want to further analyze.

II. Preface

The following document consist in my bachelor thesis: “Measuring performance objectives of planning department at Emons Group”. This document is the final project that I need to present and defend in order to finish the bachelor program of “Industrial Engineering and Management” at University of Twente. The thesis is performed at Emons Group from March until July 2021.

This preface is meant to give my gratitude and thank all people that helped and supported me to complete this project. Firstly, I would like to thank my supervisors of the University of Twente, Sebastian Piest and Eduardo Lalla for their guidance and feedbacks regarding my work which made possible the completition of the research. Their support was one of a kind.

Secondly, I would like to thank my supervisors and employees of Emons Group which were very cooperative for the entire time that I have been researching at the company. Specifically, I would like to thank Marcel Wouterse and Thomas Massop which guided me towards the key points that I needed.

In truth I would have not been able to achieve the level of success without their instructions so thank you all for your unwavering support.

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1. Introduction

In this chapter, an overview of the company and the planning department at Emons Group will be presented. In section 1.1, a brief company description of Emons will be introduced since it is where the research is taking place and an overview of how the planning department currently operates. In section 1.2, details will follow about the research stating the problem identification process which consists in motivating the core problem according to the problem cluster, deliverables, and the research scope. Lastly, section 1.3 will provide a conclusion about the chapter.

1.1 Company

Emons Group is a privately owned group of companies specialized in logistics and transportation of different types of goods. Operating in more than 10 different countries in Europe, Emons is widely known for its service. Emons Group is operated by several departments which one of them is “Planning” which is responsible for all the route planning that the trailers will go through to fulfill customer orders.

The vision of the future for Emons is about having cheaper, faster, and more sustainable methods of goods transportation using the newest and more developed methods. Going green as a company is a challenge for them which the more effort and specialized ways are used as inputs, the output will outperform the current logistics market and their rivals.

1.1.1. Company structure

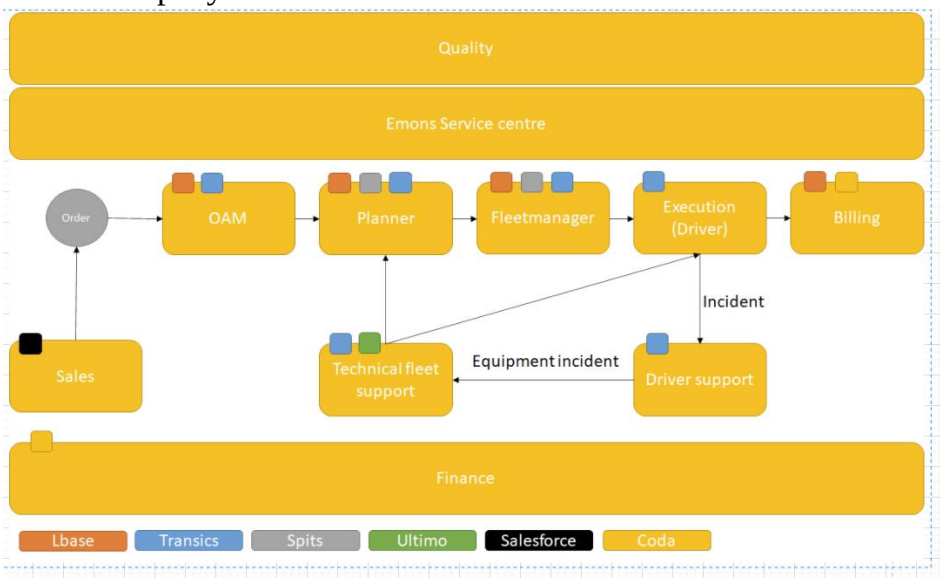

Figure 1: Company structure (Emons presentation 2021)

In figure 1, the operational department structure is presented with all the connections each department has and all the software they use. First comes the Sales department which is responsible for the marketing side and dealing with customers analysis to provide a better service for order-making. Secondly, OAM stands for Order Account Management which is the department involved with gathering and analyzing all the coming orders from the customers. The software used for this department consists of Transics and LBase. This department has a direct connection with the planning department which function is explained below and the software used are LBase, Transics, and Spits. The Fleetmanager department is responsible for managing all the drivers that are used and also stands as a communication tool

between the planners and the drivers. The software they use are the same as planners. Following, after the orders are planned, the billing department is responsible for assessing the costs and delivering the final bill that the customer has to pay for the service. The software used are LBase and Coda. Furthermore, the Driver support and the technical fleet support are the departments that deal with incidents, and together with the planning department, they contribute to the solution of each one. The software used are Ultimo and Transics. Lastly, there is the Finance department which deals with decision-making for investments but also analysis of the current financial situation of the company. The software they use is Coda.

1.1.2. Planning department

The most important sector at Emons is the planning department. Planning is the main branch for all the major operations that occur at this company. It consists of all the decisions that will be taken to fulfill the orders using operation and cost-efficiency. The major difficulty in this department is the complexity due to a large number of orders, which might reach 200 per month, resource allocation, and the responsibility it has for the profitability of the company.

According to the preliminary research that was done by me through interviews and discussions with employees, the Planning Department at Emons is performed by two internal planners that deal with separate orders categories and one external planner which is responsible for the functionality and communication of this department with other departments of the company. They have to deal with the planning of all the orders that come to Emons every day and allocating 120 trucks and drivers to fulfill client's requests. The majority of the orders have the United Kingdom as a final or first destination so Brexit is a bottleneck that the Planning department has to deal with.

At present, the decision-making of planning these orders consist of the calculations done by these planners and also communication with 2nd parties logistics company such as ferries or cargo transportation. There is no decision-making software or other means of deducing optimal route planning for the orders so every process is taken into account by these two planners' expertise through years of work experience. LBase, Transics, and Spits which are the software that the planners use, only assist in ease of resource allocating.

Furthermore, planning consists of some other duties that these planners should perform. There is separate planning for the drivers holidays which for every driver takes place 1 week our of 4 weeks. Also, trailers and trucks require to have planned for their maintenance. These two resources need at least once a year proper maintenance but in case of disruptions, extra planning for maintenance is required. Meaning, there is extra complexity in this department for resource allocation to fulfill the order demands.

1.2. Problem identification

Since Emons Group has been created, its motto has always been to achieve better, faster, and cheaper logistics services to their customers (CEO Emons Group). As mentioned above, the planning department consists in allocating the resources that Emons have such as trailers, trucks, and drivers to the orders that come every day.

Currently, Emons Group does not have a method to measure how well the employees of this department perform their tasks. These two employees are some of the most experienced of the company in what they do so the tools to measure should come from entities with the same level of experience and knowledge. Due to the belief of the company stakeholders that this

department is not failing on day to day basis and the employees being capable of solving the problems that arise in the planning process has resulted in the department has not been analyzed for performance improvements.

To summarize, there is no tool for the stakeholders to measure how well this department performs in order to make improvements in certain aspects if required and needed. These reasons led to the creation of the problem cluster created and explained in section 1.2.1.

1.2.1. Problem cluster

To identify the core problem, firstly, all the problems should be connected together in a form of a problem cluster with their derivative problems. Then, at the end of the tree branch, we can determine the core problem. “A problem can only be a core problem if it can be influenced” (Heerkens & Winden, 2017). While having conversations and interviews with stakeholders but also with the employees of the planning department online and physically, some inputs for problems were provided. Furthermore, these inputs led to more problems which in the end formed a tree of problems called a problem cluster. In Figure 2, the problem cluster-specific for the Planning department is presented.

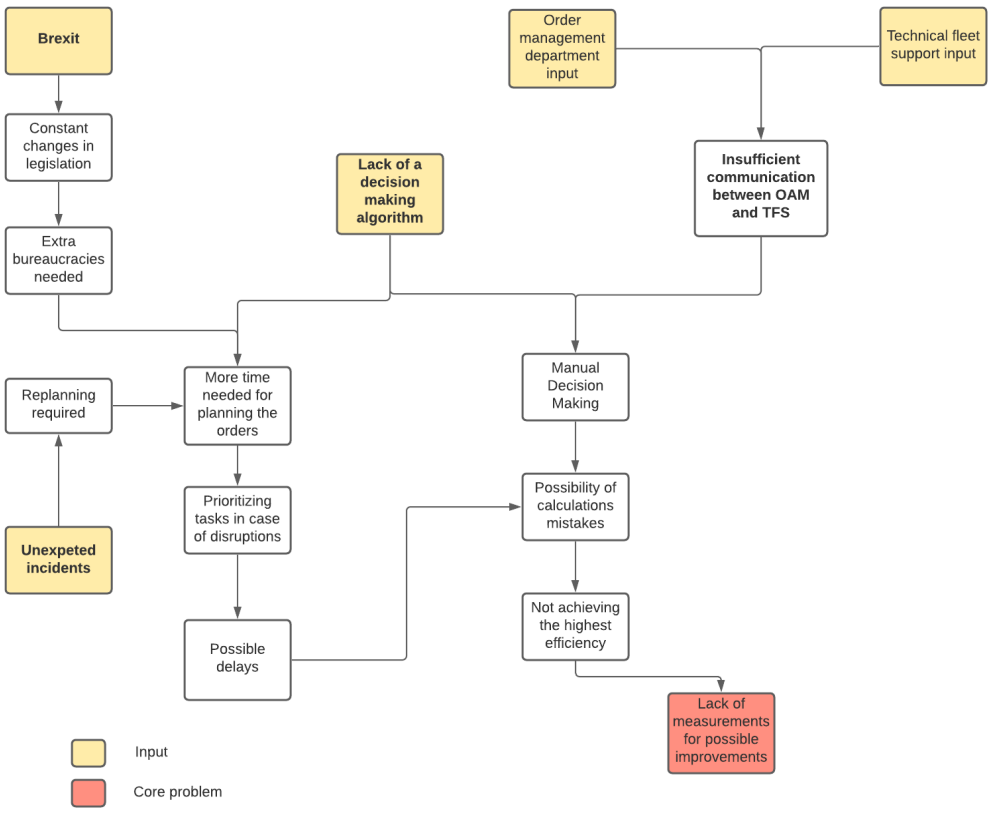

Figure 2: Problem cluster of the planning department

1.2.2. Core problem

"Lack of a measurement method for possible improvements"

The information in the problem cluster was defined via the conversation with the stakeholders and the employees of the planning department. All the inputs mentioned in figure 2 lead to other problems that the planning department has. Eventually, by reasoning that one problem causes another problem, all the roots were linked to the core problem being lack of a measurement method. Then, a discussion with the stakeholders leads to the confirmation that this core problem can be further analyzed in order to find an appropriate solution.

1.2.3. Motivation of core problem

In the problem cluster above, the inputs consist of the current situational aspects that the Planning department at Emons is facing. The most recent one is Brexit. Due to the United Kingdom leaving the European Union, certain procedures need to be taken for all the customers of Emons that require transportation of goods in or out of that country. To enter the UK, the trailers and trucks can use three different methods which are ferries, cargo transport, and through the shuttle that links France and England. For each of these methods, there is certain documentation that needs to be filled by the planners for every order and this documentation differs when the trailer enters the UK through France, Belgium, or the Netherlands. These bureaucracies lead to more time for planning the orders but it is solely impactful only for the planning department without including other departments.

Following, another input is unexpected incidents that might occur during transportation. From having a tire crack to road accidents there is quite a challenge for the Planning department to fulfill every order even in the worse situation.

Currently, the planning of the orders is done by two employers that allocate 120 trucks to different trailers specialized for different types of goods. This job requires high expertise in resource allocation methods and route vehicles problem calculations with dozens of constraints for each order. Therefore, these two employers fulfill their duty of achieving satisfactory results because they have many years of work experience in this field. But in these types of companies dealing with hundreds of orders per month, the lack of a decision-making algorithm that can find the most optimal route for every order might be considered a necessity. Not being able to have such a method, the entire work becomes manual and this leads to possibilities of calculation mistakes and missing the opportunity for higher efficiency in their planning.

The last two inputs that are required for the planning of the orders to start are both the inputs from Order Account Management (OAM) and the Technical Fleet Support (TFS). The way these inputs are passed through the Planning department is through a joint software called Spits. In this software, the OAM uploads daily all the new orders coming from emails or Emons website, and the TFS uploads daily all the available resources to fulfill the orders so the planners could start allocating resources to orders. But in case of certain disruptions, a chaotic situation occurs and the solution often happens to be that the two planners deal with tasks that should be performed by another department in the company. This leads to the thought of insufficient communication between these departments which connects with the manual decisions to solve these disruptions.

All these links and connection between these problems lead to the Planning department not achieving the highest efficiency and effectivity that it could. My view on process insight and standardized work instructions for Emons is that they do not fully achieve a standardized working environment. Dealing with a large number of chaotic situations every day, the planners have adopted to solve these issues in the simplest way possible without relying upon them in a structured way of operating. As mention in the Management Summary. Emons as a company lacks an overview of how well the planning department performs its duties and to be able to have a response to that need, numerical variables should be defines and the performance should be measured. This process can be done by selecting and implementing a performance management framework and conducting a baseline measurement and KPIs. More information will follow in the next chapters.

1.2.4. Research scope

The research scope of a study explains the extent to which the research area will be explored in the work and specifies the parameters within which the study will be operating.

In this case, the main scope of my research would be about performance measurements in a company. This analysis consists of information about the planning departments in general, the jobs of the planners, and the complexity of transportation planning in a logistics company. Also, inside this scope, there will also be an analysis of the specific variables that are needed to measure how well this department is performing. These variables will be measurable by different types of methods such as data gathering and operationalization.

Furthermore, the research will also be included inside the scope of transportation companies specifically build a generic model for Emons. The main questions that will be researched would be of the type of how these companies keep up with the demand and how well do they improve and adapt to new technological improvements. This idea will be beneficial for the research due to the fact that it can be proven valuable to the company in the near future. If in the research, a thorough analysis is performed inside the scope of how logistics companies perform, the conclusion of the performance measurement for the planning department will be reliable and realistic.

1.2.5. Deliverables

The first deliverable for the company is an excel file consisting of all the tasks of the planning department and how are they linked with other processes, subtasks, or other departments. The excel sheets can be found in the appendix.

The second deliverable would be to present a visual representation of the excel file using a software called PowerBI which has the purpose to show potential issues regarding the attributes of those tasks. More information will follow in section 3.1.

The third deliverable would be to design a business process flowchart and to link it with other processes of the other departments to understand the flow of information through Emons. This deliverable can be found in section 3.2.

The fourth deliverable would be to define a set of KPIs that could potentially be used to measure performance indicators of the planning department using real data of precious orders that Emons possess in their database. The entire method of selecting is presented in chapters 4 and 5.

The fifth and last deliverable would be to present these KPIs using visual representation tools such as dashboards in order to understand and show the measurements that can be used to evaluate the performance objectives of the planning department. This deliverable can be found in chapter 6.

1.3. Conclusion of Chapter 1

At the beginning of this chapter, an introduction about the company structure and the planning department is given. These two sections form the environment that this thesis is taking place. Following, the problem identification was discussed with all its components which resulted in the statement of the core problem to be: *"Lack of a measurement method for possible improvements".* This thesis aims to research the way that this core problem will be tackled and provide an adequate solution. The solution will be based on presenting a set of KPIs and visualizing them using a dashboard.

2. Methodology

In this chapter, the methodology of this thesis will be described. Starting with section 2.1 which will explain the problem-solving approach with all the steps that will be used. Following with section 2.2 which is about the research design and its components and lastly a conclusion section for this chapter.

2.1. Problem-Solving approach

In this section, the problem-solving approach will be defined and it will be applied to the planning department of Emons. Specifically, in the following sections, it will be described how the problem was defined until the implementation phase.

The problem-solving approach that will be used in this thesis is taken from the book by H. Heerkens & A. van Winden (2016) called "Solving managerial problem systematically". The method is called "Managerial Problem-Solving Method" and this is considered to be a 7 steps approach.

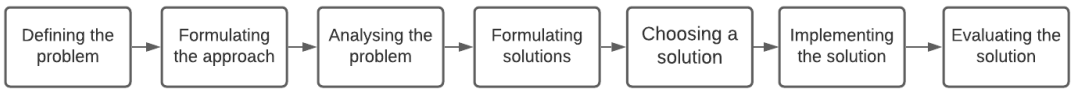

Figure 3: MPSM

MPSM allows for implementation even without having built particular knowledge on each step, rather a general outlook is sufficient. This framework does not separate designing and research, rather they go side by side. It facilitates knowledge building through research and problem solving through design (H. Heerkens & A. van Winden, 2016).

2.1.1. Defining the problem

During this phase, it is required to define the actual problem Emons company is facing. This problem is thoroughly explained in section 1.2. So the problem is specifically: *"Lack of a measurement method for possible improvements".* This problem was presented to the stakeholders and the employees of the planning department at Emons and was verified by them concluding that an approach like this model is needed at the company.

2.1.2. Formulating the approach

Following, the 2nd step of MPSM is to formulate the approach on how to tackle and solve the core problem. The way to do that is to gather data and distribute it through different KPIs that can be numbered in order to draw conclusions. The data gathering method will mostly consist of interviews of the employees, different surveys, and what is actually in Emons database regarding all the planning that is done throughout a period of time. Knowledge questions will arise on how to perceive that data and how to find the correct measurements techniques and will be solved using systematic literature review (see Appendix).

The research requires to be qualitative but also quantitative. The qualitative part consists of a task analysis which is performed that consists of linking daily tasks of the planning department with other departments and drawing conclusions based on certain attributes. The quantitative one includes the data analysis which will be distributed to specific KPIs, a method of valuation will be conducted. This method will contain a set of goals that Emons have and will be compared to the reality of the performance indicators. Then, conclusions will be possible to be drawn and decision-making will follow.

2.1.3. Analyzing the problem

Based on my preliminary research and the lectures I have had for MPSM in the university, the analysis of the problem requires certain activities. The most important ones are to look for causes, review previous solutions and use relationship models to define possible relations between the cause and the problem.

At Emons Group, the planning department is considered to be a separate department from the rest due to the fact that the people that work in planning are required to have a high experience level and adequate skills in logistics and route planning theories. Therefore, the stakeholders of Emons lack the knowledge on how to measure and evaluate the performance of this department and to define whether there might be problems that require better solutions. In addition, a systematic approach is needed to solve a managerial problem of this scale so, for this thesis, a solution to that problem using dashboards and KPIs will be designed.

2.1.4. Formulating and choosing a solution

These 2 steps consist in describing a set of solutions that could possibly solve the problem and actually choosing which one would perform best. This set of solutions can be considered appropriate and adequate when decision-making processes are established, criteria are defined, scaled, and weighted and a method of evaluation for these criteria is designed.

2.3.5. Implementation and evaluation of the solutions

Lastly, an implementation plan will be conducted. This plan would consist in presenting my findings to the company and discussing with the company supervisors how well could the proposed solution actually fit the company. After discussing, the company will provide feedback about the solution which is going to be used for future improvements.

2.2. Research design

Research design is the framework of research methods and techniques chosen by a researcher. These techniques consist in how to gather the information that the researched needs such as interviews, observations, statistics, surveys, experiments, or opinions. The design allows researchers to hone in on research methods that are suitable for the subject

matter and set up their studies for success. For this research, the information gathering will mostly be with interviews, observations, surveys, and opinions leaving out the statistical approaches.

2.2.1. Assessment of Research Design

2.2.1.1. The research type

Specifically for the Emons Group, the type of research is descriptive rather than explanatory due to the fact that in this thesis, there will not be an explanation about the current situation of the performance of the planning department.

Another characteristic of the research type is to define the research population. The research population would be the employers of the planning department which currently are three but also the members of the department of order management and technical fleet support since they are directly linked with the planning department which in total are eight people.

Furthermore, for research done thoroughly, there is a set of choices that should be considered.

- Influencing variables: In Emons case, the variables will not be influenced. They should always be considered as internal and without any interference from other parties.
- Direct contact with research population: For this research, it is required to be in direct contact rather than observing from behind. Constantly, questions will arise and communication with the employees will make the research be as adequate and realistic as possible.
- Cross-sectional vs longitudinal research: In this case, cross-sectional research will be used. All the measurements will be taken simultaneously without considering the change of the variables throughout the time aspect.
- Data gathering method: Raw data will be filtered to the desired entities, questionnaires, surveys, and interviews.

2.2.1.2. The key variables

The variables that will be used for this research will be chosen from a list which is written below. These variables were designed using literature research about studying performance measurements of employees and combining those with what the stakeholders want to analyze. More information about the literature will follow in chapter 4 and the selection method is discussed in section 5.2.

- Utilization Rate
- Average time for task completion
- Overtime Rate
- Orders processed/unit of time
- Incidents process time
- Draft planning/order
- Employee turnover possibility
- Managerial satisfaction
- Employee satisfaction
- Continuous improvement rate
- Number of complaints
- Planning response time

- Planning to other processes ratio
- Administrative expenses
- Background check expenses

The chosen variables will be constructed in a way to create a dashboard model and draw conclusions. Possible relationships with the variables mentioned above will be linked with the constraints of the transportation methods. For example, if a delay of an order happened, it might be the case that the shuttle was closed for construction which is not Emons fault but a 3rd party was involved. This way it can be determined in a correct manner that the real performance measurements are fully internally and not affected by other sources.

2.2.1.3. Data gathering

The data gathering method for this thesis is designed in two categories. The first category is a number of surveys and structured interviews. Author Nick J Fox in the paper named "*Using interviews as a research project*" describes interviews as: "The interview is an important data gathering technique involving verbal communication between the researcher and the subject. Interviews are commonly used in survey designs and in exploratory and descriptive studies. There is a range of approaches to interviewing, from completely unstructured in which the subject is allowed to talk freely about whatever they wish, to highly structured in which the subject responses are limited to answering direct questions".

The second data gathering method is by using the data from the company database. This will help to achieve a satisfactory level of correctness of the research but also understanding the reality behind Emons numbers. Firstly, the raw data will be filtered in order to have only the information that is needed for the KPIs, and secondly, the data will be analyzed in order to be adjustable for the design of the dashboard.

2.2.1.4. Research questions

The research questions are used to split the research into several parts that can be researched separately and then combined together for an adequate response. These questions help for a division of ideation because they keep one idea at one question. To solve the core problem, the main question that has to be answered is: *"How to measure the performance of the planning department at Emons Group?"* Following, this question can be split into sub-questions accordingly for each of the steps of the problem-solving approach that is chosen.

Research Question 1: *"How does the planning department at Emons look like?"*

Research Question 2: *"What are the potential key variables that can be used to measure performance indicators at the planning department?"*

Research Question 3: "*What criteria should be taken into account to measure performance in the planning department?"*

Research Question 4: *"Which KPIs are suitable and appropriate for the planning department?"*

Research Question 5: *"How can KPIs be measured and implemented in the planning department?"*

Research question 6*: "How can the model be evaluated over long-term ensuring adequate results and contribution to the decision-making process?"*

2.3. Conclusion of Chapter 2

In this chapter, the methodology that will be used for this thesis has been described. Based on the literature and the book of Hans Herkens that thoroughly explain the MPSM, the approach has been adjusted to solving the core problem that Emons has. Every step is explained and will be used to give an adequate solution. Furthermore, the research design with all its components is given. The main aspects of the research design were to state the key variables which was done in section 2.2.1.2 and state the research questions explained in section 2.2.1.4.

3. Context analysis

This chapter is dedicated to understanding the context of the environment that this thesis is taking place and contributing to answering the first research question:

"*How does the planning department at Emons looks like?*"

In section 3.1, a task analysis that was performed in the company is shown. In section 3.2, the process and systems of the planning department are expressed and explained in a flowchart. In section 3.3 the complexity of the planning department will be stated. Following with section 3.4 which is a SWOT analysis for the planning department and lastly with section 3.5 which is the conclusion.

3.1. Task analysis

In order to understand the planning department's functionalities, first, a task analysis had to be done. This analysis consists of creating an overview of the tasks that the employees perform on a daily basis, assessing these tasks via certain attributes, and incorporating this data in a dashboard. Figure 4 and 5 show the list of tasks of the employees and the list of triggers which are the starting or ending points for these tasks.

Taskcode	Taskname	Taskdescription	Time min (minutes	Time max (minutes)
100086	Look over capacity		0	5
100087	Look over #orders		0	5
100088	Meeting with OAM		0	60
100089	Price calculation		0	60
100090	Loading/Unloading scenarios		0	20
100091	Wrapping final overview for the day		0	10
100092	Look into the future orders		0	30
100093	Planning process		0	480
100094	Scanning through screens		0	60
100095	Replanning (Standart)		0	180
100096	Replanning (Nonstandart)		0	180
100097	Look at maintanance conditions		0	120
100098	Book ferries or other booking types		0	60
100099	Planning for orders of glass		0	60
100100	Fill the legislation form for different countries when entering UK		0	30
100101	Check if the ongoing orders are going well		0	30
100102	Contacting fleet managers to confirm drivers status		0	20
100103	Contact OAM in case of disruptions or lateness of orders		0	20
100104	Check the timings for ongoing orders		0	30

Figure 4: Tasks of planning department

Triggercode	Triggername
200051	OAM has uploaded all the orders to Spits
200052	OAM has uploaded all the orders to Lbase
200053	Technical fleet support has uploaded the available trucks and trailers
200054	Fleet managers confirms no-disruptions with drivers
200055	Serial numbers from fleet managers are sent to planners
200056	Bookings are confirmed
200057	Forms of custom clearance are sent to planners
200058	Drivers update their status
300037	Drivers confirm their future routes
300038	Fleet managers are informed for future plans
300039	Serial numbers are updated in the forms
300040	Forms of customs are approved
300041	Shipment is ready for ferries
200059	Fleet managers upload the list of available drivers
200060	Emails from technical fleet support with disruptions

Figure 5: Triggers of tasks

After aligning the triggers that start or end a certain task, attributes were needed for understanding the properties of each task. The attribute list presented in table 2 was created from the conversations with the stakeholders but also the members of the improvement squad of Emons.

Attributecode	*Name*
400001	Discrete
400002	Continuous
400003	Repetitive daily
400004	Repetitve weekly
400005	Repetitve twice/week
400006	Repetitve three times/week
400007	Repetitve four times/week
400008	Repetitive monthly
400009	NonRepetitive
400010	Low level of thinking
400011	Medium level of thinking
400012	High level of thinking
400013	1 Personel needed
400014	2 Personel needed
400015	3 Personel needed
400016	No extra personel needed
400017	Low experience required
400018	Medium experience required
400019	High experiencerequired
400020	No preparation required
400021	Other departments involved
400022	<5min info required
400023	>5min info required
400024	No extra information required
400025	Deadline present
400026	Soft deadline/internal deadline
400027	No deadline present

400028	Can be performed outside office
400029	Can only be performed in the office
400030	Rarely wrong / unrealiable info received
400031	Sometimes wrong / unreliable info received
400032	Not always performed
400033	Experience / knowledge in the area needed
400034	Sometimes missing input
400035	Repetitive bi-weekly

Table 2: Attribute of tasks

After assessing all the tasks with one or more attributes, a data file was created. This file, apart from consisting only in the list of the tasks with their attributes, was also added some extra information regarding the departments that these tasks include and the application that are used. This additional analysis was requested by the stakeholders which suggested that will help with the visualization of the data.

This file was used as an input for the dashboard which was created in PowerBI (software specialized in creating dashboards). The dashboard consists of two pages and is the visual representation of all the links between tasks, triggers, attributes, departments, and applications. Figure 6 and 7 show the two pages of the dashboard.

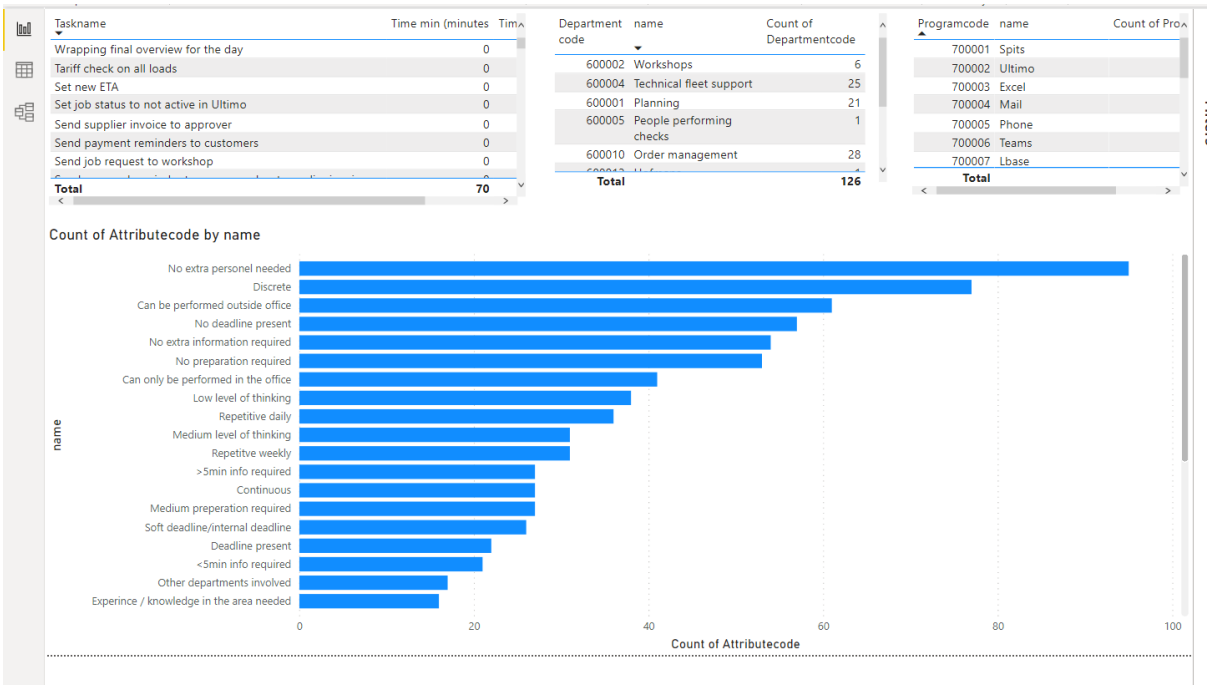

Figure 6: Task analysis dashboard, page 1

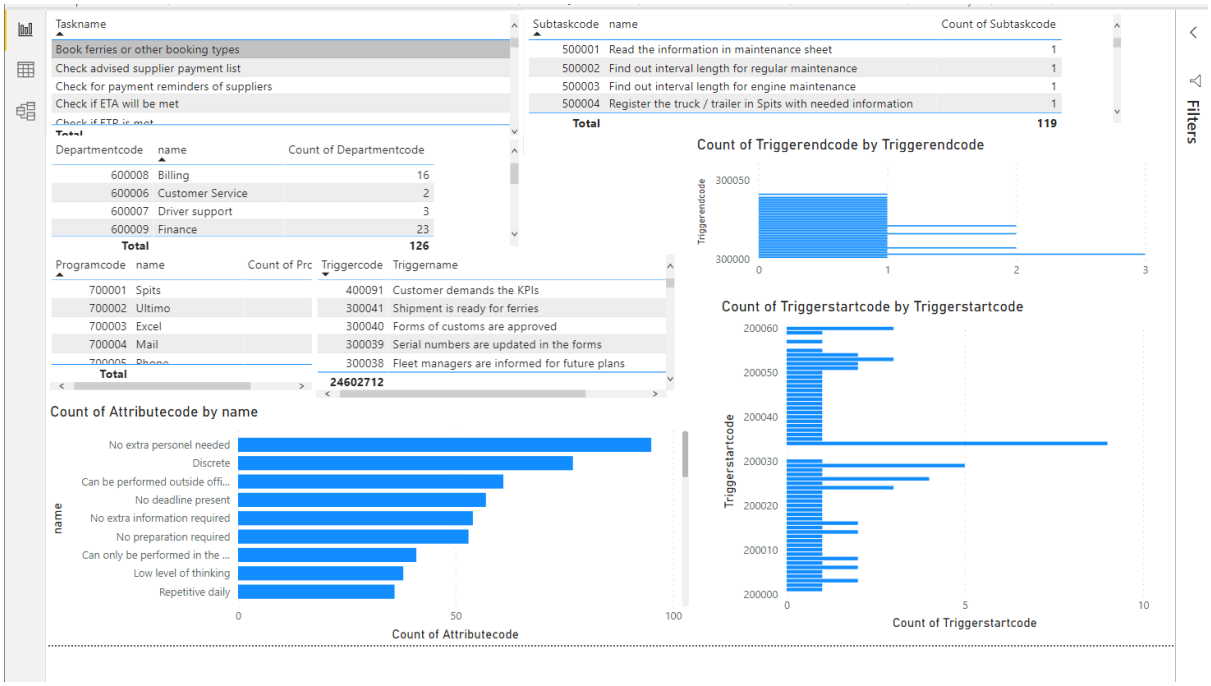

Figure 7: Task analysis dashboard, page 2

The main purpose of this dashboard was to understand the functionalities of the planning department by analyzing certain attributes of employee's tasks. Furthermore, it helped in visualizing all the processes that this department deals with and contributed to creating flowcharts for a better understanding of this department.

3.2. Process and systems

The planning department at Emons mostly has to deal with the planning of allocating resources to orders. This process consists of certain tasks that follow up one another with an input which is the order made by the customer and the final output which is the route planning of that order. For the best description, a process flow chart is displayed below which has the purpose of understanding the flow of the processes and the flow of information in order to see in which of the aspects the planning department faces bottlenecks.

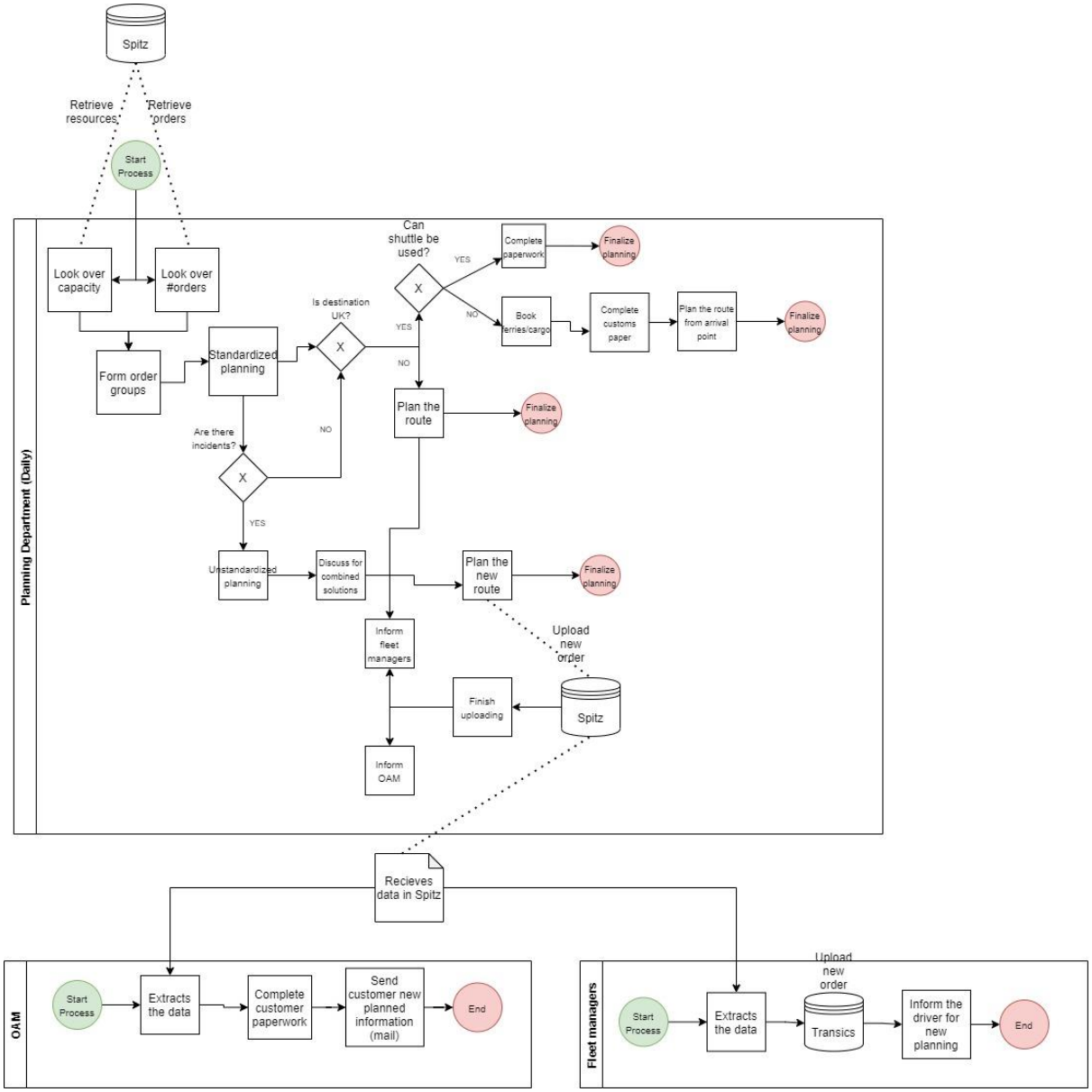

Figure 8: Process flow for planning department (daily)

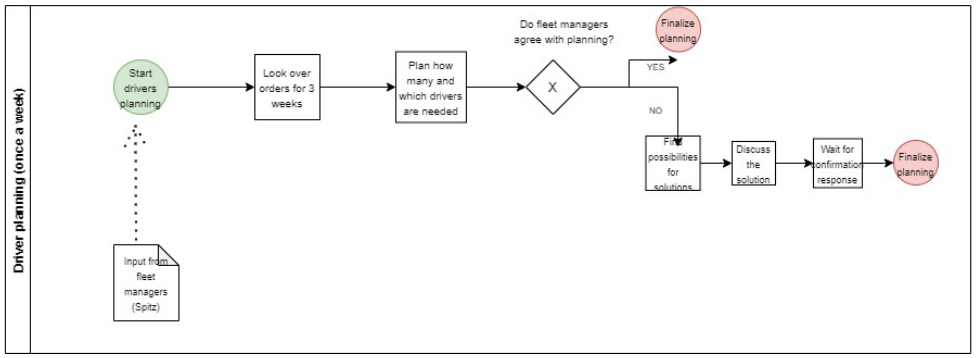

Figure 9: Process flow for planning department (once a week driver planning)

In figure 8, all the daily processes of the planning department are shown. The first input for the planning of allocating the resources come when in the system of Spits there is uploaded an overview of the orders that need to be planned from the Order Account Management (OAM) department and the second one comes from the Technical Fleet Support (TFS) where

it is uploaded all the available trucks, trailers and drivers that can be used for planning. Due to Brexit, the orders are split into two categories, whether the final destination is in UK or not. Following, there is standardized planning which consists of the normal procedure of route planning of orders using their specific methods, and also unstandardized planning which deals with orders that an incident has occurred. The planning for these orders is either delayed or postponed until the incident is discussed first. If everything is smooth in categorizing the orders and resolving the incidents, the process flow of planning the orders is straightforward with all the tasks displayed in the figure above.

Furthermore, this department has to deal with the planning the schedule of the drivers which always happens once per week. The process flowchart for driver planning is shown in figure 9. The restriction for this planning is that drivers work 3 weeks and rest 1 week so before making the actual planning, the employees are required to create an overview of the orders for the upcoming 3 weeks and make a draft planning for the drivers. Then, this information is passed on to fleet managers which are responsible for the drivers and they confirm whether the draft planning is acceptable or not. If not, another review of the draft planning is proposed until the planning department receives the confirmation to finalize the planning of the drivers' schedule.

The systems that are being used by this department consist in the design to make the information accessible by the three departments: OAM, Planning, and TFS. The software that is used is called Spits which makes it possible to have a live overview between all the employees of these three departments in order to quickly catch the problem that occurs and resolve all the issues.

3.3. Complexity

The planning department is considered to be the most complex one at Emons Group. This process of planning has a major responsibility due to the fact that a lot of unnecessary costs can come up from this department if mistakes are made. The complexity stands in 3 different aspects according to the discussions done with the employees.

1. **Restrictions**
   This is a major complexity because not all the resources can be allocated to all the orders. In the current situation, Emons has restrictions about specific trucks that cannot enter UK, specific drivers that cannot travel outside the EU, and specific trailers that cannot carry certain goods. Considering these three restrictions at the same time for every order results in a challenging duty to accurately plan to achieve maximum efficiency.
2. **Incident analysis**
   The planners have the duty to deal with incidents that happen at the moment when they occur. When incidents occur, their tasks consist in making a new planning to fulfill the order and not solving the incident and can also result in last-minute change of the scheduled orders.
3. **Live tracking**
   Another task that the planners have to deal with daily is to constantly monitor the orders that are being delivered. Using Transics (software that planners use), they can see whether the times of arrival of orders will be met or not. In situations that delay

occurs, they are required to make a new planning to prevent a domino-effect of delays.

3.4. SWOT analysis

Another characteristic when conducting a context analysis is to perform a SWOT analysis. SWOT stands for strengths, weaknesses, opportunities, and threats. It allows the departments to get a bigger picture of perspective about their operations which can lead to certain improvements. Figure 9 represents a SWOT analysis conducted specifically for the planning department at Emons Group.

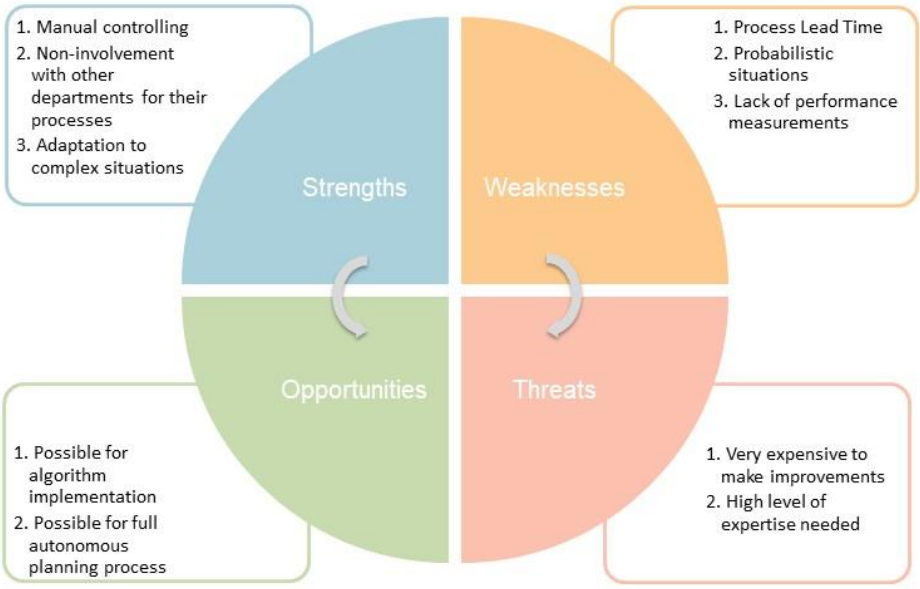

Figure 10: SWOT analysis

Strengths

1. Manual controlling – all the tasks are processed by humans, easy to control and make changes
2. Non-involvement – the department works mostly on their own without distractions or dependencies from other departments
3. Adaptation – complex situations or problems are always solvable as long as adaptation is possible.

Weaknesses

1. Process lead time – planning is a high time-consuming process that results in lead times that should be taken into account
2. Probabilistic situations – planners have to deal with the probability of occurrence of certain situations making the department a really complex one

3. Lack of performance measurement – Emons currently has no tools to measure the performance

Opportunities

1. Possible for algorithm implementation – the planning process can be fully automated using algorithms that can achieve the maximum efficiency
2. Possible for full autonomous

Threats

1. Expensive to make improvements – every improvement is very complex and requires specialized people and lots of time to be implemented
2. High level of expertise – planning deals with a lot of mathematical and complex calculations in order to function correctly

A conclusion to this SWOT analysis would be to analyze one of the weaknesses and develop it in order to make a strength or an opportunity out of it. There can also exist a case to develop on a deep level one of the opportunities and have it become a strength. But due to the threats that Emons consider development at this scale very expensive and unfeasible at the moment, should be taken into account in the future. According to the preliminary research and discussions about what were the possibilities at the company to improve would be the lack of the performance measurements which is one extra reason why it is the thesis of this topic.

3.5. Conclusion of Chapter 3

The main of this chapter was to provide an answer to the research question: *"How does the planning department at Emons looks like?".* The first contribution to answer this question was the task analysis which presented how the tasks of the employees are assessed with the attributes mentioned. The second one was the process flowchart that presented how tasks are linked together in order to show the flow of the process starting with the placement of an order and delivering the final planning for that. The third one was to explain the complexity of the department which helped to understand the three main aspects that the planners have to deal with on a daily basis. And the last contribution was the SWOT analysis which provided a general overview of the department as a whole and the prospective it has for improvements.

4. Theoretical perspective

The aim of this chapter is to give an answer to the following research question:

"What are the potential key variables that can be used to measure performance indicators at the planning department?"

Starting with section 4.1, the performance measurement as a concept will be presented. Using a systematic literature review, this concept will be made as understandable as possible and be related to the planning department of Emons. Secondly, section 4.2 will be discussed how to measure the performance, and lastly, concluding with section 4.3 that will be about defining the possible KPIs that could be analyzed. In the appendix, the way the systematic literature review was performed can be found.

4.1. Performance measurement

Performance appraisal is the strength of performance management, which in turn affects organizational performance. It helps to identify and overcome the problems faced by the employees on his/her work (Mackey and Johnson, 2000). It can also lead to the development of a company as a whole due to the fact that performance measurement contributes to continuous improvements regarding internal processes completed by employees. But the process of understanding performance measurement should first be split into three main categories.

4.1.1. Purpose of measuring performance

According to Robert D. Behn, the main contribution of measuring performance is because it is helpful in achieving eight specific managerial purposes. These managerial purposes are evaluate, control, budget, motivate, promote, celebrate, learn and improve and can also be considered as the eight key factors that managers have for measuring performance. Unfortunately, there is no single performance measurement that can evaluate all the eight managerial factors. Instead, the way that this idea can be thought through is to think of attributes of one managerial purpose that performance measurement can contribute to.

4.2.2. Need for measuring performance

All companies aspire for organizational improvements. These improvements consist of creating a set of goals, completing and evaluating them. These three aspects define the necessity for measuring performance due to the fact that in each of the above-mentioned steps, an assessment of the ongoing process should be made. According to David Osborne, performance measurements are needed to focus critically on the current and future development of an organization.

4.2.3. Concept of appraisal on employee performance

Recher in 2010 has stated that in many organizations performance appraisal continues to be a matter of rewarding employees as individuals. While performance appraisal is also a component that inspires competition between colleagues, these colleagues are also required to perform as team members. Thus, an employee could also be in an unpleasant position whereby they are officially expected to depend upon their performance as a private, often in competition with his/her teammates. This emphasis creates an issue for the performance of the worker. Therefore, this concept can be seen as a difficulty when considering presenting

the idea of performance measurements to employees in order to gather only the positive aspects of the process.

4.2. How to measure performance

The most difficult part of the performance measurement process is to objectively and accurately define an attribute for measurements in the field that is being analyzed. In Emons case, the performance measurement is seen as quantifying the effectiveness and efficiency of the department in a given time period and compare it with the goals set at the beginning of the measurement. When considering this idea, these attributes are named key performance indicators (KPIs).

For the purpose of measuring employee performance, different input forms can be used for taking the feedback from the various sources like the supervisor, peers, and the employee (Mello, 2010). According to Mello, it is very important that these measurements are taken on a regular basis in order to get a complete evaluation of performance. Overall, making this process continuous also motivates and improves employee performance.

According to Rudman (2003), measuring employee performance based on only one factor can give inaccurate results and create a negative impression of the employees and the department. Supposing that a measurement is taken for the time completeness of a certain task, an employee might perform at an excellent level but the department fails to meet the goals and objectives.

4.3. Possible KPIs for measuring planning department

In this section, the KPIs will be determined and explained. The literature research present the idea that the main metrics of KPIs should focus on quantity, quality, speed, and cost. Combining these metrics with the strategic objectives that Emons has for the planning department, a list of potential KPIs will be presented.

According to Piotrowicz and Cuthbertson (2015) in a paper for an exploratory study in performance metrics in the supply chain, the list of KPIs they provided accordingly with the main metrics mentioned above is stated as follows.

Quantity

1. Utilization rate
2. Overtime rate
3. Number of complaints
4. Process ratio

Quality

1. Improvement rate
2. Managerial satisfaction
3. Employee satisfaction
4. Employee turnover possibility

Speed

1. Average completion time
2. Lead times (different dimensions)

Cost

1. Administrative expenses
2. Background check expenses

Combining the above-mentioned KPIs with the strategic objectives of Emons for the planning department, some adjustments can be made which results in the final KPIs that are going to be used with explanation presented in table 3.

Utilization rate	Ratio of billable hours with total hours logged
Overtime rate	Ratio of extra hours with total hours
Number of complaints per time	Ratio of complaints with unit of time desired
Continuous improvement rate	Improvement rate for the planning department
Managerial satisfaction	At what extent the management team is satisfied
Employee satisfaction	At what extent the employee is satisfied
Resource allocation process to other process ratio	Ratio of actual planning process with all processes
Employee turnover possibility	At what extent is employee addition or replacement possible
Orders processed per time	Number of orders divided by unit of time desired
Incidents process time	Time it takes to process the incidents
Incident response time	The time difference between incident reported and the solution starting time
Average time for task completion	Time for all tasks needed divided by number of tasks
Draft planning per order on average	Number of drafts needed for an order
Administrative expenses	Total expenses for administrative costs
Background check expenses	Total expenses for checking extra processes

Table 3: List of potential KPIs

4.4. Conclusion of Chapter 4

In this chapter, the performance measurement was discussed. It was defined using literature research which contributed to the understanding of the concept via describing the purpose, need, and concept of performance measurement. Following with definitions and citations about the ways to perform a performance measurement. Key performance indicators were used for the most optimal way to measure performance. The last section was about finding potential KPIs that can be used for the planning department from the literature review combined with the strategic objectives of Emons. In the end, the list with the KPIs was presented answering the research question stated at the beginning of the chapter.

5. Solution Design

In this chapter, the solution to the problem will be made concrete starting with section 5.1 which explains the criteria that will be used for the KPIs. The criteria will be selected from a list and weighted accordingly with the strategic objectives that Emons has. Secondly, section 5.2 will show how the process of the selection of KPIs is done and the reasoning behind it, and lastly concluding the chapter with section 5.3.

5.1. KPI criteria

This section will be given an answer to the following research question:

"What criteria should be taken into account to measure performance in the planning department?"

The performance measurements are seen as a method to evaluate effectivity and efficiency of activities. These measurements are a necessity for the decision-making process and a regular evaluation of the action that corresponds with the daily activities of a department. As stated in the paper of Neely, Richards, Mills & Bourne (1997), is defined to be a group of 22 different criteria to evaluate KPIs but the main question is which of these are appropriate to be analyzed in a planning department.

1	Performance measures should be derived from strategy
2	Performance measures should be simple to understand
3	Performance measures should provide timely and accurate feedback
4	Performance measures should be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others
5	Performance measures should reflect the "business process" – i.e. both the supplier and customer should be involved in the definition of the measure
6	Performance measures should relate to specific goals (targets)
7	Performance measures should be relevant
8	Performance measures should be part of a closed management loop
9	Performance measures should be clearly defined
10	Performance measures should have visual impact
11	Performance measures should focus on improvement
12	Performance measures should be consistent (in that they maintain their significance as time goes by)
13	Performance measures should provide fast feedback
14	Performance measures should have an explicit purpose
15	Performance measures should be based on an explicitly defined formula and source of data
16	Performance measures should employ ratios rather than absolute numbers
17	Performance measures should use data which are automatically collected as part of a process whenever possible
18	Performance measures should be reported in a simple consistent format
19	Performance measures should be based on trends rather than snapshots
20	Performance measures should provide information
21	Performance measures should be precise – be exact about what is being measured
22	Performance measures should be objective – not based on opinion

Table 4: List of criteria from "Designing performance measures: a structured approach" by Neely et al., (1997)

However, these criteria consist of 22 different aspects which might not be applicable to the planning department of Emons, therefore, the final list will be decided upon interviews with the stakeholders of the company.

After the interviews with the improvement squad at Emons and the stakeholders, it was decided that the 5 criteria stated in table 4 represent at an adequate level the strategic objectives that Emons has. Next, the importance of these criteria was scaled from 1-5 with 1 being less important and 5 being the most important. Table 4 also shows the weights applied to the 5 chosen criteria.

Weight	*Criteria*
4	1. Performance measures should be derived from strategy
3	4. Performance measures should be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others
3	6. Performance measures should relate to specific goals (targets)
4	11. Performance measures should focus on improvement
5	21. Performance measures should be precise – be exact about what is being measured

Table 5: Selection of Criteria with the assigned weights

These criteria and weight will be used for the following section as input to determine the appropriate KPIs. Together with the data gathering methods the measurements of these KPIs will reflect upon the answer to the main research question.

5.2. KPI selection

This section will be given an answer to the following research question:

"Which KPIs are suitable and appropriate for the planning department?"

The appropriate KPIs will be chosen from a list mentioned in section 1.4.1. Using a scoring method, three stakeholders from the company will participate in a survey and the result of this survey will answer the research question.

5.2.1. KPI scoring

There are a lot of methods for scoring KPIs and the one that will be used in this thesis is of a form of Likert scale. A Likert scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term is often used interchangeably with rating scale (Karl L, 2005)

Figure 11: Likert scale

Scoring from 1-5 with 1 being "strongly disagree" and 5 being "strongly agree" will be used to determine if a KPI is appropriate to be used for the planning department. In the survey, the stakeholders will be presented the list of KPIs and will be asked the question of whether they agree or not that a KPI can be used for certain criteria. Each KPI will have scoring for each of the criteria and according to their weight, the value will be multiplied and showed in the end. After the discussion with the stakeholders, it was decided that a total number of 4 KPIs will be used for measurement.

5.2.2. Survey results

KPIs	Stakeholder 1	Stakeholder 2	AVG
Utilization rate	59	61	60
Average time for task competition	60	62	61
Overtime rate	55	53	54
Orders processed/time	62	61	61,5
Incidents process time	65	63	64
Draft planning/order	58	55	56,5
Employee turnover possibility	42	45	43,5
Managerial satisfaction	45	48	46,5
Employee satisfaction	41	42	41,5
Continuous improvement rate	49	53	51
Number of complaints	32	31	31,5
Incidents response time	64	60	62
Resource allocation process to other process ratio	63	62	62,5
Administrative expenses	45	48	46,5
Background check expenses	40	42	41

Table 6: KPI survey

For example, the value of Utilization rate for stakeholder 1 is calculated by multiplying the weight of the criteria with the score given from the stakeholder and then summing up all the results per KPI for that criteria. Noting that the maximum score can be achieved by 4*5+3*5+3*5+4*5+5*5=95. The KPIs with the highest result will be chosen for the next steps.

The final KPIs that will be used are:

- Orders processed/time
- Incidents process time
- Incidents response time
- Resource allocation process to other process ratio

The stakeholders decided that these KPIs are more important and adequate related to the criteria that were chosen and these measurements will mostly consist of the data coming from surveys interviews and information from the data analysis team of Emons. Furthermore, the KPIs that were selected represent at a satisfactory level the strategic objectives that Emons has when considering the planning department due to the fact that these KPIs can actually measure the performance of the department to a certain extent. The results of these measurements can give Emons a starting point when making decisions upon what to change and improve in the planning department at specific periods throughout the year.

5.3. Conclusion of Chapter 5

In this chapter, the findings from the literature are discussed with the stakeholders. The same discussion also resulted in the selection and weighting process of the criteria. The 5 chosen criteria were used to find which KPIs are suitable to be analyzed further using a survey completed by two of Emon's stakeholders. The result of that survey was the response to the research question and the final KPIs were decided.

6. Implementation

In this chapter, the process of measurement and implementation of the above selected KPIs will be performed with the purpose of answering the following research question:

"How can KPIs be measured and implemented in the planning department?"

In this section, a way of measurement will be expressed and also how the visualization of these KPIs will take place. The most commonly used way of monitoring a set of KPIs is by creating a dashboard. This dashboard consists of a set of rules, formulas, and fonts in order to be understandable by all the parties involved in the process.

Furthermore, the dashboard will be integrated within a new software that Emons is currently working on called LBase. This software has the purpose of having all the processes of all the departments but especially the planning department to be in one place with accessible data at all times. As mentioned before, the planning department operates using Spitz and Transics. The LBase will be the replacement for both of them and will perform all the functions in one place.

In section 6.1 the dashboard design will be presented following with sections 6.2 and 6.3 which will be about the KPI design and implementation. In section 6.4, a description of the possible dashboards that could be used will be given and in section 6.5 the actual dashboard will be presented.

6.1. Dashboard design

W. Eckerson describes dashboards as business intelligence (BI) reporting tools that aggregate and display critical metrics and key performance indicators (KPIs) on a single screen, enabling users to monitor and examine business performance at a glance. Dashboards extract and communicate high-level insights such as anomalies, issues, and trends for end-users of all skill levels before they choose to analyze data in more detail using advanced mechanisms like contextual analytics. (Wayne W. Eckerson, 2011).

Dashboards consist of sets of logical rules but also a variety of design tools. The rules correspond with having the data logically correct and ready to be visualized. There are some benefits of dashboards but also a couple of limitations.

Benefits of a dashboard

- Enhanced visibility
- Timesaving efficiency
- Better forecasting
- Real-time analytics
- Help in decision-making

Limitations of a dashboard

- Flashy design and extra information might cause users to lose the range of measurements and make mistakes in the analysis of the data.
- Difficult in attaching supporting data to the dashboard
- The technology used for developing dashboards might differ from what companies use as software.

6.2. KPI design

The most important aspect of designing the KPIs for the dashboard is to make the analysis and the visualization at a coherent and clear level in order to properly show the findings from the data in a correct way. To do so, an overview of the variables and how their calculations work should be explained beforehand. The variables that will be analyzed have their own way of measurement and this is expressed in the table below.

KPI	*Calculation method*	*Source of data*	*Who acts upon data?*
Orders processed/time	$\frac{Count\ of\ rows\ of\ processed\ order}{Unit\ of\ time}$	LBase database	Planning department
Incidents processed/time	$\frac{Count\ of\ rows\ of\ incidents}{Unit\ of\ time}$	LBase database	Management team
Incidents response time	$Time\ incident\ is\ updated - start\ time\ of\ process$	LBase database	Planning department
Resource allocation process to other process ratio	$\frac{Time\ of\ resource\ allocation}{All\ time\ needed\ for\ all\ processes}$	LBase, Surveys	Management team

Table 7: KPI analysis

Based on the results of those formulas, charts will be created which will make possible the evaluation of performance measurements of the planning department.

6.3. Implementation of KPIs

The implementation process for the company consists of the link between the new data system they are developing and constructing through LBase and the dashboard design which is explaoned above. The purpose of this implementation is to have in one platform the dashboard with the strategic KPIs and the database which planners use on day to day basis.

Figure 12 shows a flowchart representing how the implementation will take place. LBase will be used to continuously retrieve the desired information and will be added to the formulas in order to get the result for each KPI.

1. Orders processed/time – From the planning data in LBase, count of rows of processed orders will be retrieved and also the time of which the planners take to complete the process. According to the stakeholders, the time of analysis can be adjusted. Using these two parts of information, a chart with the result according to a desired time dimension can be created (monthly, weekly, daily)
2. Incidents process time – In the sheet of incident planning in LBase, information that will be retrieved are the time that the planners start the process and the time the incident is resolved. Same as previously, a chart can be created with order dimension or incident type dimension according to the desire of analysis.
3. Incident response time – In the Incident Planning sheet, two of the entities are IncidentUpdateTime and IncidentStartProcess which are the times when the incident is updated and when the incident started to be processed. The chart created can be combined with a dimension of time but also dimension for Incident types.

4. Resource allocation to other processes ratio – From LBase the information about the total time of operation will be retrieved and from the planners, the total time of working will be retrieved. Dividing these two numbers and combining the result with a dimension of time (monthly, weekly, daily) or process can have a positive effect on decision-making.

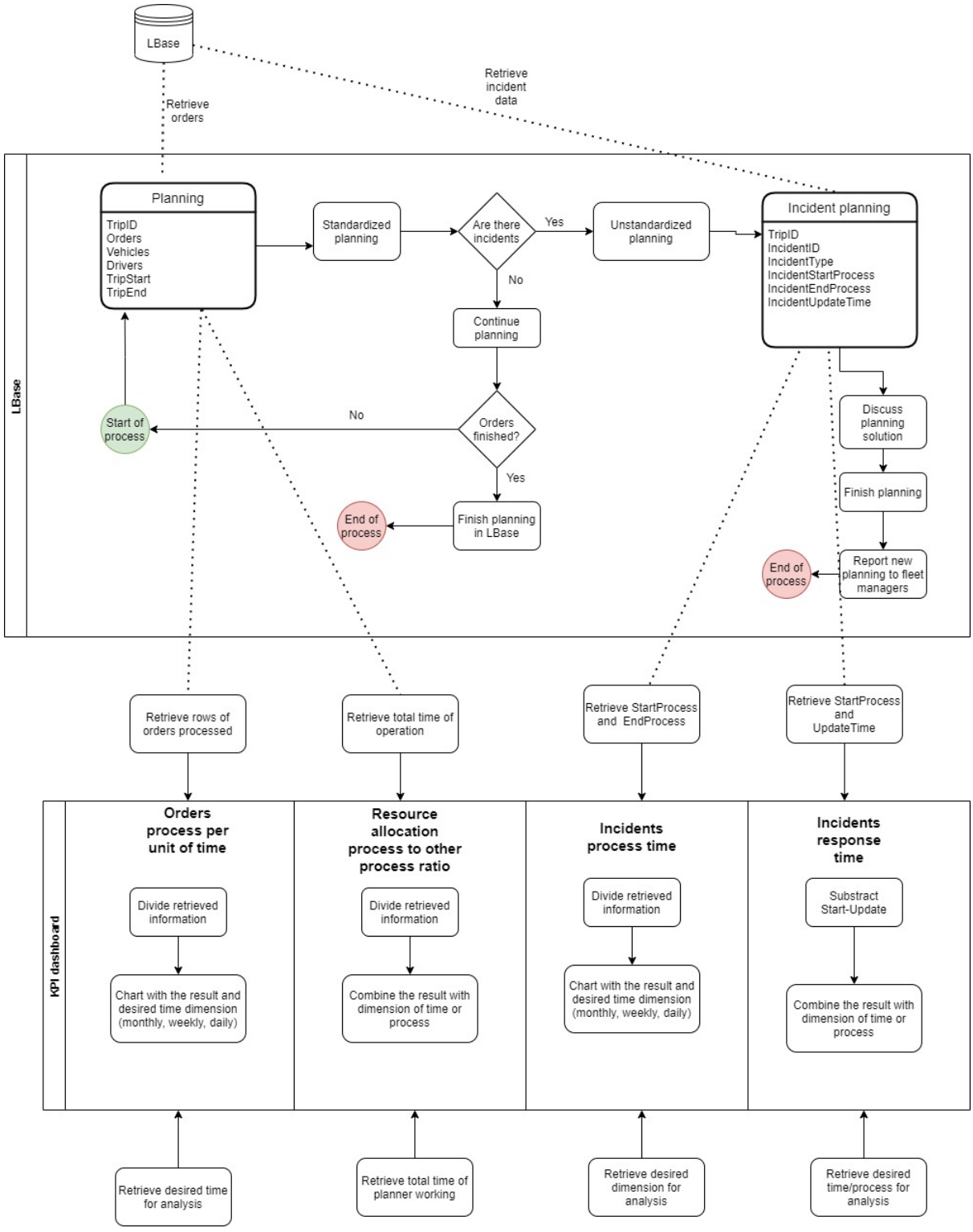

Figure 12: KPI implementation scheme

6.4. Visualization tools

The last step in the implementation process is to decide which visualization tool is Emons going to use. The most commonly used tools are PowerBI, Tableau but also online versions such as Qlick or Geckoboard.

The priority of this implementation process is to have the data easily accessible and importable to the visualization tool that is going to be used. Unfortunately, even though online dashboard creators are cheap, the adaptability of the data that Emons have is impossible. Therefore, a choice between Tableau and PowerBI should be made. The main factors that make the difference between these two tools are:

- The functionalities options
- The budget that is going to be used.

According to the information provided in Tableau.com and Microsoft.com, Tableau annual license is more expensive than PowerBI but in terms of functionalities and settings, Tableau offers more options that PowerBI. Also, the data sources for Tableau are more extensive than PowerBI so the second one might be a better option when a live data extraction is considered. But the major benefit of PowerBI that makes the difference is the integration between other Microsoft applications which Emons currently uses extensively. So according to these facts, the stakeholders of Emons will preferably use PowerBI over Tableau and integrate it within LBase database.

6.5. Dashboard with KPIs

In this section, a visualization of the dashboard will be given. For this dashboard, mock up data will be used due to the fact that at the current moment that this thesis is taking place, it was impossible for Emons to provide accurate data that could be analysed and used for the KPIs mentioned in section 6.2. Therefore, the aim of this section is to present how the data can be visualized in a simple excel dashboard and how can the results be used for the decision-making process.

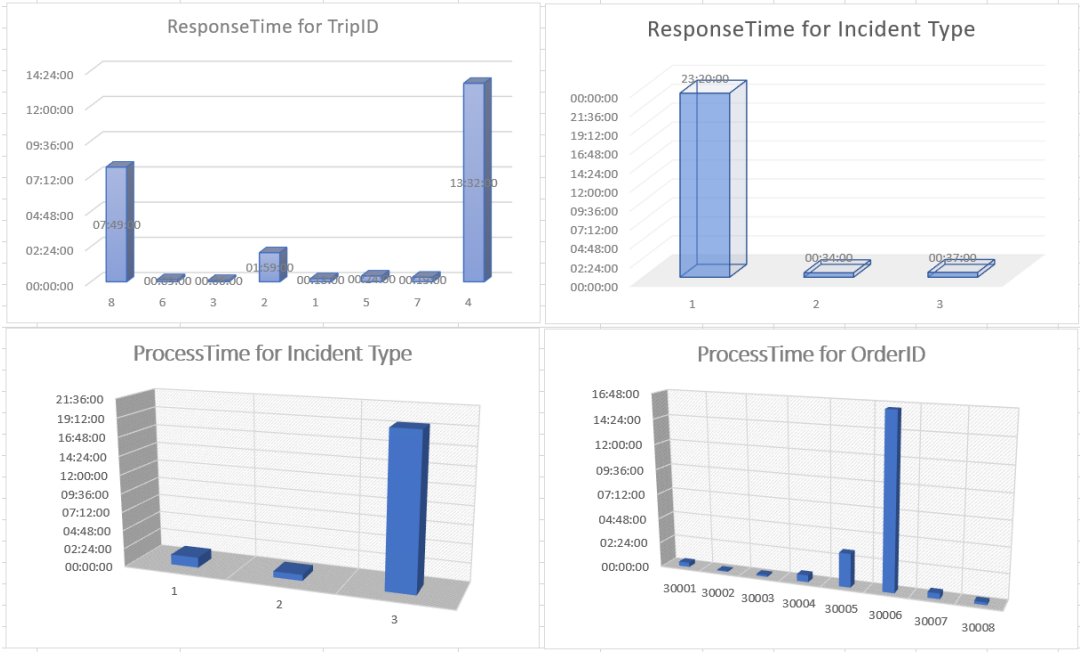

Figure 13: Incident dashboard

Process and Response time

In this dashboard, four charts with different information are given. The first and second chart represent the response time with dimension of trips or IncidentType respectively. In X-axis there is the TripID/IncidentType from the data and in the Y-axis the response time. Response time is calculated by subtracting the IncidentStartProcess with IncidentUpdateTime. IncidentStartProcess is the time that the planners start dealing with the incident and finding solutions. IncidentUpdateTime is the time that the incident is reported from the driver. From this chart we can see that the time it takes for the planners to response for an incident of type 1 is too long compared to other types of incidents. This information can provide an incentive for the planners to look more deeply into the incident type 1 and understand why it has such a high value compared to other values. The same idea also works for the chart with TripID being in X-axis. Planners can look more into depth why Trip 4 and Trip 8 have a longer response time than other Trips. (The data and calculations can be found in the Appendix)

The third and fourth chart represent the process time with Incident type and OrderID respectively. In this case, OrderID is the same as TripID but for large quantity of data, this can change. ProcessTime is calculated by subtracting IncidentEndProcess with IncidentStartProcess which are the times that planners start dealing with the problem and finding a solution respectively. Also in this case, same decision-making logic applies. Planners can look more into the fact that why Incident type 3 takes more time to be resolved than Incident type 1 and 2. Or considering the fact that why Order 30006 takes more time to be dealt with comparing to other orders.

Orders processed per time

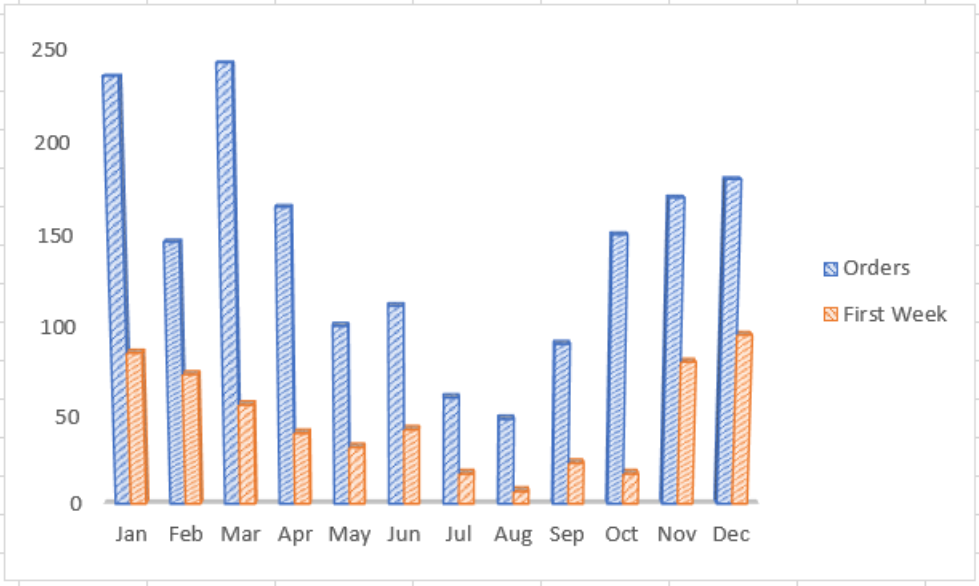

Figure 14: Orders dashboard

In this chart, the number of orders is presented analysed in the time dimension. Blue bars represents the order per month and the orange bars represent the orders in the first week of a particular month. As we can see from this data, the planning department deals with a large number of orders in Winter comparing to Summer. Even though, in March there is the largest number of orders processed in a month. Using this dashboard, the management team can raise questions like why the numbers of orders keeps raising from October to March but in

February there is a sudden drop in orders processed. Another question is why the planners process almost half of the orders in the first week in most of the months but in August and October they process less than 1/4th. More questions can rise and this chart can be used as a tool that provides a combination of information with visualization that can help the management team decide where to look into and what decisions to take to improve.

Resource allocation

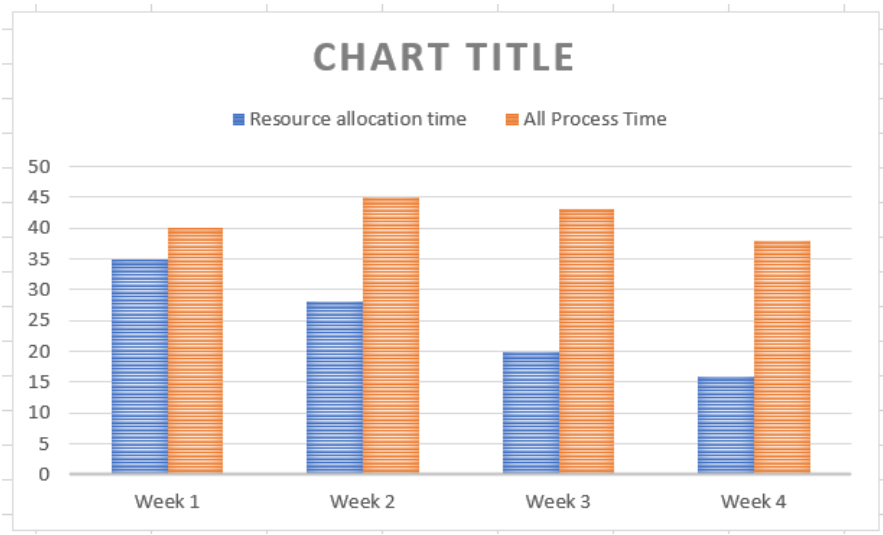

Figure 15: Resource allocation dashboard

In this chart, both resource allocation time and all process time are expressed in hours. The dimension used is "weeks of a particular month" (other dimensions can be used such as days, months, years, orders, processes). Resource allocation time value means the time in hours planners spend to allocate trucks, trailers and drivers to orders and all process time value represent the number of hours planners work per week. From the data, some conclusions can be drawn such as the ratio of resource allocation time keeps decreasing from week 1 to week 4. A reason for that might be that as time goes by, planners tend to deal with other processes that might be more important at the moment than allocating the resources. Anyway, this dashboard helps the management team to decide to look into further details for the reasons why the ratio keeps decreasing as number of weeks increases.

6.6. Conclusions of Chapter 6

In this chapter, the design of the dashboard was discussed. Following with the design of the KPIs which expressed how the calculations of the KPIs can be performed. Then, the implementation of the KPIs was explained with the main aspect being the process of analysing data real time from LBase database of planning department. Furthermore, the visualization tools that Emons can use were discussed and the one that is more beneficial to Emons is PowerBI. Lastly, a visualization with mock up data in a simple excel dashboard was presented which showed in an easy way how the charts and conclusions could look like. The aim of this chapter was to answer the research question: *"How can KPIs be measured and implemented in the planning department?"*. All the sections mentioned above contribute to providing an answer to this question with the main aspects being the visualization of the dashboard with KPIs and the implementation scheme on how the data can be retrieved.

7. Evaluation

In this chapter, a framework will be presented that can be used to evaluate the model over the long term in order to ensure sufficient results. The framework consists of a step-by-step process that will be discussed. Therefore, the aim of this chapter is to give an answer to the research question:

"***How can the model be evaluated over the long-term ensuring adequate results and contribution to the decision-making process?"***

In section 7.1 the framework will be shown and all its components will be explained. Following, section 7.2 describes the way that the evaluation will be performed from Emons with all the conceptual aspects being adjusted for the planning department and closing with section 7.3 for general conclusions.

7.1. Evaluation Framework

A framework used widely in the evaluation of a new technological tool is called "The unified theory of acceptance and use of technology (UTAUT)". This model is formulated and developed by Venkatesh et al for the purpose of determining the likelihood of success of new technological improvements such as dashboards in this case. There are 6 conceptual aspects for this model that need to be analyzed (Venkatesh, 2003).

1. **Performance expectancy** – expectation that using the dashboard will help in improving the job performance
2. **Effort expectancy –** expectation of how much effort is needed to use the dashboard
3. **Social influence –** the impact the dashboard has on the planners
4. **Facilitating conditions –** the expectation that the company has the technical, financial, and organizational infrastructure to support the usage of the dashboard
5. **Behavioral intentions –** intention to work with the dashboard and accepting it in operations
6. **Use behavior –** the way the users are going to work with the dashboard (not applicable in this dashboard case because the dashboard is only a visualization tool)

Apart from these 6 conceptual aspects, the model also consists of 4 more user aspects such as gender, age, experience, and voluntariness of use. In figure 16, the UTAUT model is given as formulated by Venkatesh.

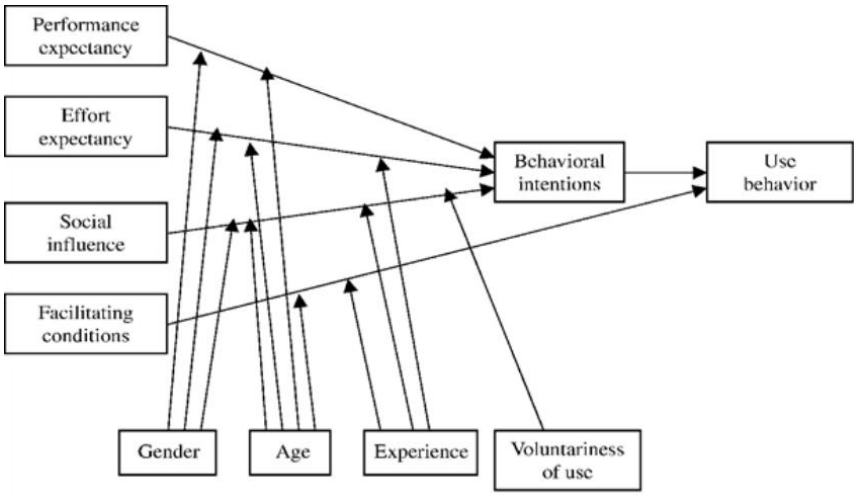

Figure 16: UTAUT model. "The unified theory of acceptance and use of technology" (Venkatesh; Viswanath; Morris; Michael G; 2003).

7.2. Performing evaluation

The evaluation of the model will consist of a workshop done by the company on a regular basis and analyze all the aspects mentioned in section 7.1. According to Emons Group, evaluation of departments and certain decisions are taken once a year or when it is needed due to circumstances so the evaluation of the model presented in this thesis will also be done once a year.

The participation in this yearly workshop will be the management team of Emons and the employees of the planning department. The management team will be responsible for the explanation of the workshop and together with the employees, an analysis of all the aspects will be taken. A Likert scale will be used with scores 1-5 with 1 being “negative feedback”. 3 being “neutral” and 5 being “positive feedback”. At the end of the workshop, the results will provide information on whether the model needs improvements or not and in which aspects. In sections 7.2.1 until 7.2.6, the conceptual aspects will be explained in more depth and adjusted to the planning department of Emons.

7.2.1. Performance expectancy

The expectation of performance is related to how well the model is performing at fulfilling its aim. The evaluation of this characteristic is necessary because it can provide whether the job performance of the employees is improved throughout the year of analysis. There are four outcomes from the evaluation of performance expectancy.

1. The model is considered to be useful for the company and it causes an improvement at the planners
2. The model is useful for the company but it does not provide any job improvement for the planners
3. The model is not very useful for the company but it does increase job performance.
4. The model is not very useful for the company and it does not provide any job improvement.

7.2.2. Effort expectancy

This section is related to how easy it is to use and operate the dashboard. Since the dashboard is the visualization of KPIs with the data drawn from the Lbase database, once it is established properly, the technological effort will not be much of a problem. Therefore, the analysis of these characteristics will consist of four criteria that can measure if the dashboard is considered effortless or not.

1. At what extent the dashboard is clear and understandable.
2. At what extent the dashboard is easy to use
3. At what extent the dashboard is easy to be learned
4. At what extent the dashboard can be adjusted

7.2.3. Social influence

This section considers the fact of whether the dashboard has a social impact on the planners as employees. A dashboard is a measurement tool that will be used by the management team of Emons to see values of measurement performance indicators of the planning department. This idea can cause a problematic situation among the planners because it can create a feeling of judgment for their work based on some indicators which might or might not measure correctly how well they are performing. The indicators do not consider outside factors other than the data that is used to calculate the values therefore, there might be situations that the

dashboard fails to be inclusive to other factors that should be considered when measuring performance such as sickness, tiredness, or even working environment.

On the other hand, the dashboard can cause motivation towards the employees due to the fact that the planners might consider the project to be an adequate one. They can use the dashboard for themselves as well and think about improvements about their work on their own without having the feeling of judgment from the management team. Anyway, the final results for these characteristics will provide Emons with information on whether the dashboard needs improvement in societal aspects or not.

7.2.4. Facilitating conditions

This section talks about the capabilities that Emons has to support the usage of the dashboard from technical, organizational, and financial aspects. The analysis will consist of the following ideas that will be discussed during the workshop

- **Organizational**
  Can the dashboard be used in other departments of Emons?
  Can it be determined correctly whether the other departments have the need for the dashboard?
  Does other departments have the appropriate knowledge of understanding and comprehending the dashboard?
- **Technical**
  Can Emons provide regular maintenance to keep using the dashboard?
  Does Emons have the resources to keep the dashboard up to date and improve data analysis when needed?
- **Financial**
  Can Emons afford the cost of using the dashboard?
  Can Emons afford the cost of improving the dashboard?

All the answers to these questions contribute to the results and the decision-making process if the dashboard fulfills the requirements for facilitating conditions for the upcoming year.

7.2.5. Behavioral intentions

This section is related to the idea of understanding the intentions to use the dashboard and accepting it in operations. The intentions can be different from a year to another and that is why the analysis upon this concept is needed because it can provide whether the dashboard is still adequate to provide the benefits for the upcoming year. The analysis of behavioral intentions consists of the following questions.

1. At what frequency is the dashboard currently used?
2. Do the strategic objectives of Emons still need the usage of the dashboard?
3. Does the dashboard influence the operational aspects of the planning department enough to use it for another year?

The responses to the questions can provide information on whether the behavioral intentions of the dashboard are still important to be considered for the upcoming year.

7.3. Conclusions of Chapter 7

The aim of this chapter was to give an answer to the research question about the way that Emons can evaluate over the long-term the model that is described in this thesis. The framework that is used is from the paper "*Unified theory of acceptance and use of technology*" which described the evaluation process according to different conceptual aspects. A workshop will take place once a year which will discuss those characteristics. Following section 7.2 these aspects were adjusted to the planning department and a thorough analysis was conducted. This chapter successfully answers the research questions about evaluation.

8. Conclusion and recommendations

This chapter concludes my thesis and will provide the research conclusion, a summarise of the main findings, and a discussion for further research. Furthermore, limitations of this study will be presented and also a contribution to the theory consisting in the generalizability of the results.

8.1. Research conclusion

This thesis was conducted with the purpose of giving an answer to the main research question. This research question arose from the planning department of Emons Group due to the lack of measurement methods for improvements. Consequently, the research question that was formulated: *"How to measure the performance of planning department at Emons Group?"*.

For this research, the MPSM was used which consisted of a step-by-step process to give a solution to the core problem. Firstly, the research questions were constructed and then analyzed in more detail in order to provide an adequate response which contributed to creating the overview that Emons needed for the planning department. To summarize, the main aspects of this thesis were to understand the environment of the planning department, researching literature to define potential criteria and KPIs, to the framework that contributed to the KPI selection, following by the implementation of the KPIs in a dashboard view and lastly, an evaluation framework which can be used every year for Emons to judge the contribution that the model gives to the planning department.

8.2. Contribution to the practice and theory

The contribution to the practice is the overview of how the step-by-step process of MPSM when combined with the appropriate literature for performance measurements can lead to a systematic approach in how to create and evaluate a dashboard model. This way, an answer can be given to different core problems that require a performance analysis using logical thinking and real-time data. This model can also provide companies with structured ideas to help them create their own dashboard models appropriately with the strategic objectives that they have. The model consists of the conceptual aspects of the process of building and the path used in this thesis can be implemented into other companies due to its generalized way of developing.

The contribution to the theory is the process of defining the nature and characteristics of the situation that needs to be modeled. The combination of the literature of measuring performance with the understanding of a planning department, which was made possible

because of the physical visits to the company, provides the process that was achieved from defining the problem to designing the solution.

8.3. Limitations of the study

The main limitation of this research thesis is that the dashboards and KPIs presented were not backed up by real data of Emons but with a mock-up dataset. This happened because the type of data that was needed was not currently collected by Emons and for them was impossible to provide a combination using the data that they have.

Another limitation of this research is that the KPIs mentioned sometimes might fail to provide an accurate measurement of the performance. KPIs that were used had simple calculations with only two variables which can be drawn from the Emons database and are not inclusive to considering situational aspects and different conditions of the planning department.

8.4. Discussion for further research

Two stakeholders of Emons were asked to fill a survey form where they would state whether they agree with a KPI regarding the criteria that were chosen. Based on their results, four KPIs were selected and eight others were left out due to having low scores or low interest for development according to the stakeholders.

One of them was the continuous improvement rate which translates to the ability of the planning department to continuously make the extra effort and deal with new situations in order to improve their processes which can be learning-wise or technology-wise. The tough aspect of this KPI is how to choose the method of measurement since the planning department is very specific and unique which makes it almost impossible to compare it with a specified norm. Having that many aspects, constraints, and restrictions about the processes that correspond within the planning department, a very structured way of measurement will need to be conducted which might lead to a future topic for another bachelor thesis.

Another interesting KPI that was found in the literature was the employee turnover possibility which measures the ability of how adaptable and convenient is the process of replacing employees or introducing new ones to the team. The measurement of this KPI has to deal with how well the working environment and the duty of a planner at Emons are explained to an upcoming employee which can be done via having an online course, physical internship, or even testing to see how well the description of a planner is explained and understood. Even though, Emons currently had no interest in this KPI due to the fact that they do not need to measure turnover possibilities in the planning department since there are very few people working there compared to other departments and the measurement at this scale is out of a bachelor student field.

8.5. Recommendations for Emons Group

The main recommendation for the planning department is to have the KPIs that were selected being measured on a routine systematic, not only when decision-making processes are needed. This way, a clear view of the increase in productivity of the employees and the efficiency overall of the planning department will be recognizable. Also, the routine measurement ensures a better understanding of the KPIs which can lead to new implementations or upgrades for the dashboard.

Another recommendation is to investigate other KPIs with the purpose of implementing them into one dashboard only for the planning department. If all the KPIs that were mentioned in section 2.2.1.2 are implemented in a dashboard, combinations between the data but also the variables can lead to new views of improvements for this department. Furthermore, having a clear understanding of the dashboard for one department can lead to ease of designing for other departments as well and to create a central place where all visualization is made. This way it can lead Emons to evolve into a full digital decision-making system.

The last recommendation would be to have a better adjustment at the data that they possess. Currently, not all the data that they have is accessible because it requires to combine and merge different data sources from different software which most of the time is a major challenge that leads to logical mistakes and huge costs for this data analysis. Hopefully, the new LBase upgrade that they are currently developing will resolve some of the data-related issues that they are facing but overall, the easier the access that the stakeholders have to the data, the better decisions are made.

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Appendix

Research Criteria

Inclusion Criteria

Number	Criteria	Reason for inclusion
1	Performance measurement	Fulzele V. states that lack of continuous assessment increase reluctance of transportation logistic companies
2	Route planning	Directly influencing planning departments in logistic companies.
3	Resource allocation	The knowledge needed to asses management efficiency of given resources in logistics.
4	Order planning	A heuristic criteria present in every decision making when planning orders.

Table 6: Inclusion criteria

Exclusion Criteria

Number	Criteria	Reason for exclusion
1	Brexit	An external problem that occurs influencing company as a whole but not particularly performance.
2	New technological adoption	Solving methods using new developed artificial intelligence but non-applicable to certain situations of transportation companies.

Table 7: Exclusion criteria

Database

The databases that were used were Scopus and FindUT. Both the databases are very professional and appropriate for systematic literatures researches. The above criteria could be backed up by information in scientific papers, articles or different journals in order to explicitly mention concrete facts and already conducted conclusions.

Both Scopus and FindUT provide a friendly user interface for non-experienced researchers and the feature to use BOOLEAN operators could easily factor out unwanted research for a more accurate information. On the other hand, Scopus did not provide all the scientific papers or articles free of charge so this made Scopus a less accessible database rather than FindUT which could be used by all the students. Even though the number of results after searching in FindUT was far less than Scopus, the information provided was quite adequate and appropriate for this thesis.

Search terms and strategy

The main search term that was used in these databases was “performance measurement using KPIs in logistics companies for order planning department”. This search term was split differently using parentheses. The first term was: “performance measurement KPIs”, the second one was: “logistic companies” and the third one was: “order planning departments”.

As these three search terms should be combined together for appropriate results containing all those information, a BOOLEAN operator “AND” was used.

Number of search results

Date of search	Search term	Scope	Number of articles
Scopus			
22/05/2021	"performance measurement KPIs" AND "logistic companies" AND "order planning department"	Keywords	27
FindUT			
22/05/2021	performance measurement KPIs AND "logistic companies" AND "order planning department"	Field	14
Total			**41**
Non-readable (payment/not available)			-18
Duplicated			-6
Excluded after abstract			-5
Total			**12**

Figure 17: Search results

Summary Matrix

Article title	Author and year	Core topic
The use of performance-based contracting in managing the outsourcing of a reliability-centered maintenance program	Ahmed, M. N. (2019)	The case analysis reveals the use of a risk–reward payment scheme and key performance indicators (KPIs) deployed to support the management of the outsourced maintenance function.
Performance evaluation of an online benchmarking tool for European freight transport chains	Dewan, Zunder, T. H., & Jorna, R. (2013)	Six Key Performance Indicators were identified: Transport cost, Transport time, Flexibility, Reliability, Quality, Sustainability. The functionality of an online transport chain benchmarking e-tool is detailed.
Performance measurement of sustainable freight transportation: a consensus model and FERA approach.	Fulzele, V., & Shankar, R. (2021)	Lack of a continuous sustainability assessment and monitoring tool increases the reluctance of freight transporters to adopt world-class sustainability practices.
Why Measure Performance? Different Purposes Require Different Measures	Robert D. Behn (2015)	The paper provides a literature review about how important the performance measurements are and the contribution to the eight managerial purposes.
Performance measurement and metrics in supply chains: an exploratory study.	Piotrowicz, W., & Cuthbertson, R. (2015)	The purpose of this paper is to explore the approaches and metrics used to measure supply chain (SC) performance, and to understand the relative perceived importance of such measures.
Agricultural Sector Performance Evaluation in Terms of Financial Indicators: A Comparison of Czech Republic, Slovakia and Western Balkan States	Jana Hornungová. (2018)	Traditional financial indicators (calculated from accounting data) are still used to evaluate performance level, what have been considered to be the most appropriate approach over a long period of time in spite of different accounting and financial indicators.

Performance measurement and management: a literature review and a research agenda	Taticchi, P., Tonelli, F., & Cagnazzo, L. (2010)	The purpose of this paper is to review the literature in the field of performance measurement and management (PMM) for small and medium enterprises (SMEs) and large companies and propose a research agenda for the future.
A comprehensive KPI network for the performance measurement and management in global production networks.	Verhaelen, B., Mayer, F., Peukert, S., & Lanza, G. (2021)	The trend of globalization has led to a structural change in the sales and procurement markets of manufacturing companies in recent decades. In order not to be left behind by this change, companies have internationalized their production structures.
Solving Order Planning Problem Using a Heuristic Approach	Wang, C. N., Nguyen, N. A. T., & Dang, T. T. (2020)	For building material distributors, order planning is a key process as a result of the increase in construction projects' scale and complexity.
Designing performance measures: a structured approach	Neely et al. (1997)	Describes the development and testing of a framework which can assist in the process of designing performance measures. Grounds the framework in the relevant literature and explains how it was developed and tested through a series of action research projects
Performance measurement in business process outsourcing decisions.	Weimer, G., & Seuring, S. (2009)	The purpose of this paper is to present four outsourcing contracts and conducts a detailed analysis of their performance measurement systems.

Table 8: Conceptual matrix

KPI Interview form

KPI selection survey

Your name: ……

Criteria that were chosen:

1. Performance measures should be derived from strategy
2. Performance measures should be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others
3. Performance measures should relate to specific goals (targets)
4. Performance measures should focus on improvement
5. Performance measures should be precise – be exact about what is being measured

KPI	CRITERIA 1	CRITERIA 2	CRITERIA 3	CRITERIA 4	CRITERIA 5
1. UTILIZATION RATE					
2. AVERAGE TIME FOR TASK COMPETITION					
3. OVERTIME RATE					
4. ORDERS PROCESSED/TIME					
5. INCIDENTS PROCESS TIME					
6. DRAFT PLANNING/ORDER					
7. EMPLOYEE TURNOVER POSSIBILITY					
8. MANAGERIAL SATISFACTION					
9. CONTINUOUS IMPROVEMENT RATE					
10. NUMBER OF COMPLAINTS					
11. INCIDENTS RESPONSE TIME					
12. RESOURCE ALLOCATION PROCESS TO OTHER PROCESS RATIO					
13. ADMINISTRATIVE EXPENSES					
14. BACKGROUND CHECK EXPENSES					
15. EMPLOYEE SATISFACTION					

The reason of this survey is the selection process of KPIs that I will need to measure for my thesis. Above there is a list of KPIs I came up from literature research about what KPIs are used in different departments in a company in order to measure and evaluate.

Based on the criteria mentioned above, I would like you as a stakeholder of Emons to evaluate at what extent do you agree or disagree that the KPI is appropriate to be measured according to the criteria. The scale will be from 1 – “strongly disagree” to 5 – “strongly agree”. If you have a question regarding this survey with the KPIs or criteria, please let me know.

Data for the dashboard

TripID	IncidentID	IncidentType	IncidentUpdateTime	IncidentStartProcess	IncidentEndProcess	ProcessTime	ResponseTime			Weeks	Resource a	All Process Time
8	30001	1	17/03/2021 22:11	18/03/2021 06:00	18/03/2021 06:25	00:25:00	07:49:00			Week 1	35	40
6	30002	2	15/03/2021 10:21	15/03/2021 10:30	15/03/2021 10:35	00:05:00	00:09:00			Week 2	28	45
3	30003	2	12/03/2021 14:34	12/03/2021 14:40	12/03/2021 14:50	00:10:00	00:06:00			Week 3	20	43
2	30004	1	10/03/2021 07:21	10/03/2021 09:20	10/03/2021 10:00	00:40:00	01:59:00			Week 4	16	38
1	30005	3	10/03/2021 06:57	10/03/2021 07:10	10/03/2021 10:23	03:13:00	00:13:00					
5	30006	3	14/03/2021 14:21	14/03/2021 14:45	15/03/2021 07:11	16:26:00	00:24:00					
7	30007	2	16/03/2021 15:30	16/03/2021 15:49	16/03/2021 16:21	00:32:00	00:19:00					
4	30008	1	12/03/2021 16:28	13/03/2021 06:00	13/03/2021 06:15	00:15:00	13:32:00					

IncidentType	ResponseTime	ProcessTime
1	23:20:00	01:20:00
2	00:34:00	00:47:00
3	00:37:00	19:39:00

TripID	OrderID	VehicleID	DriverID	TripStart	TripEnd		Month	Orders	First Week
1	10001	NL80BA	20001	10/03/2021 06:13	10/03/2021 13:45	AvG	Jan	235	85
2	10002	NL74CD	20002	10/03/2021 07:21	11/03/2021 11:45		Feb	146	73
3	10003	NL25DU	20003	12/03/2021 08:20	13/03/2021 06:30		Mar	242	56
4	10004	NL34KL	20004	12/03/2021 11:25	14/03/2021 13:45		Apr	165	40
5	10005	NL76IU	20005	14/03/2021 12:30	15/03/2021 18:55		May	100	32
6	10006	NL80BD	20006	15/03/2021 07:21	16/03/2021 22:30		Jun	111	42
7	10007	NL74CU	20007	16/03/2021 08:33	17/03/2021 23:11		Jul	60	17
8	10008	NL25DP	20008	17/03/2021 09:23	18/03/2021 05:10		Aug	48	7
9	10009	NL34KX	20009	18/03/2021 10:11	19/03/2021 00:32		Sep	90	23
10	10010	NL76OO	20010	19/03/2021 06:13	20/03/2021 15:45		Oct	150	17
11	10011	NL80BH	20011	20/03/2021 07:11	21/03/2021 21:25		Nov	170	80
12	10012	NL25VC	20012	21/03/2021 11:24	22/03/2021 00:34		Dec	180	95

Figure 18: Data used for dashboard