BACHELOR THESIS

Creating a portfolio of the applications at Traffic Today

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Preface

This research is conducted at the online marketing agency Traffic Today, as the final assignment before obtaining the Bachelor's degree in Industrial Engineering and Management at the University of Twente.

Firstly, I would like to thank Traffic Today for the opportunity to graduate at their company. The company and its employees welcomed me with warm hospitality and made me feel a part of the company as well for half a year. A special thank you to Dominique Bouwmeester, who provided me with all the resources, support, and answers to my questions during the research.

Secondly, I would like to thank my supervisor Abhishta for his guidance and time during the recurrent meetings of the research. I would like to thank my second supervisor W. J. A. van Heeswijk as well, for his clear feedback at the end of the research.

Lastly, I want to show gratitude to my family and friends who supported me during my whole Bachelor and research.

Hopefully, you enjoy reading my Bachelor thesis.

Meike Kruger

Enschede, July 2021

Management Summary

This research is executed at Traffic Today, which is an online marketing agency, with its headquarters in Deventer. It is a start-up company that started ago with five employees and has already grown to a company with 47 employees and counting. In this research, the eight main applications that are used internally will be examined and mapped into a clear overview.

Since the company is growing fast, more applications are being used, which is resulting in a lacking overview of applications. Therefore, Traffic Today wants to create a portfolio of applications to make their company more efficient. An application portfolio provides a consolidated view of the applications including their functional and financial aspects. The research question of this research is, therefore: *'How to create a portfolio of the applications at Traffic Today and how to operationalize this portfolio?'*

This research starts with a systematic literature review to search for previous scientific research that is already been executed on this subject, followed by literature studies to gain more knowledge on Application Portfolio Management (APM) and on how to execute and analyze a good survey, since a survey is held to get an overview of the current situation. With APM the applications of Traffic Today will be evaluated to show how these applications can contribute to achieving business goals. The second step is to get a clear insight into which applications are used and who owns the applications. Thirdly, the current situation is mapped into an application portfolio. In the fourth step, the artefact is created, which is in this research the dashboard with Key Performance Indicators (KPIs). In the dashboard, it will become clear how the applications are functioning according to the KPIs. After creating the dashboard, the application portfolio is rationalized and improvements are researched. At last, the validity of the dashboard is shown and an advice is created.

Mapping the business process model of a new client shows that to finish a process a lot of different steps in different applications need to be executed. This is taking up a lot of time and a smarter way of working should be researched. From the survey, it becomes clear that all the functions of the applications are needed, but that the application itself should be replaced or more interfaces have to be created.

There are six KPIs shown in the dashboard, which all give information about the functioning of the applications. The dashboard exists out of the main dashboard and an explanatory dashboard if the company wants more information on a certain category.

To optimize the current application portfolio, it is recommended to replace four of the current applications: Teamleader, the website, Google Spreadsheet, and Moneybird. To find a good replacement for the applications, an analysis should be made with multiple trade-in options. To create extra interfaces, three options are stated. The first option is to use an already existing automation program. Secondly, Traffic Today could choose to workflow program the interfaces themselves. At last, they could look for overarching applications that contain multiple functions.

The main advice for Traffic Today is that they should keep investing time in optimizing the application portfolio since application rationalization is an ongoing process and technology is keep moving fast.

Contents

Chapter 1 Introduction

This introduction is written to explain the basis for this research and will include the research methodology behind this research. The subject of this research is to optimize the applications within Traffic Today by creating a portfolio of the intern-used applications.

This subject is being researched since I have a high interest in the management of efficiency at a company. A lot of companies are not working in their most efficient way, which is a shame since a lot of companies have a high potential to grow and become more efficient. Therefore, I wanted to conduct research that will show a more efficient way of working, if possible. Besides that, the research is going to be held at an online marketing company instead of a very high focused IT company. This is done because I want to show that the field of Industrial Engineering and Management (IEM), can be applied to all kinds of companies instead of high-tech companies only.

1.1 Traffic Today

This research is originated from an assignment of the company Traffic Today (Traffic Today, 2021). The company Traffic Today is a marketing agency, with its headquarters in Deventer. The company is a fast-growing marketing business that started three years ago. They are focusing on the higher segment of the online marketing market. It started with five employees and is now already at 47 employees and is still growing every month. This shows how fast the company is expanding. Since the research is originated from the company, Traffic Today is the main stakeholder. The individual employees working at Traffic Today and the application companies will be affected by this research and are therefore stakeholders as well.

When working with five people, a consultation could be easily done but working with more than 40 people, everyone does their part and is keeping track of their progress within the applications. This is resulting in a lot of applications from which different departments are working. Traffic Today wants to create a portfolio of applications, to make their company more efficient. In this portfolio, the internally used applications are stated with their functional and financial features.

The current situation consists out of a lacking overview of applications, which is having the consequences of a lot of time spent in the applications and a high data-entry error (Ghosh, 2015). This has as a cause that the profit will reduce and that the labour costs will increase. Therefore, the goal of this research is to come up with an advice on where the recommendations and how to implement these are stated. This goal has to be reached within ten weeks.

1.2 Defining the problem

The problem owner within this research is the marketing company Traffic Today. This research contains an action problem since there is a problem that is destitute of a solution. Along the way, there will be knowledge problems popping up as well, since a lot of information has to be gathered to solve the action problem (Heerkens & Winden, 2017).

1.2.1 Identification of action problem

When searching for an action problem within the company Traffic Today, I have researched the current situation of the company (reality) and what Traffic Today wants their situation (norm) to be.

To find the core problem out of the problem context, an inventory list is made to give an overview of all the existing problems in the current environment of Traffic Today:

- *There are many applications from which is worked from (Variable: number of applications)*
- *The possibility of data entry errors is high when processing data (Variable: margin of error)*
- *A lot of time is spent on processing data (Variable: time)*
- *Lacking portfolio of the current internal applications (Variable: portfolio)*

All these problems are implying the same, which is leading to the action problem: 'There is an inefficient way of working with the intern applications'.

1.2.2 Problem cluster and the core problem

From the inventory list, it becomes clear that almost all the problems can be related to each other. There is a lacking portfolio of the internal applications which is caused by the high number of applications to work from. Since there are a lot of applications to work from, it is taking up a lot of time to process different types of data. This extra time-consuming will cause high labour costs.

The high amount of time spent on processing the data into different applications originated from the lacking overview will result in a high margin of data-entry error. This will lead to a lower satisfaction of customers which in the worst-case scenario will lead to losing customers. Eventually, is this affecting the profit, which will decrease. All these relationships, causes, and effects are exhibited in the problem cluster below. From the problem cluster, the core problem emerges: '*There is a lack of overview of the intern applications.*'. A portfolio will give more clarity of the importance of each application and whether to maintain the applications or to replace or retire them (McKeen & Smith, 2010).

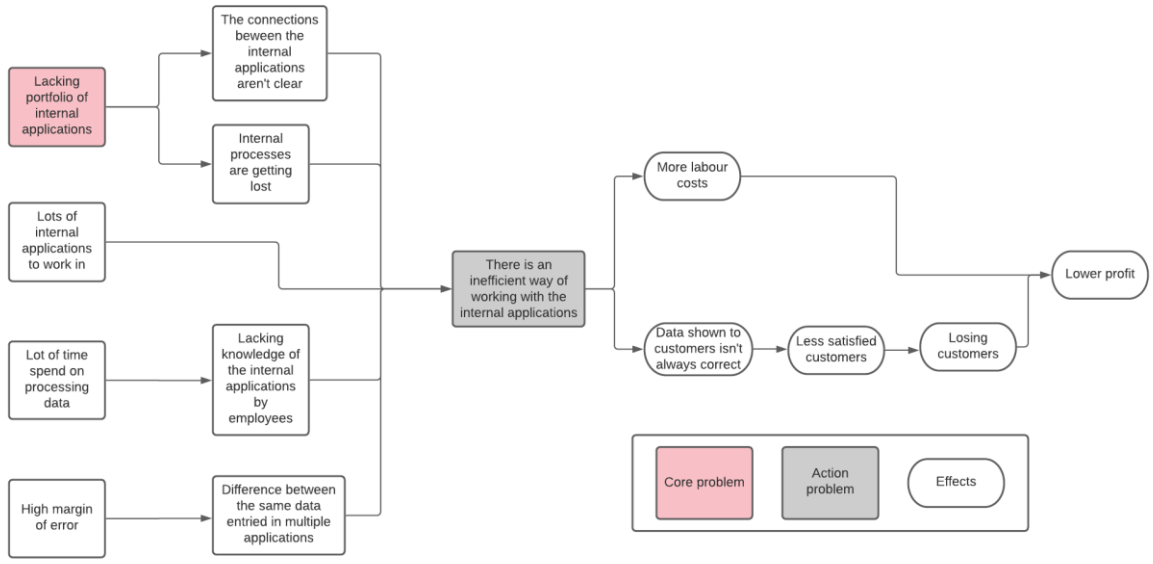

Figure 1: The problem cluster which is displaying the core problem, action problem, and the belonging effects.

1.2.3 Measurement of norm and reality

The core problem that is established now, should be made more concrete and clearer with a norm and reality both in there. The norm and reality will be represented by the same variable and to designate this, a variable needs to be designed that can present both the norm and reality. For this problem, there are multiple variables in which the norm and reality can be represented: the number of applications, a margin of data-entry error, the amount of time spent, and the portfolio. Since the portfolio is connected to the number of applications that affect the margin of data-entry error and the amount of time spent, 'portfolio' will be the variable to express the norm and reality in. The remaining variables are used as indicators, to make the problem quantifiable. The indicators for the variable portfolio are the following:

- *Number of internal applications*
- *Time spent*
- *The margin of data-entry error*

The norm is a lacking portfolio which generates a high amount of time spent and a high margin of data-entry error. The reality should be a clear portfolio which will cause a lower time spent and a lower margin of data-entry error.

1.2.4 The research question

The research question of this research will help to solve the action problem that is stated before. The research question of this research is:

'How to create a portfolio of the applications at Traffic Today and how to operationalize this portfolio?'

To create a portfolio, Application Portfolio Management (APM) is used. "APM is the ongoing management process of categorization, assessment, and rationalization of the IT application portfolio." (McKeen & Smith, 2010, p. 158)

The goal of this research is SMART defined (Aghera, et al., 2018). The goal is made specific by analyzing the problem cluster and by creating a list of deliverables. It is made realistic to achieve within ten weeks since that is the duration of the research. Furthermore, the goal is measurable by measuring the results that the portfolio created with a dashboard will cause. These results are measured by measuring the indicators of the main variable before and after conducting the research.

1.3 Formulating the approach

To start working on the core problem, a problem-solving approach is made. In here the plan of attack is made to make sure that every aspect is being taken with and analyzed. Before making the plan of approach, there is first investigated in what we already know and which means there are at my disposal.

The main cause of the core problem is that there is no portfolio of the internal applications used, which is leading to a lot of time spent working in them and a high margin of data-entry error. The solution is depending on these causes since both have to be decreased to solve the core problem.

The main stakeholder that is going to be involved in this research is the company Traffic Today itself. The University of Twente is going to be involved as well since the assignment will lead to my graduating of the Bachelor of Industrial Engineering & Management.

Before starting the next phase, I have looked at which means I already have at my disposal. The company has some workflows of certain applications already, which I can use in my analysis. I also have access to the company's applications itself and I have an account for the main files of the company. Furthermore, I have a workspace at the company at which I will be working from two days a week and if COVID-19 will reduce, I will work there more often.

1.3.1 The 3D's

To start making the plan of attack, 3D's are used. This stands for Do, Discover, and Decide (Heerkens & Winden, 2017, pp. 53-59).

Do encompass everything that needs to be done during the bachelor assignment. To give a clear overview of all the to-do's during the bachelor thesis, a detailed time plan is made and shown in Appendix A.1.

Discover is about the knowledge that you have to acquire to find a solution for the action problem. Therefore, some knowledge questions are created, which will give the knowledge to help solve the action problem in the end. During the research, new knowledge questions could come up. When this is happening, I will go to the research cycle to gain the knowledge to answer the specific knowledge question. The following knowledge questions have to be solved during the research:

1. *How to use Application Portfolio Management (APM) to create a portfolio of the applications?*
2. *How to create a good survey and how to analyze the results of a survey that will take into account the points of view of the employees regarding the current situation?*
3. *How does the current application portfolio look like?'*
4. *How to create a dashboard that will show the functioning of the internal applications?*
    - *How does a good dashboard look like?*
    - *How can the dashboard help with optimizing the application portfolio?*
    - *Which KPIs will be shown in the dashboard?*
    - *How to visualize the KPIs in the dashboard?*
5. *How to operationalize the application portfolio in order to create an optimal portfolio?*
    - *What can be improved from the current situation?*
    - *How can this be implemented?*
6. *How can the dashboard be used in the company?*
    - *How to make the dashboard valid for the company?*

Decided is that I am only going to be focusing on the main intern applications to improve. This is to reduce the workload since all the intern and extern applications are too much to look into when working with a time limit of ten weeks. The intern process is chosen above the extern process since the intern process has to be clear to work it through in the extern process.
The main applications that will be focussed on in this research are as follows:

- *Asana*
- *Slack*
- *Everhour*
- *Google drive*
- *Google spreadsheet*
- *Teamleader*
- *Website Traffic Today*
- *Moneybird*

1.3.2 Systematic approach

The problem is solved by executing the Design Science Research Process (DSRP) approach. The DSRP is used since a dashboard should be created with a portfolio of the intern-used applications and the Key Performance Indicators (KPIs). The DSRP is a methodology system that offers a guideline for designing an artefact during research, which is in this case a dashboard. It consists out of six phases and if all the phases are conducted during this research, the research question is answered.

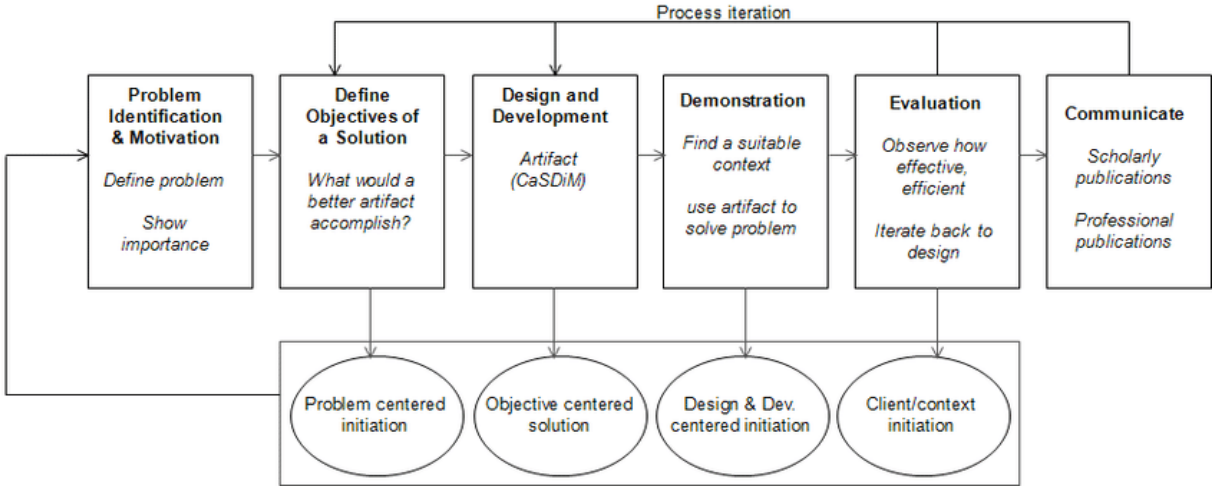

Figure 2: Design Science Research Cycle

The first phase of the research is to define the problem and the motivation of this research. This is defined in Chapter 1 and includes the methodology and the identification of the problem with a problem cluster. The second step that is carried out in this first phase is to execute a Systematic Literature Review (SLR), to search for already executed scientific research on the subject.

In the second phase 'Define objectives of a solution', literature studies are executed, to gain more knowledge on APM. APM is used to approach the problem and to answer the research question. The second step is to get a clear insight into which applications are the most important. A survey will be held with the management team of the company. Within this survey, all the different aspects of the company are represented, such as the Human Resource manager and the director. In this manner, it becomes clear how the employees look at the current situation. The third step in this phase is that I will describe the current situation: 'How does the current application portfolio look like?', 'What different categories are there?', 'How does a process look like within the company?'. This will result in an organizational model of the company with applications and will give an overview of the process in the current situation.

Now, the third phase of the DSRP is entered: develop and development. In this phase, the results of the research will be stated. The results of the survey will be specified and analyzed. Furthermore, a dashboard will be created with KPIs. Therefore, literature studies will be

executed to gain knowledge on how to create KPIs and a fitted dashboard. After the literature studies, the KPIs can be created and measured. With the KPIs, the dashboard can be made, which will give an overview of the current situation of the applications regarding the KPIs. Here knowledge question four is answered.

Now, phase four of the DSRP 'Demonstration', can be entered. Here the application portfolio will be rationalized by searching for improvements within the current portfolio and how these improvements can be implemented. This will answer question five of the knowledge questions.

At last, phase five of the DSRP is entered, which is the evaluation phase. Here, the results will be written down in the report and some recommendations are made for the company. A description of how the dashboard functions will be stated here as well, to make the dashboard valid for the company after this research as well.

1.3.3 Deliverables

The main deliverable of this research is the report itself. This report can be divided into several deliverables. The analysis of the applications, including a portfolio of the applications and a dashboard with KPIs are the main two deliverables. Added to this analysis, the survey that is going to be held within the management team will be the third deliverable. This makes the basis of the thesis and from here solutions could be formed.

The fourth deliverable is resulting from this basis: the solutions including the final chosen solution. After the final solution choice is made, an advice will be formed in which will be stated what the recommendations are and the intended improvements that are coming with. This advice will be the fifth deliverable and will consist out of an implementation plan, to make it a smooth transition if the company decides to execute the advice.

1.4 Concluding research methodology

The goal of this research is to create an application portfolio and to operationalize this portfolio. In order to solve this problem, a problem-solving approach is formed, which is based on the DSRP approach. There is first looked at what has to be done during this research, followed by what knowledge has to be discovered. Lastly, there is decided to focus on only eight applications, since the time limit of this research is ten weeks. The final deliverables of this research are the report, including the recommendations and advice for Traffic Today, and the artefact of this research, which is a dashboard created with KPIs.

Chapter 2 Literature Review

The goal of this research is to come up with an advice and to create a dashboard that will help the company Traffic Today to transfer into a more efficient environment. Before starting the problem-solving approach, I've searched if there is already held research on the subject of optimization applications and creating an application portfolio. This research is executed by conducting a systematic literature review (SLR). In order to execute the SLR properly, the following steps are executed (Noort, SLR Assignment, 2021):

1. *Definition of the research question*
2. *Defining inclusion and exclusion criteria*
3. *Defining which databases to use*
4. *Describing the search terms and the belonging strategy*
5. *Listing the numbers of searches found*
6. *Create a conceptual matrix of the articles found*
7. *State the key findings of the articles*

2.1 The research question

The research question of this research is defined as:

'How to create a portfolio of the applications at Traffic Today and how to operationalize this portfolio?'

Since this research is focussing on a specific company, there is no existing research available that is researching this subject for Traffic Today. However, creating a portfolio of applications and operationalization of application portfolios has been done before. Therefore, the research question for this SLR is as follows: 'How to create an application portfolio and how to operationalize this portfolio?'.

2.2 Inclusion and exclusion criteria

In order to answer the created research question, inclusion and exclusion criteria have to be defined to limit the number of hits in the databases. When inclusion and exclusion criteria are defined, the search for articles will be more specific and the articles will be more relevant to the research question. The inclusion and exclusion criteria are stated in Table 1.

Criteria	Defined
Inclusion	Application portfolio, Application Portfolio Management (APM), Application Rationalization (APR), Application Landscape, Outcome of the paper (The paper should be relevant to this research), Research design of the paper (Should be similar to this research in order to use), Scientific articles
Exclusion	Language (Dutch and English are the only languages that can be understood), Date (the research shouldn't be outdated, so at least 2010), Studies (Business studies and IT studies are relevant to this subject)

Table 1: Inclusion and exclusion criteria that will limit the number of hits in the databases.

2.3 Databases

Step three of the SLR is to define the databases to use. The number of databases that I will search is between two and four to let the articles not originated from only one database (Vimeo, Choosing the right databases, 2021). A database should be relevant for the research, match the information needed, and should add something unique.

Search engines will give millions of results consisting out of news articles, school reports, scientific articles, and more. Therefore search engines will not be used during this research, since their scope is too big and is showing non-relevant articles as well. For this research, there is chosen to use domain-specific databases and multidisciplinary databases, since both databases are consisting out of scientific articles that can be filtered so that only the relevant articles can be shown. As a domain-specific database, there is chosen to use IEEE Xplore. The University of Twente provides access to this database, which makes this database easier to use. A multidisciplinary database that is going to be used during this SLR, is Scopus. Scopus is proved as well by the University of Twente and is simple to use.

2.4 Search terms and strategy

Now that the inclusion and exclusion criteria are created and the databases are chosen, the search terms can be defined. This will be defined according to the context, intervention, mechanism, and outcome strategy (CIMO) since this is a specific qualitative research (Noort, SLR Assignment, 2021). The strategy with the related search terms is stated in Table 2.

CIMO	Constructs	Related terms	Broader terms	Narrower terms
Context	Company	Business		Online marketing, Marketing
Intervention	Applications	Application Landscape	Software	Application portfolio
Mechanism	Application Portfolio, Application rationalization	Application portfolio management (APM), Application rationalization (APR)	Application optimalisation, Application overview	
Outcomes	Overview of applications	Application portfolio	Mapping applications	Dashboard, KPIs

Table 2: Search terms based on the CIMO strategy. These search terms will be combined and entered into different databases to find scientific articles about already executed research on this subject.

2.5 Searching articles

Now that the search terms, including and excluding criteria and databases are defined, the databases can be entered to search for relevant articles. Firstly, the database IEEE Xplore is searched and secondly, the database Scopus will be entered. After entering the search terms, filters can be added to exclude the excluding criteria and duplicates will be removed. The remaining articles will be scanned and non-related articles will be deleted. The remaining articles will be reviewed. This process is shown in the table below.

Search Date	Search terms	Filters	Hits
5-7-2021	(“Applications’’) AND (“Application portfolio” OR ‘Application Rationalization” OR “Overview applications”)	2010>	11.497
5-7-2021	(“Application Landscape”) AND (“Application Portfolio Management” OR “Application Portfolio”)	2010>	7
5-7-2021	(“Application portfolio” AND “Dashboard OR “KPI”)	2010>	1.434
	Total in IEEE Xplore		**12.938**
	Include only journals		-11.198
	Limit topics	Optimalization	-1670
	Removed after scanning		-61
	Total selected for review IEEE Xplore		**9**
5-7-2021	(“Applications’’) AND (“Application portfolio” OR ‘Application Rationalization” OR “Overview applications”)	• 2010> • *Study:* Engineering, Computer Science • English	60.752
5-7-2021	(“Application Landscape”) AND (“Application Portfolio Management” OR “Application Portfolio”)	• 2010>	19
5-7-2021	(“Application portfolio” AND “Dashboard” OR “KPI”)	• 2010>	10
	Total in Scopus		**60.781**
	Limit document type	Journal, Report, Article	-44.247
	Limit keyword	Optimization	-16.138
	Limit to title	Artificial Intelligence Review, IEEE Access, Computers, and Chemical Engineering, European Journal of Operational Research	-351
	Removed after scanning		-36
	Total selected for review Scopus		**9**
	Deleting duplications IEEE Xplore and Scopus		-1
	Total selected for review		**18**
	Removed after reading		-15
	Total useful articles		**3**

Table 3: Articles that need to be reviewed. After entering the search terms, the number of hits will be limited using exclusion criteria. Afterward, articles are selected for review and finally, the number of useful articles is stated.

2.6 Conceptual matrix

As shown in Table 3, three articles remained left from the SLR. These three articles are read and the key findings are represented in a conceptual matrix. This conceptual matrix states for each

article the title, core topics, and key findings. In the last phase, the correlation between the articles and this research will be explained.

Title	Core topics	Key findings
Application Portfolio Management – an integrated framework and a software tool evaluation approach **(Simon, Fischbach, & Schoder, 2010)**	Application Portfolio Management, framework, evaluation	This article provides a framework for Application Portfolio Management. To execute APM, the following steps need to be executed: *1. Collect data 2. Analyze the data 3. Decision-making 4. Optimization.* An APM software tool evaluation approach is introduced, to make the decision process easier.
Reducing IT costs and ensuring safe operation with application of the portfolio management **(Kovácsné, 2017)**	Application Portfolio Management, IT service management, cost-benefit analysis, risk analysis.	This article states why APM is important nowadays and is linking IT management to APM and costs benefit. Furthermore, does this article state case studies which are proving that APM is useful for different companies. At last, does this research mention the risk involved with APM.
Key Performance Indicators for a Capability-Based Application Portfolio Management **(Khosrahahi, Matthes, Beese, Winter, & Yilmaz, 2017)**	Key Performance Indicator, Application Portfolio Management	This research shows useable KPIs for application portfolio management. The research divides the KPIs into three categories: Complexity, Quality, and Impact. Furthermore, does it show how these KPIs can be used to measure the functionality of applications.

Table 4: Conceptual matrix of the articles found useful after reading. This conceptual matrix includes the key findings of the articles that could be useful for this research.

2.7 Key findings

The last step of the SLR is to relate the articles to this research. The goal of this research is to create an overview of the application of Traffic Today. This is done by executing APM and APR.

The steps stated in the article 'Application Portfolio Management – an integrated framework and a software tool evaluation approach', will be used in this research to execute APM. The first step that is taken in this research is the data collection step. 'In here the current situation of the application portfolio is captured.' (Simon, Fischbach, & Schoder, 2010) In this step, it will become clear which applications Traffic Today is using and what the characteristics and key attributes of these applications are. Once this step is completed, the second step is entered, which is analysis. The information of the portfolio will be analyzed through the dimensions of the KPIs. This second step is followed by the decision-making step. Here the current portfolio will be rationalized into a more optimal portfolio. This third step is based on a detailed application analysis and will involve decisions of replacing certain applications. The last step is optimization. Here the results of the decision-making step will be put into action (Simon, Fischbach, & Schoder, 2010). In this research, the improvements are not implemented, since the

time limit of ten weeks. Therefore will this step only contain an advice for Traffic Today in which the results of the decision-making will be stated and how to implement these.

In the article 'Reducing IT costs and ensuring safe operation with application of the portfolio management' the reasons why APM is important nowadays are stated. One of the main reasons that makes APM important, is that the legacy applications can be reduced when using APM (Kovácsné, 2017). Reducing these legacy applications will reduce the related IT costs as well and makes it possible to focus on improving other critical points of a company. This information will be used during the design and development phase, where the theory for this research is described. The application portfolio risks mentioned in this article are important to take into consideration during this research as well. The first risk is operational risks. 'This risk considers the impact of application failure on business.' (Kovácsné, 2017) Categorizing the applications will help reduce this risk. The second risk is the risk of failure. An application portfolio that can show how applications should be controlled can help to reduce the risk of failures. The third risk mentioned in this research is system complexity. Here it is necessary to be transparent about the risks belonging to the applications, such as security regulations and requirements of the applications themselves. The last risk is application support risk. These risks are those that will originate from updates of already existing applications (Kovácsné, 2017). All these risks should be taken into account while executing this research.

The last article is 'Key Performance Indicators for a Capability-Based Application Portfolio Management', which is representing KPIs that can be included in the dashboard. The research divides the KPIs for APM into three categories: complexity, quality, and impact (Khosrahahi, Matthes, Beese, Winter, & Yilmaz, 2017). Furthermore, does this research state that KPIs should be frequently measured, clear, have a significant impact and encourage appropriate action (Khosrahahi, Matthes, Beese, Winter, & Yilmaz, 2017). This information can be used when creating the artefact and will therefore be used in the Design and Development phase of the DSRP.

Chapter 3 Design and Development

In this chapter, the design and development phase of the research will be elaborated. During this phase the following knowledge questions are answered:

1. *How to use Application Portfolio Management (APM) to create a portfolio of the applications?*
2. *How to create a good survey and how to analyze the results of a survey that will take into account the points of view of the employees regarding the current situation?*
3. *How does the current application portfolio look like?*
    - *How to create an application portfolio?*

First of all, the research design will be created for this research. In the research design, the method of collecting data will become clear.

Secondly, literature studies are executed to acquire knowledge about APM and how to create a good survey. After executing these, more information is gathered and the research can proceed. With the gained knowledge of the literature studies, APM will be carried out with the applications of Traffic Today. Here the third knowledge question will be answered as well and a portfolio will be created. This will give an overview of the current situation.

At last, a survey will be made and held. With this survey, the view of the employees at the current situation will be taken into account. The results of the survey will be stated in the demonstration phase, where the results will be compared with the application portfolio in order to arise points of improvement.

3.1 Research design

'A research design is a blueprint for fulfilling research objectives.' (Schindler, 2019, p. 71) During a research design, the data collection method will become clear. Here, it will become clear how, when, and where the data will be collected for the thesis assignment.

3.1.1 Type of research

There are three types of research studies: exploratory, descriptive, and causal (Schindler, 2019, pp. 51-53) This research is going to be exploratory. This is a loosely structured research that has a defined purpose (Schindler, 2019, p. 52). In this research, the aim is to look into the intern applications and to create a portfolio including a dashboard with KPIs. Both qualitative and quantitative research is used in this research design.

3.1.2 The research subjects

The research population is the company Traffic Today. Since there is only going to be looked into the intern applications, the company is the main stakeholder. Other stakeholders are the employees and the clients. If the final recommendations will alter the intern applications used, the employees have to modify their way of working. The effects of these changes could lead to a lower data-entry error which will have a positive influence on the final product that the customer receives.

3.1.3 Operationalization of key variables

The key variable is the portfolio, as mentioned before. Operationalization is used to make the variable quantifiable, which is resulting in three indicators. The indicators are as follows:

- *Time spent: Measures the time that is spent in one specific intern application.*
- *Data-entry error: Measures the data quality* (W., 2008)
- *The number of applications used: Measures the current amount of intern applications that is used.*

These variables are measurable and will be used when analyzing the applications of the company.

3.1.4 Explaining choice of data gathering method

Both monitoring and communication studies will be used to gather data. With the monitoring study, the applications of the company itself will be examined. These observations will help to get a better understanding of how the applications are used and how they are connected. Here some improvement points could already appear. Literature studies will be executed as well, to answer the knowledge questions. These are quantitative research methods.

The communication study is going to be executed by asking questions in meetings and conducting a survey. With these answers, some insights will be gained on how the employees think of the intern-used applications. This is a qualitative research method.

3.1.5 Explaining choice of data analysis method

Analyzing the applications is a qualitative research method since it is an analysis of the data and this data will be examined. There are different steps in analyzing the applications: look into the applications, search for inefficient points, look if there is improvement possible at those points, and see what these improvements will provoke. The literature studies are qualitative research methods as well. Different articles will be studied and analyzed to search for common aspects.

The survey and meetings will be quantitative research methods executed in a multiple-methodology design since there will be first held a survey and afterward there will be held meetings to understand the answers more in-depth.

3.1.6 Limitations of research design

There are multiple limitations to this research design. First of all, the survey that is going to be executed. Participants can choose to not complete it or they will not fill it out honestly. Afterward, the meetings are going to be held which can lead to subjective answers, since only a meeting is held with the most important participants.

Furthermore, analyses of the applications are going to be made. This is made by myself and therefore could my recommendations be subjective. To limit these changes, I will keep in close contact with my supervisor of the company to see if it is still going according to the company's preferences.

3.1.7 Validity and reliability

'Reliability refers to the consistency of a measure.' (Chiang, Jhangiani, & Price, 2015) Whether a measurement is reliable, is when the assessment tool is giving consistent answers. The data that will be collected during this research has to be reliable, in order to reach the goal of the research. The conducted survey is reliable if the participants will give the same answers when filling out

the same survey again. The answers to the survey must be reliable since the decisions that will be made about the improvement will rely on these answers. To make the survey more reliable, I will focus on the phrasing of the questions that have to be clear and instruction for the questions will be added as well.

Validity is referring to how accurately a method measures what it was intended to do. (Middleton, 2020) To make the research valid, literature studies are held to gather information for the survey. There is looked into the background of the participants of the survey as well. Afterward, the results should be compared with the analysis of the applications to see if the results are the same. In Appendix B.1. a table is shown in which every section is discussed according to the reliability and validity.

3.1.8 Check on good research

Six standards distinguish good research from poor research. (Schindler, 2019, pp. 27-28) The first standard is that the purpose is clearly defined. This is done in Section 1.2, where the problem is described including its meanings and concepts and the variables. The second standard is that a clear research design is needed to execute the research planned thoroughly. This is done in Section 3.1, where the research design is elaborated. The third standard is that high ethical standards should be applied. This will be done during the whole research since this research will follow the ethical guidelines of the University of Twente. The fourth standard elaborates on the adequate analysis that is going to be held. This is shown in the problem approach, which is Section 1.3. The fifth standard is about the limitations of this research, which are stated in Section 3.1.6. At last, the sixth standard states that the findings should be reported unambiguously. This is done, by placing a table of content at the beginning of the report to facilitate quick access to sections. A structure is made as well in the report, which will show a logical order of subjects, and all the figures and tables are clearly stated in the appendixes.

3.1.9 Theoretical framework

'A theoretical framework consists out of concepts, together with their definitions and reference to relevant academic literature, existing theory that is used for your particular study.' (Abend, 2021) The theoretical perspective of this research is a macro, exploratory standpoint with both quantitative and qualitative research methods.

This research is conducted from a macro exploratory standpoint because the relations of all the intern used applications are investigated in this research and how these applications contribute to the company Traffic Today is investigated as well. Quantitative methods are used to conduct the survey, whilst qualitative methods are used to carry out literature studies and an analysis of the applications.

During this research the APM theory is used, to create a portfolio of the intern applications. Application rationalization is used to analyze the applications after the APM theory is implemented to create a portfolio. Literature studies will gain me more knowledge of these theories to make sure that these will be used properly in this research.

3.2 Application Portfolio Management

In order to create a portfolio of the applications, APM is used. 'An application portfolio provides a group-wise consolidated view of all the applications along with their functional and financial attributes.' (Sidhu & Gupta, 2017). APM is a tool that evaluates how existing, planned and potential applications can contribute to achieving business goals (Ward & Peppard, 2002). APM will be used in this research to create an application portfolio of the current situation and it creates a lot of benefits for an organization. The main benefits that Traffic Today will encounter are eliminating duplication of application functionality, enterprises becoming leaner and more efficient and communication between various functions will be improved.

During the APM process, Application Portfolio Rationalization (APR) will be used. 'APR is a process where applications portfolios are analyzed to identify overlapping functionalities, unused, redundant, underused and high-maintenance applications to achieve cost reduction, efficiency improvement, and optimum business-IT alignment.' (Rao, 2011). APR is only proved effective when it is implemented as a continuous process, which means that the company Traffic Today should continue working on APR after this research is finished. APR can be broken up into different steps, which are shown in Figure 3.

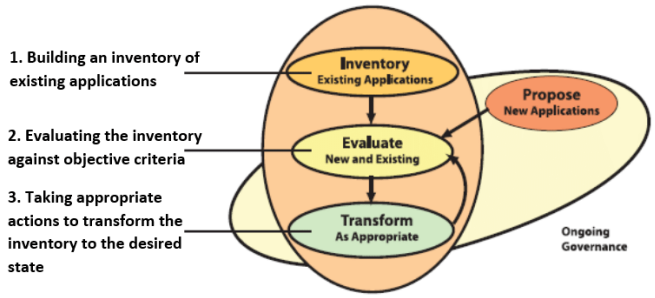

Figure 3: Application Rationalization steps (Sidhu & Gupta, 2017).

APM and APR together can be subdivided into eight steps (LeanIX, 2012):

1. *Compile a list of applications*
2. *Identify who owns the application*
3. *Identify the lifecycle of the application*
4. *Assess the usage of applications*
5. *Establish the application's business value, quality, and costs*
6. *Create an application architecture framework*
7. *Map the total concept onto the landscape*
8. *Make application rationalization a continuous process*

In order to create an application portfolio of the current situation, steps one and two are executed and an application landscape will be created. With step one, the inventory of applications will be specified and step two will show the connection between applications, which is needed to create an application portfolio framework. Then the APR will be executed, which are steps three to eight. After completing all the steps, APM and APR have been executed and an advice will be created for Traffic Today.

3.2.1 Compile a list of applications

This research is focussing on the main applications used in the company Traffic Today. The main applications are the following:

- *Asana*
- *Slack*
- *Everhour*
- *Google drive*
- *Google spreadsheet*
- *Teamleader*
- *Website Traffic Today*
- *Moneybird*

Since this research timeframe is ten weeks, there is chosen to only focus on these eight applications and to create a portfolio of these applications, and operationalize that portfolio. In Appendix B.2, the applications are expressed with their function exemplified.

In order to create a clear overview of the applications, an application portfolio is created. Here the applications that this research is focussing on are listed in an organizational body (Riempp & Gieffers-Ankel, 2007). The application portfolio will form a basis for this research and will be operationalized with APR to optimize the application portfolio. Figure 4 is the current application portfolio expressed. Asana and Everhour are connected and Google Drive and Google Spreadsheet are connected as well. The other applications do not have an integration with each other.

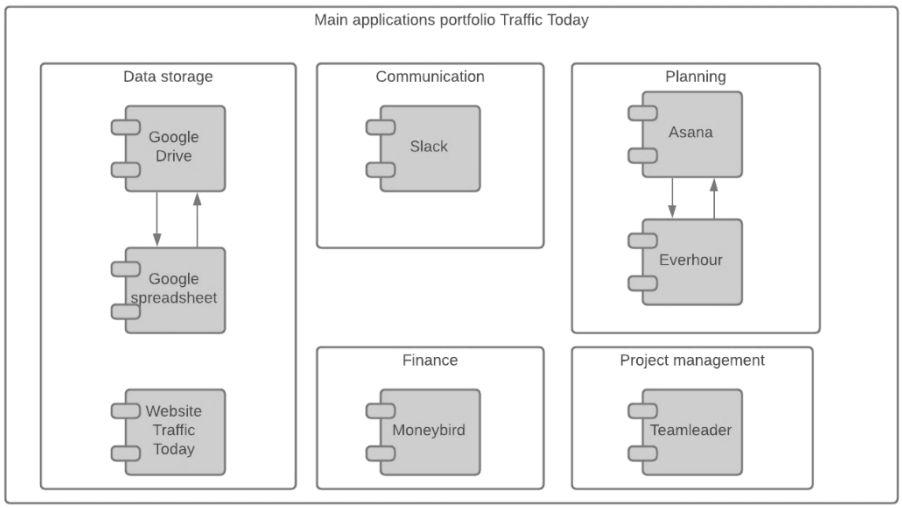

Figure 4: Application landscape including the integrations between Asana and Everhour and Google Drive and Google Spreadsheet. The applications are categorised by their function.

To show how the applications work together, a business process model (BPM) is created. This can be found in Appendix B.3. This model shows that every application is used within a process, but that a lot of steps have to be taken to finish the process correctly. All the data has to be filled in by hand and a lot of the same data has to be filled in at different applications.

The BPM is created for the process of a new client and the different pools are the different applications in order to make it clear which applications are used during this process. At the start of the process is it already becoming clear that a lot of steps in different applications are needed to execute the process correctly. Only distributing the client between different teams, takes up five different actions in three different applications, which is shown in Figure 5.

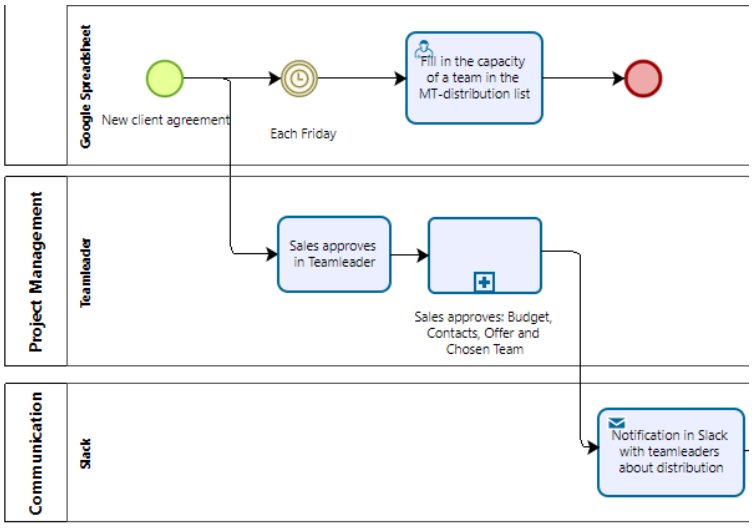

Figure 5: Business Process Model new client. In this figure it becomes clear that a lot of applications are used during one process. This small part of the BPM shows that only distributing a client is taking up five steps.

Additionally, a lot of different people need to fill in information during this process and everything is filled in by hand, which takes up a lot of time. This is shown in Figure 6. In this figure, the project manager needs to fill in five different types of data in Asana, before having an intake conversation with the actual client.

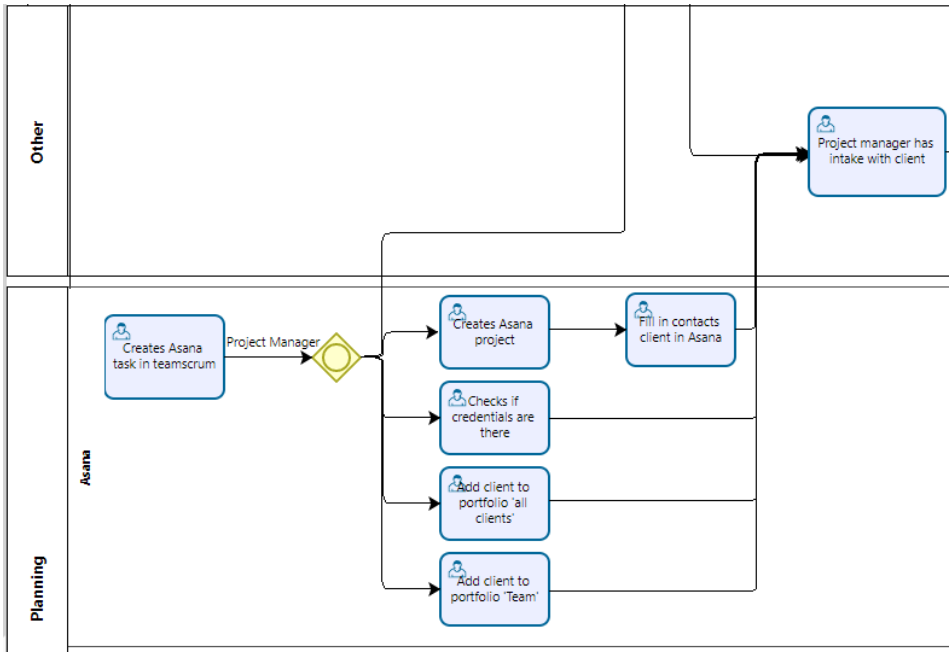

Figure 6: Business Process Model new client. This figure is showing that a lot of data has to be entered in applications to execute only a small step of a process.

3.2.2 Identify who owns the application

In this section, the related stakeholders of each application are stated (LeanIX, 2012). Generally, during this step, it becomes clear that only a handful of people are using the applications and that some applications have become useless.

Every employee is using at least four out of the eight applications at Traffic Today. These applications are Asana, Slack, Google Drive, and Google Spreadsheet. Since Asana is the main planning application, every employee in the company is using this. Slack is the communication channel of Traffic Today, which is used by every employee as well. Especially, since COVID-19 is

this application proving its business value for the company. Google Drive and Spreadsheet are used by every employee too. These are the main data storage applications in which all the important files for the organization are stored. It is mainly used for common files that are public to all the employees.

Teamleader and Moneybird are applications that are used by sales and team leaders only. Sales will fill in new clients and deals in Teamleader, whilst the team leaders will fill in all the sales made. With Moneybird, the invoices are processed by sales. The team leader will use Moneybird for information about the financial stages of their clients.

At last, the website Traffic Today is used by sales and project managers. Sales will fill in a form at the website when a new client appears. This will make the team leaders aware of information about new projects. Project managers use the forms of the website to transfer the projects to a new project manager.

3.3 The Survey

This research continues with a survey that is held with the team leaders and management team of the company Traffic Today. The team leaders and management team form the bones of the company and are therefore a good representation group of Traffic Today. The survey exists out of some general questions and several specific questions about the applications. In order to get the best answers, the survey was held in Dutch since this is the main language that is spoken at the company and the questions are then better understood.

Initially, interviews were going to be held at the company to gain information. Since the COVID-19 outbreak, only a few employees can be physically present at the office, which made it not an option to hold the interviews offline. Instead of doing the interviews online, I created a survey to gain the information needed. I have chosen to do a survey instead of an offline interview, because of the difficulty of the subject. Holding an interview means that the participant had to answer immediately when a question is asked while executing a survey implies that participants can think their answers well through which will lead to more sophisticated answers. It will also give the participants the freedom to fill in the survey at a time that they could select by themselves. Especially with the COVID-19 outbreak, Traffic Today was even busier than before.

3.4 Concluding design and development

This chapter discusses the design and development phase of the DSRP. This research is an exploratory research that focuses on Traffic Today and its employees. The research will use APM in order to create an application portfolio and it uses APR to operationalize this portfolio. To gain knowledge, a survey is held at the company. This survey is answered by the management team and the team leaders of Traffic Today. The survey consists out of general questions and specific questions about the applications themselves.

Chapter 4 Results

In this chapter, the results of the survey are stated and analyzed and knowledge question four is answered, by creating an artefact for the research. This knowledge question is stated below.

4. *How to create a dashboard that will show the functioning of the internal applications?*
    - *How does a good dashboard look like?*
    - *How can the dashboard help with optimizing the application portfolio?*
    - *Which KPIs will be shown in the dashboard?*
    - *How to visualize the KPIs in the dashboard?*

The research is still in the third phase of the DSRP: Design and Development. In this part of the phase, the results of the research are shown and the artefact is made, which will help solve the research question. In the previous chapter, the current situation is elaborated, which will be shown in the dashboard created in this chapter.

4.1 The results of the survey

The survey was sent to six persons of the company, four of the management team and two team leaders. The survey was anonymous to give everyone the possibility to answer the questions honestly. Four persons filled in the survey, which is an answer rate of 66.7%. Since the four persons still form a good foundation for the company and work with almost every application as well, the results of the survey can be used to show how the company Traffic Today looks at the current situation.

4.1.1 The results of the general questions of the survey

In this section, the main results of the survey will be stated. The survey consists out of multiple-choice questions and open questions, where the participants' answers could be exemplified.

The survey started with some general questions about the current situation. The main result from these questions was that all the participants state that Traffic Today is using too many applications than needed. The answers are exemplified with statements such as: 'There is no central system with applications.' and 'For each part, we use a separate application instead of researching the possibilities of connecting multiple applications or searching for an all-encompassing application.'.

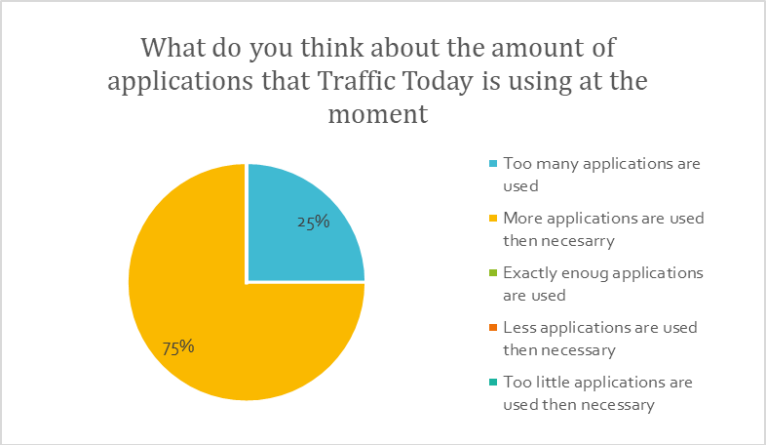

Figure 7: General results survey. The graph shows that Traffic Today is using more applications then necessary according to the participants.

On the other hand, the participants do find almost all the applications needed to execute their job correctly. This is showing that the function of the applications is necessary for their jobs, but the number of applications could be reduced. Since a lot of applications are used, the participants state that a lot of their time is spent on the applications. One of the exemplified statements of this question: 'Since data needs to be entered in multiple applications, a lot of time is spent in some of the applications.' The data entry of the applications is not very difficult according to the participants, but there is a high error sensitivity.

Interesting is, that the participants have a different view of the saved data. Two participants say that all the data is saved after use. One participant says that exactly enough data is saved and the last participant says that only a small part of the user data is saved. This could mean that people are saving their data differently and no general route is used to save data or the question is incorrectly understood which makes the question invalid.

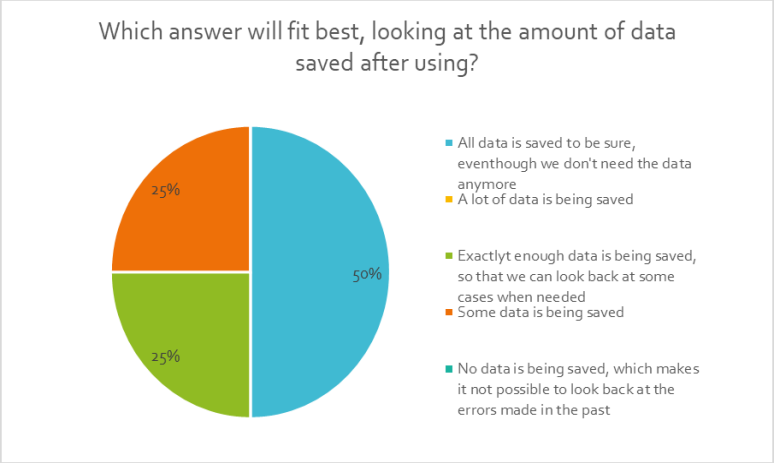

Figure 8: General results survey. This graph is showing that the opinions on how much data is saved, differs between the participants.

The final result that can be concluded when analyzing the general questions is that Traffic Today has no central system of applications, which is leading to a lot of time spent entering data into all the applications. Subsequently, this can result in a high data entry error sensitivity. However, the functions of the applications are needed to execute the work correctly.

4.1.2 Survey results from Asana

The results of the Asana questions show that this application has a high business value for Traffic Today. A lot of time is spent on the application, especially for the participants that are involved with the project management. Two of the participants find it complicated to work in Asana and would have liked to have a better introduction before starting to work in this application. One of the participates exemplifies: 'Working with labels makes it difficult since not everyone is using the same labels and this leads to a lot of errors. It does seem like a complete application and it is therefore not easy to find a better application for this function.'

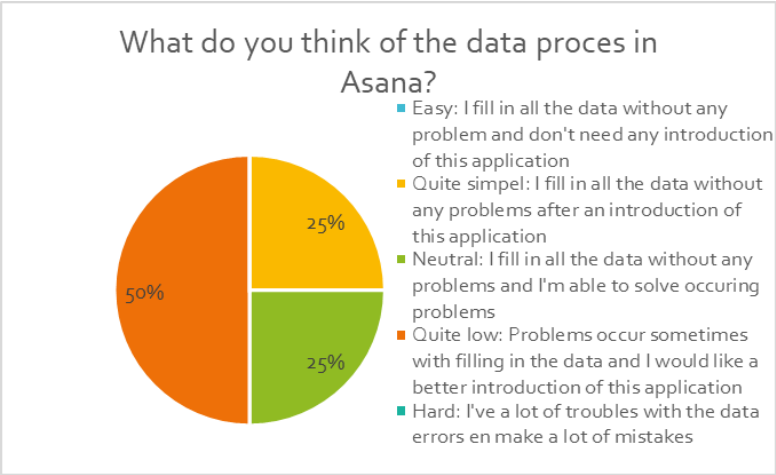

Figure 9: Survey results Asana. This graph shows that the participants find it sometimes hard to fill in the data.

All things considered, is Asana a well-working application with a high business value for Traffic Today, but the application could use some more elaboration on how to use it. This could be elaborated with for example a manual.

4.1.3 Survey result Slack

Analyzing the answers about the application Slack, it becomes clear that this application is the main communication channel of Traffic Today. Slack is an easy-to-understand application that does not need a lot of practice. Therefore, is this application commonly used in the company, and is it becoming the main communication channel for all intern communication. The participants additionally think that sometimes too much of their time is spent on this application. Since COVID-19, online communication is becoming more important which is explaining the high amount of time spent in the application. Half of the participants think that Slack is the best application with this function available and the other half does not mind it if the application is replaced with another application with the same function.

In the end, Slack is an application with a high functionality level which makes the application important to the company. The application is very easy to understand which makes it a good application with value to the participants.

4.1.4 Survey result Everhour

The next application in the survey is Everhour. The participants find it hard to work with this application and would like to get a better introduction on how to work with this application. Besides that, one participant thinks that a new application with the same function would work better for the company. All the participants are agreeing on the fact that the application's function is really important for the company itself. Therefore, the application should get a better introduction or should be traded in with a better application. 'The application does have a high business value for our company, but the application is not giving us a clear overview': exemplifies one of the participants.

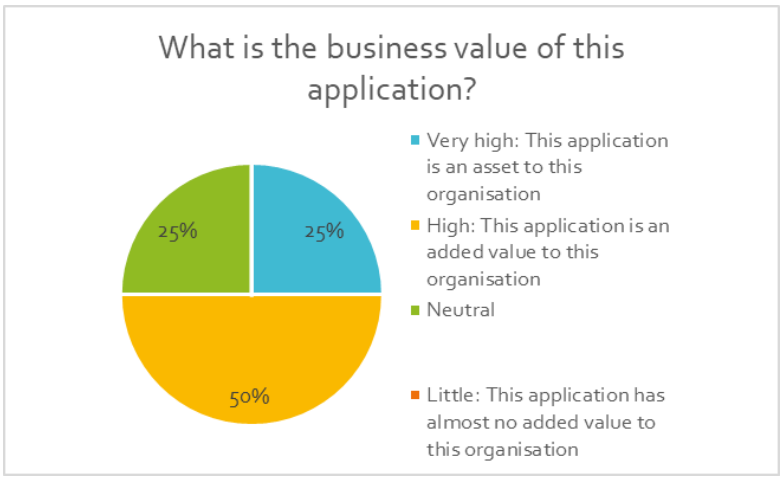

Figure 10: Survey result Everhour. This graph shows that the business value for Everhour differs from neutral to very high.

It can be concluded that Everhour has an important function for the company, but that the application should get more exploration on how to work in it or should be traded in for an application with the same function.

4.1.5 Survey result Google drive

The main result, when analyzing the survey's answers is that Google Drive is a useful application since everyone can work in the same documents and documents are saved in the cloud.

However, Google Drive is slow to work in and the overview of documents is not clear. Besides that, a lot of mistakes are happening, because documents are incorrectly copied or changed without saving the old files which are resulting in that all the files are becoming a mess.

Figure 11: Survey result Google Drive. This graph shows that the quality of this application is not very high nor very low.

Therefore, is Google Drive an useful application because of the commonly shared files in the cloud, but another application with the same functioning plus a better overview would be recommended.

4.1.6 Survey result Google spreadsheet

For Google Spreadsheet are the results similar compared to Google Drive. Since the two applications are connected this makes sense. The spreadsheets are very limited compared to Excel, but working in the same files is a must for the company. Therefore, Excel is not an option

and should there be looked for another application that does have the function of working together but is not as limited as Google spreadsheet. Because of the limitations of Google Spreadsheet, too much of the time of the participants is getting lost in this application.

4.1.7 Survey result Teamleader

Only a few participants are using the application Teamleader. Therefore, not all the answers are trustworthy. Besides that, the application functions well but since it is not connected to other applications, all the data should be filled in separately which is taking up a lot of time. Therefore, they would prefer the extra function of connecting multiple applications.

4.1.8 Survey result Website traffic today

Sales are using the website to fill in forms of new clients to make sure that the team leaders receive the right information. Since only a few employees use the website as an application, not all the participants filled in these questions. The participants who are working with this application, think that the application should be trade-in for a better functioning application since the website is only used for forms as a temporary solution.

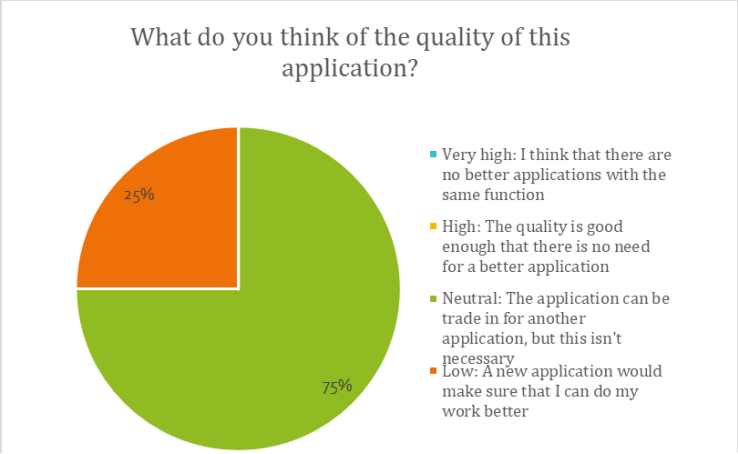

Figure 12: Survey result website Traffic Today. The graph shows that the quality of the website is not sophisticated anymore for the company.

4.1.9 Survey result Moneybird

Moneybird is one of the more financed-focused applications in the company. It is easy to use and has a high business value for the company. It does have its limitations with getting output according to a participant. Therefore, there could be looked into the possibilities of trading this application off with an application that has extra options for output and a better overview.

4.1.10 The survey collated with Application Portfolio Management

In this section, the results of the survey are collated with APM. APM is in this research the first two steps as stated in Section 3.2., 'Compile a list of applications' and 'Identify who owns the application'.

The main results from the survey were that the function of all applications is needed, but that the application itself could most of the time be replaced with other applications with better functioning or an application that could be connected to multiple applications. Some applications should be more exemplified before starting to work in it as well. Another point that became clear is that because of the complexity of some applications and entering the same data in different applications, a high margin of data entry errors arises.

What is shown in the BPM, is that a lot of steps need to be executed for one single process. Multiple steps consist out of entering the same data in different applications. It can also be seen in the application landscape that no application is connected, except Asana and Everhour and Google Drive, and Google Spreadsheet. From the survey, it can be concluded as well that these two points are resulting in that a lot of labour time is spent in the applications to execute a process.

Since the functioning of the applications is necessary to execute the work at Traffic Today, there should be investigated into how to rationalize the application portfolio. This should be executed in such a way that the function of applications still exists, but that the applications are trade-in or connected to other applications. This will lead to less labour time spent during processes, which will also lead to a lower data entry error.

4.2 The KPIs

'Key performance indicators are those indicators that focus on the aspects of the organizational performance that are the most critical for the current and future success of the organization.' (Parmenter, 2015) Characteristics of KPIs are that they are timely, simple and they should have a significant impact. Timely indicates that they should be measure on a time basis, which is every day, week, or month. Simple implies that every employee should understand the KPI. Lastly, they should have a significant impact on the organization to be a 'Key' performance indicator.

4.2.1 The checklist

For the dashboard that is going to be created, KPIs are needed. These KPIs will be used to design a dashboard and will be visualized in the dashboard through graphs and charts to give the dashboard a clear overview of the current application portfolio. From this dashboard, it should become clear how the applications are functioning and if the application portfolio is optimal. As mentioned before, the KPIs should be time-based, simple, and should have a significant impact. Furthermore, in this research, the KPIs should concern all the applications mentioned in this research and it should be related to the functioning of the applications. These requirements are summed up in a checklist for KPIs in Table 5. If all the requirements are met, the KPIs are suited for this research and can be analyzed in order to insert them into the dashboard later on.

The application website of Traffic Today is an exception on the checklist point 'Does the KPI cover all the applications mentioned in this research?'. Since this application holds only the forms part of the website and not the whole website itself, it is not valid to consider aspects such as costs and lifecycle as real values for the application website Traffic Today in this research. Therefore, for some KPIs, the application website Traffic Today may be excluded, since the form is a really small part of the website Traffic Today and will therefore have no value for certain KPIs.

Description	Check
Can the KPI become time-based (Is it measurable on a time basis)?	Yes/No
Is the KPI simple and can it be understood by every employee?	Yes/No
Does the KPI have a significant impact on the company?	Yes/No

Does the KPI cover all the applications mentioned in this research?	Yes/No
Is the KPI related to the functioning of the applications?	Yes/No
Is the KPI measurable?	Yes/No

Table 5: Checklist KPIs

4.2.2 Number of KPIs

After creating a checklist for the KPIs, there should be researched into the number of KPIs that need to be created. The researcher Miller has discovered, that human short-term memory is limited to holding seven pieces of information, plus or minus two (Doorey, 2021). Since the decision-making process is fast, the dashboard needs to show the most important data immediately and this will influence the short-term memory of the human. Therefore, there is chosen to take the seven, plus or minus two as the basis for the number of KPIs that will be shown in the dashboard. The number of KPIs may therefore be between five and nine.

4.2.3 Creating the KPIs

Now that the checklist is created and the number of KPIs is known, the KPIs can be made. APM and APR are using the business value, quality and costs, and the lifecycle as important aspects to rationalize the application portfolio. Therefore, there is inspected if these four aspects could be changed into KPIs.

Business Value: Starting with the business value, I have researched what business value is. With business value, it is shown how valuable and how useful an application is to the users (Kannan, 2012). It can be measured with the survey that is held together with the belonging results stated in Section 4.1. Business value is time-dependent and can change over time, therefore it is necessary to measure this KPI every month, quarter, or year (Paras & Westbrock, 2013). The checklist is applied to show if business value is suited as KPI.

Description	Check	Explanation
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The business fit should be measured on a time based since it changes over time. This can be done every month, quarter, or year but every month or quarter is preferred to keep it up to date.
Is the KPI simple and can it be understood by every employee?	Yes	When the business value is exemplified, it is understandable for everyone.
Does the KPI have a significant impact on the company?	Yes	The business value is in this case, how the employees look at the functioning of an application and since everyone is working with the applications has the KPI a significant impact.
Does the KPI cover all the applications mentioned in this research?	Yes	Every application has a business value.
Is the KPI related to the functioning of the applications?	Yes	The business value shows how valuable and useful an application is, so yes.

Is the KPI measurable?	Yes	The KPI will be measured with the following question of the survey: 'What is the business value of this application?'

Table 6: Checklist Business value. This checklist shows that all the requirements are met in order to make Business value a KPI. The business value can be measured for every application and should be measured at a regular time base.

Technical Fit: Besides the business value, technical fit is an important aspect of the APR as well. Technical fit is the degree to which an application meets the standards set by the company (Paras & Westbrock, 2013). Traffic Today does not have fixed standards for applications, but this can be measured by using the results of the survey as well. The technical fit has to be measured as well on a time basis since technology is an ongoing process and applications can become outdated very fast.

Description	Check	Explanation
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The technical fit should be updated on a regular time basis since technology is changing fast and an application could become old very fast. This can be measured at the same time based as the Business Value
Is the KPI simple and can it be understood by every employee?	Yes	When exemplified the KPI is very simple and understandable.
Does the KPI have a significant impact on the company?	Yes	The KPI makes sure that it is shown when an application is outdated or not working very well according to the employees and this can have a significant impact on the company.
Does the KPI cover all the applications mentioned in this research?	Yes	This can be measured for all applications.
Is the KPI related to the functioning of the applications?	Yes	The KPI is covering the technical aspects of the applications, so yes.
Is the KPI measurable?	Yes	The KPI will be measured with the results from the following questions of the survey: 'What do you think of the data process of this application?', 'What do you think of the quality of this application?', 'What is the level of this application?'.

Table 7: Checklist Technical fit. This checklist confirms that all the requirements are met in order to make Technical fit a KPI. The KPI is measurable for every application and it is important to measure the KPI on a regular time basis.

Costs: The next aspect that is mentioned in the APR steps is costs. For the applications, the monthly costs are known and these costs will be the third KPI. The costs are very important to state in the analysis since applications can have for example an 'okay' technical fit and business value but have high monthly costs because of updates or other factors. If this is the case, Traffic Today can decide to look into other applications with the same technical fit and business value but lower cost.

Description	Check	Explanation
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The costs will change over time since the company Traffic Today is a fast-growing company and the subscriptions of the applications should be expanded. This can be measured at the same time based on the previous KPIs.
Is the KPI simple and can it be understood by every employee?	Yes	The costs are very straightforward.
Does the KPI have a significant impact on the company?	Yes	Costs are a really important aspect of a company since too many costs can have a negative influence on the profit of a company.
Does the KPI cover all the applications mentioned in this research?	Yes (Exclude the Website)	All the applications have costs, except the website Traffic Today since the forms are such a small part of the website these costs can be set at 0.
Is the KPI related to the functioning of the applications?	Yes	Costs can have a relation to the functioning of an application. High costs can have the consequence that an application is up to date and working without any bugs, but this is not always the case.
Is the KPI measurable?	Yes	The costs are measurable.

Table 8: Checklist costs. The checklist confirms that Costs can be made into a KPI. For this KPI, the application website is excluded.

Lifecycle: The last aspect is lifecycle. Application Development Life Cycle (ADLC) is the theory that explains how any application is discovered, designed, developed, released, and maintained (Gavrilova, 2020). In this research, the applications are already released by different IT companies, which makes the maintenance stage the only interesting stage to look into. In this stage, the application is continuously being improved. Therefore, bugs and errors occur occasionally and the technology is up to date (Gavrilova, 2020). The lifecycle can become a KPI if it checks all the boxes of the checklist, which means that it should be measurable as well. To make the KPI measurable, some data of the applications need to be created. This data will be the date that the application was released, the number of bugs, and the updates of the application. To make it time-based, the number of bugs and updates should be measured on a regular time base of three months.

Description	Check	Explanation
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The lifecycle should be measured on a time based, as previously stated. This can be monthly, every quarter, or every year but a quarter is preferred.
Is the KPI simple and can it be understood by every employee?	Yes	When exemplified this KPI will be simple enough to make it understandable for every employee.
Does the KPI have a significant impact on the company?	Yes	The lifecycle is very important to the company since with this KPI it can be shown that an application should be trade-in or be kept.

Does the KPI cover all the applications mentioned in this research?	Yes (Exclude the website)	Every application has a lifecycle, besides the website Traffic Today. Since the forms are only used internally, the forms will not be updated and they can be filled in offline as well which is leading to zero bugs. The forms were later on added to the website, which means that there is no actual release date and this application is only used as an interim solution.
Is the KPI related to the functioning of the applications?	Yes	The lifecycle is showing how an application is functioning, has encountered bugs or errors, and when an update has taken place.
Is the KPI measurable?	Yes	The KPI will be measured with the released date, the number of bugs, and the updates of the application.

Table 9: Checklist lifecycle. The checklist confirms that lifecycle can become a KPI. For this KPI the website application is excluded since there are no values available for this application. The KPI should be regularly measured, to see if the lifecycle is improving or getting worse.

The number of interfaces: One of the main problems that resulted from the survey and analysis that was held on the applications, was that there are almost no interfaces between the applications. The interfaces are in this case a connection between different applications, that shows that the applications are related and communicating (Wagner, 2021). Figure 4 is shown that in the current situation only four applications are communicating with each other. This is between Everhour and Asana and Google Drive and Google Spreadsheet.

Description	**Check**	**Explanation**
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The number of interfaces should be updated on a regular time basis.
Is the KPI simple and can it be understood by every employee?	Yes	When exemplified the KPI is easy to understand.
Does the KPI have a significant impact on the company?	Yes	When the number of interfaces changes, will this have a significant impact on the company since this will change the BPM of processes within the company.
Does the KPI cover all the applications mentioned in this research?	Yes	It measured the interfaces between all the applications.
Is the KPI related to the functioning of the applications?	Yes	The connection between the applications is connected to the functioning of an application.
Is the KPI measurable?	Yes	The number of interfaces will be measured. In the current situation is the number of interfaces one between the eight interfaces.

Table 10: Checklist interfaces. The checklist confirms that the interfaces can become a KPI. For this KPI is it important that the KPI is explained correctly, to make the KPI simple.

Application per category: The applications used can be divided into multiple categories, as shown in Figure 4. These categories are Communication, Data storage, Financial, Planning, and Project management. Showing these categories in a dashboard makes it clear in which

categories most applications are functioning. If for example is shown that almost all the applications are placed in data storage, but data storage itself is still not functioning well, there can be investigated if there is an overarching application.

Description	Check	Explanation
Can the KPI become time-based (Is it measurable on a time basis)?	Yes	The applications should be measured when a new application is added or when an application gets updated with extra functioning. Therefore is it recommended to keep it up to date. This can be done every quarter of a year together with the other KPIs.
Is the KPI simple and can it be understood by every employee?	Yes	The KPI is very simple.
Does the KPI have a significant impact on the company?	Yes	The KPI has an impact in such a way that it becomes clear if there should be investigated in new applications and it gives a great overview of the ratios of each category.
Does the KPI cover all the applications mentioned in this research?	Yes	Every application is put in a category.
Is the KPI related to the functioning of the applications?	Yes	As stated before, the category ratios can show if new applications are needed or if interfaces should be created, which is related to the functioning of the KPIs
Is the KPI measurable?	Yes	Every KPI is categorized and every category is measured by the number of applications in that category.

Table 11: Checklist category. The checklist confirms that category can become a KPI. There should be a focus on the category ratios, to get a clear overview of this KPI.

There are now six KPIs created to visualize a dashboard for the application portfolio. According to Miller's theory, there should be around seven KPIs to make sure that the short memory of humans can still process the data, and six falls between the margins. The KPIs can be sorted into three main categories: Impact, Quality, and Complexity (Khosrahahi, Matthes, Beese, Winter, & Yilmaz, 2017). The KPIs are categorized in Table 12.

Categorized KPIs		
Impact	***Quality***	***Complexity***
Costs	Business Value	Number of Interfaces
Application per category	Technical Fit	Lifecycle

Table 12: Categorised KPIs

4.2.4 Visualizing the KPIs

Now that the KPIs are created, they should be visualized into a dashboard. To make the dashboard clearer, the dashboard will be divided into three categories as stated in Table 12. In this section, the data and the visualization of each KPI will be stated and the final dashboard will be created.

Impact

***Costs*:** Investigating the data that needs to be gathered for this KPI, shows us that the data is very straightforward. The costs of each application will be gathered and this can be updated on a regular time basis, such as each quarter.

For this KPI, the website Traffic Today will have a zero value in the data that is collected. Since the application website Traffic Today is only focussing on the forms on the website, only a really small part of the website is looked into. Since this part is so small in comparison to the website, the costs are set back to zero.

Furthermore, the applications of Google Drive and Spreadsheets are paid through one invoice of all the overarching applications of Google Workspace. Therefore, are these applications combined, and do they have one cost value. The data of this KPI in the current situation is shown in Table 13.

Application	Costs	Costs per month
Asana	€1524,50 (per month)	€1524,50
Slack	€3000,00 (per year)	€250,00
Everhour	€7,00 (per person per month)	€280,00
Google Workspace (Drive & Spreadsheet)	€1467,35 (per month)	€1467,35
Teamleader	€525,00 (per quarter)	€175,00
Website Traffic Today	-	-
Moneybird	€30,00 (per month)	€30,00

Table 13: Cost per application

Now that the data is collected, the KPI can be made visual. To make them visual, the program Tableau is used in which data can be connected in order to create a dashboard. After putting in the data of the KPI, multiple options for visualization are shown. For this KPI there is chosen to visualize it with a bar chart, which will make it clear in one view, how high the monthly costs of an application are. The applications are sorted from highest cost to lowest cost to make it even easier to see which application is the most expensive and which is the cheapest. Furthermore, is Google Drive and Google Spreadsheet visualized in the same colour since as stated above these are paid through one invoice. The application website Traffic Today is shown in the bar graph as well, but this application can be excluded as well in the dashboard by hand if necessary. The visualization is shown in Figure 13.

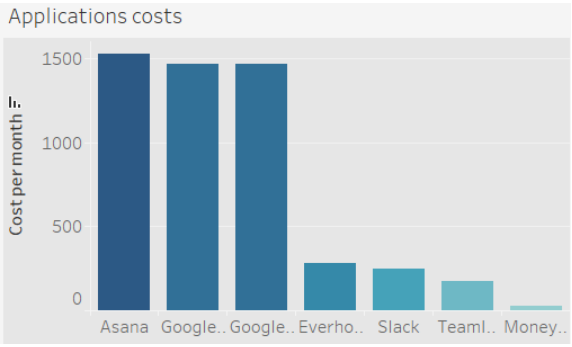

Figure 13: Costs graph. This graph is showing that Asana is the most expensive application. Google Drive and Google Spreadsheet are both containing the same value, since these applications are payt through Google Workspace. Therefore both these bars are made the same colour.

When Traffic Today wants to see the change over time in costs per application, they can add an extra graph to the explanatory dashboard. In this graph, the changes in costs per month are shown in a line graph per application. This line graph will illustrate if the costs increase or decrease over time and if the costs are keeping increasing, but the lifecycle is not improving there could be researched if it is still worth investing. Since this graph is based on future data, the graph is not visualized in the dashboard yet. There is made an example graph with non-existing values that will make it clear how this graph will look like. This graph is stated in Appendix C.1.

Application per category: With this KPI, the data is very straightforward as well. As shown in the application portfolio in Section 3.2.1, the application landscape consists out of five categories. For this KPI the data is the applications with their corresponding category.

Application	**Category**
Asana	Planning
Slack	Communication
Everhour	Planning
Google Drive	Data Storage
Google Spreadsheet	Data Storage
Teamleader	Project management
Website Traffic Today	Data Storage
Moneybird	Financial

Table 14: Application per category

With the data gathered, the visualization can get started. For this KPI, a bar chart is made as shown in Figure 14. This type of chart is shown to make it clear which category has the largest number of applications and which category has the lowest number of applications. This is convenient when for example the communication is not going very well. Additionally, in this graph, it becomes clear that there are only a few communication channels. In this case, there could then be looked at other applications that are focussing on communication to improve the current situation. Furthermore, the graph will show the number of applications present in the category.

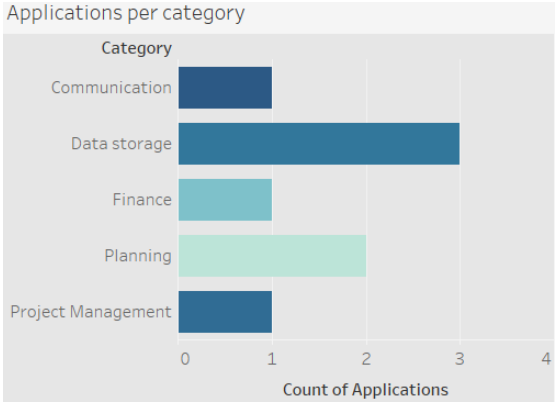

Figure 14: Graph applications category. This graph is showing that data storage is the category that is the biggest represented by the applications.

Quality

Business Value: Now that the KPIs regarding the impact are visualized, the KPIs concerning the quality are analyzed. The first KPI that is looked into is 'Business value'. As stated in the checklist in Table 5, the data for measuring this KPI will be gathered from the survey question: 'What is the business value of this application?'. The business value is taken for each application and this is turned into a business score by giving the answers a number which is shown in Table 15. The data is shown below in Table 16.

Answer	Score
Really High	5
High	4
Neutral	3
Low	2
Nothing	1

Table 15: Score Business value

Application	Business value					Business score
	Really high	***High***	***Neutral***	***Low***	***None***	
Asana	25%	75%	0%	0%	0%	4,25
Slack	50%	25%	25%	0%	0%	4,25
Everhour	25%	50%	25%	0%	0%	4
Google Drive	0%	75%	25%	0%	0%	3,75
Google Spreadsheet	0%	25%	75%	0%	0%	3,25
Teamleader	0%	0%	100%	0%	0%	3
Website Traffic Today	0%	0%	50%	50%	0%	2,5
Moneybird	25%	25%	50%	0%	0%	3,75

Table 16: Score business value. The business score is calculated by multiplying the percentages with the score business value, shown in Table 16.

Besides the main dashboard, there is an exemplified dashboard as well that will elaborate on the quality KPIs. For business value will this dashboard contain the business values with a colour legend to make it clear which application has a perfect business value and which application could improve. The figure in which this visualization is shown is Figure 15. From this figure, it can be seen in one glance that most applications have a good business value since they are green. The darker the green, the better the application and everything that is from yellow to red has a low business value.

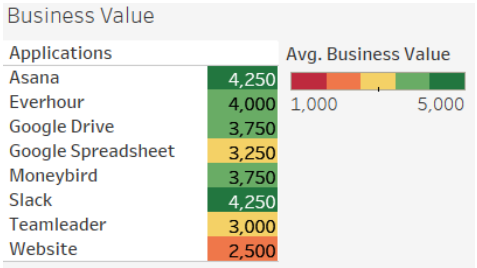

Figure 15 Graph business value. The vallues from yellow to red are not good enough for Traffic Today.

Technical Fit: The other KPI regarding the quality is the technical fit. This KPI will be measured with the results from the survey as well. The following questions will be analyzed: 'What do you

think of the data process of this application?', 'What do you think of the quality of this application and 'What is the level of this application?'. The technical fit will be measured the same way as the business value. The technical fit will be turned into a score which can then be put into Tableau to create a fitting visualization of this KPI. Since this KPI contains data from three questions, the average score of the three questions is taken as the end score.

Application	**Data Process**					**Quality**					**Level**			
	Easy	Simple	Neutral	Difficult	Hard	Really high	High	Neutral	Low	None	Complicated	Hard	Neutral	Easy
Asana	0%	25%	25%	50%	0%	25%	50%	25%	0%	0%	0%	0%	75%	25%
Slack	75%	0%	25%	0%	0%	50%	0%	50%	0%	0%	0%	0%	25%	75%
Everhour	0%	25%	25%	50%	0%	0%	25%	50%	25%	0%	0%	50%	50%	0%
Google Drive	25%	50%	25%	0%	0%	0%	25%	50%	25%	0%	0%	0%	25%	75%
Google Spreadsheet	25%	50%	25%	0%	0%	0%	25%	50%	0%	25%	0%	0%	50%	50%
Teamleader	0%	25%	75%	0%	0%	0%	0%	100%	0%	0%	0%	25%	75%	0%
Website Traffic Today	25%	0%	75%	0%	0%	0%	0%	75%	25%	0%	0%	0%	50%	50%
Moneybird	25%	25%	50%	25%	0%	0%	25%	50%	25%	0%	0%	25%	50%	25%

Table 17: Technical fit per application

The scores given to the different answers can be found in the tables below.

Answer	**Score**	**Answer**	**Score**	**Answer**	**Score**
Really High	5	*Easy*	5	*Complicated*	1
High	4	*Simple*	4	*Hard*	2
Neutral	3	*Neutral*	3	*Neutral*	3
Low	2	*Difficult*	2	*Easy*	5
Nothing	1	*Hard*	1		

Table 18: Value scorecard survey results

These tables combined will give us the average technical fit, which is shown in Table 19.

Application	**Data level**	**Quality**	**Level**	**Technical fit**
Asana	2,75	4	3,5	3,42
Slack	4,5	4	4,5	4,33
Everhour	2,75	3	2,5	2,75
Google Drive	4	3	4,5	3,83
Google Spreadsheet	4	2,75	4	3,58
Teamleader	3,25	3	2,75	3
Website Traffic Today	3,5	2,75	4	3,42
Moneybird	3,75	3	3,25	3,33

Table 19: Technical fit score. The percentages from Table 17 are multiplied with the scores in Table 18.

The technical fit KPI will have an extra visualization in the exemplified dashboard as well. This graph will help give an overview of the parameters of the technical fit: data process, level, and quality. Looking at the graph, these three parameters are shown next to each other for each

application. Hence, it becomes clear what the values are for each application. The graph is shown in Figure 16. This graph can be used if an application needs improvement and more insight into the functioning is needed.

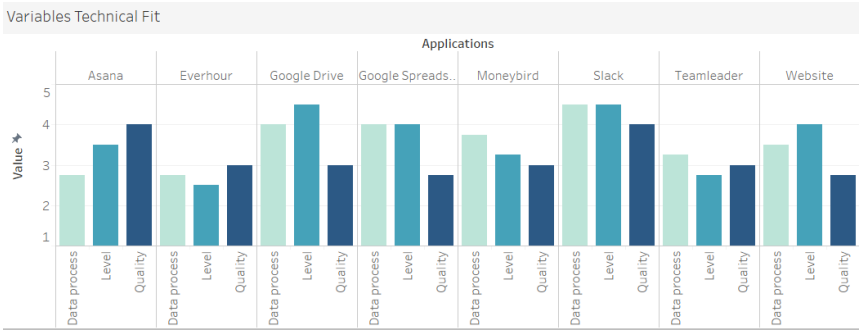

Figure 16: Graph technical fit. This graph shows the three aspects that are combined to calculate the technical fit.

Business value vs. Technical fit: To analyze if applications are still fitted with the company, the KPIs Business value and Technical fit will be shown in one graph in the main dashboard. This will be visualized in a scatter plot that will exist out of four quadrants. Every quadrant has its meaning and if an application is in a certain quadrant, it can be shown if the application should be trade-in. The scatter plot will give with a simple glance, which applications do not have a high business value and technical fit.

On the vertical line is the business fit shown, whilst on the horizontal line, the technical fit is stated. From Figure 17 can be seen that the scatter plot is divided into four quadrants. The first quadrant is in the higher left corner. This stands for a high business value, but low technical fit (Paras & Westbrock, 2013). The applications have a high business support. However, they are very challenging in the IT department. The next quarter is the one in the lower-left corner, which stands for a low business value and a low technical fit. These applications need to be replaced (Paras & Westbrock, 2013). The following quarter is in the lower right corner with a low business value, but a high technical fit. Most of these applications are relatively new and are built on IT requirements instead of the functionality that a business needs (Paras & Westbrock, 2013). With some extra functions, these applications can become a real asset to the company. The last quarter is in the higher right corner and this contains applications with a high business value and a high technical fit. The company can keep these applications and these applications do not necessarily need to be changed.

The lines that divide the scatter plot into four quadrants are given the value of 3.5, since a score of 3 means that the value and fit are neutral and above 3 has the application a higher value or fit. As shown in Figure 17, only two applications belong to the upper right quadrant which means that the other applications could use some improvements.

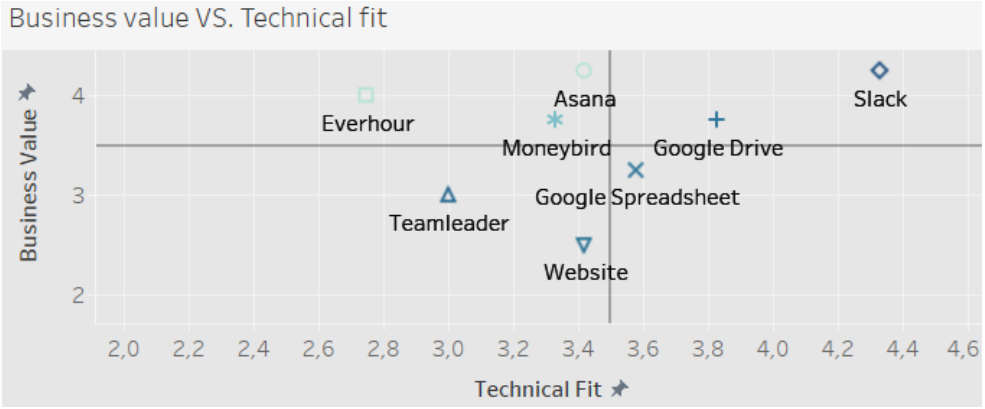

Figure 17: Scatter plot Business value vs. Technical fit. The figure is divided into four quadrants. The applications in the lower-left quadrants are scoring the lowest and the applications in the upper right quadrant are scoring the highest.

Complexity

Number of Interfaces: After visualizing the impact and quality KPIs, the complexity KPIs will be next up starting with interfaces. The number of interfaces is the data that needs to be visualized for this KPI and this can be measured by researching the connections between applications. In the application landscape in Section 3.2.1 are two connections shown: Everhour and Asana and Google Drive and Google Spreadsheets. In the visualization, it is important to show which applications are connected, to make it clear which applications are working alone and which applications are collaborating. The data that is used to create a graph of this KPI is shown below.

Application	Relationship	Line Y	Line X	Circle Y
Asana	Everhour	4	2	4
Slack		4	4	4
Everhour	Asana	3	1	3
Google Drive	Google Spreadsheet	2	3	2
Google Spreadsheet	Google Drive	1	3	1
Teamleader		1	1	1
Website Traffic Today		4	3	4
Moneybird		1	2	1

Table 20: Interfaces application data. The lines and circle values are random values between zero and five to give the applications a random spot in the graph.

The relationship column as stated in Table 20, shows which interfaces there exist. The lines are points at the axis of the graph that will show each application within the graph. In this case, the graph has a maximum of 5 on the axis. The lines X and Y are random points created between 0 and 5. Circle Y is the same as line Y, to create a double-axis, which makes it easier to visualize the KPI in a graph. The visualization of the KPI is shown in Figure 18.

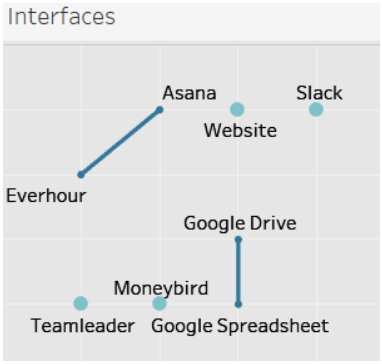

Figure 18: Interfaces between applications

Lifecycle: The last KPI that needs to be visualized is the lifecycle. The data for this KPI will consist out of the release date, the number of bugs, and updates of the applications. As mentioned before, the application website Traffic Today will not have a valid value for this KPI since the application in this research is such a small part of the website itself.

When gathering the data, the data is obtained from the last three months. This gives an overview of the current status of the applications and that the data has to be updated on a time base. In this case, is a time base of a quarter recommended. The data used for the KPI is shown in the table below.

Application	**Release date**	**Bugs April**	**Bugs May**	**Bugs June**	**Updates April**	**Updates May**	**Updates June**
Asana	Apr-2012	1	9	6	4	7	7
Slack	Aug-2013	-	1	-	2	5	3
Everhour	Jan-2015	-	-	-	2	1	3
Google Drive	Apr-2012	-	-	-	3	3	-
Google Spreadsheet	Mar-2006	-	-	-	-	1	-
Teamleader	Feb-2018	-	4	4	1	-	-
Website Traffic Today	-	-	-	-	-	-	-
Moneybird	Jan-2018	-	-	4	1	1	3

Table 21: Data lifecycle. The values are gathered from the status application websites themselves.

For visualizing this KPI, there is chosen to make a butterfly chart in which the bugs and updates are shown. In this way, it becomes immediately clear if an application has a lot of bugs and no updates or if an application has a lot of updates and a lot of bugs. If an application is outdated, has only a few updates, and additionally has a lot of bugs then the application could be trade-in for a better one. The butterfly chart is shown in Figure 19.

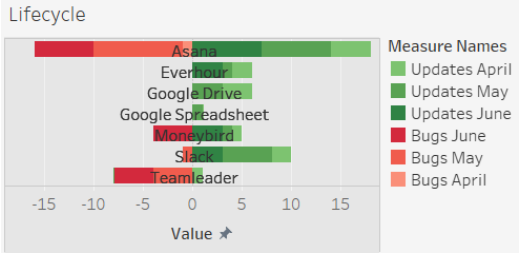

Figure 19: Graph lifecyle per application

The release date is not shown on the main dashboard since an application can exist for a long time and function well at the same time since updates are more important than the age of an application. It could be convenient to look into the release date of an application when it is not certain yet if the updates are enough to make sure that the application is not behind on IT. Therefore, another graph is shown on the exemplified dashboard in which the release dates are shown. This is shown in Figure 20 and consists out of a simple table containing the dates.

Release date	
Applications	
Asana	1-4-2012
Everhour	1-1-2015
Google Drive	1-4-2012
Google Spreadsheet	1-3-2006
Moneybird	1-1-2018
Slack	1-8-2013
Teamleader	1-2-2018

Figure 20: Release data applications

4.3 The dashboard

A dashboard is a system that visualizes data in a clear overview such that decisions can be made (Janes, Sillitti, & Succi, 2012). In a dashboard, data is visualized with charts and tables. In most cases, dashboards are used to impress clients and are those dashboards, therefore, containing as much data as possible (Janes, Sillitti, & Succi, 2012). However, in this research, the dashboard is used for internal functioning, and therefore is there no need to impress clients. The dashboard will for that reason not be overloaded with data but will be created in such a way that it has a clear overview of the most important KPIs.

4.3.1 The looks of a good dashboard

A strong visual presentation of an interface such as a dashboard can greatly affect the interpretation of the interface (Grabowski, 1991). Therefore, the dashboard needs a strong and clear presentation of the data, in such a way that little space for own interpretation is left.

When writing down the text in a dashboard, the typography must be consistent. Maximal two different fonds may be represented on the dashboard to not make the dashboard untidy. The text needs to be in high contrast with the background of the dashboard, in order to let the text stand out (Dhareshwar, 2018).

Researching into the looks of the graphical images in a dashboard, it is demonstrated that the images should be clear and simple with only a few details (Geckoboard, 2021). Another important detail is that the data should be labeled, such that it is clear what the data means (Dhareshwar, 2018).

The last subject of visualizing a dashboard is the colours. Colour is one of the most effective ways to enhance information processes (Dhareshwar, 2018). A dashboard should contain at most seven colours to keep the dashboard apparent. There should be looked into the different levels of saturation between colours as well in case some of the dashboard consumers are colour blind (Dhareshwar, 2018).

4.3.2 The method in which a dashboard can help with solution forming

Decision-making processes are crucial for the success of an organization (Hansoti, 2010). Therefore, does every organization, small or large, need to optimize its decision-making process. The process of decision-making needs to be fast and accurate to participate in the growing global market of today (Hansoti, 2010). A dashboard is an interface that gives immediately an overview of various data, in order to accelerate the decision-making process.

For this research, the data of the application portfolio is visualized into a dashboard. This will help the decision-making process of which applications to keep and which to trade-in. Since a dashboard gives a clear and fast overview of the data, solutions can be made even faster.

At the moment, Traffic Today does not have an employee that is keeping track of the application data. Therefore, will it take a long time before the company realizes that an application's life cycle has ended already. This will lead to higher labour time and data entry errors since the application is not functioning optimally when the life cycle is ended.

The dashboard that will be created in this research will show the application data in such a way that the company can easily see which applications need to trade in and which applications can be kept.

4.3.3 The visualized dashboard

Now that all the KPIs are created and visualized, the main dashboard can be created. As mentioned in Section 4.3.1, the dashboard should consist of a maximum of two fonts and seven colours. Besides that, the graphs should be clear enough to leave a minimum space left for own interpretation which can be done by adding labels.

Before adding graphs into the dashboard, there is first a division of the three categories put into the dashboard. In these three boxes, the graphs with the corresponding KPIs will be shown, in order to make the categories clear.

After the division into three boxes, the boxes can get filled up with the KPIs. This will result in the main dashboard, shown in Figure 21. The main colour of the dashboard is made blue since the colour blue does not give any extra information such as the colour green means correct and the colour red means wrong. There is a different kind of shades of blue used since colour shades between the same colour are easier to see if someone is colour blinded.

To keep it clear which application is in which quarter in the ‘Business value vs. Technical fit’ graph, the colour of the application is changed into different shapes. Furthermore, the lifecycle is changed into red and green since here the values mention if something is correct or wrong. The updates are green since this is a positive change and the bugs are red whilst that is a negative change.

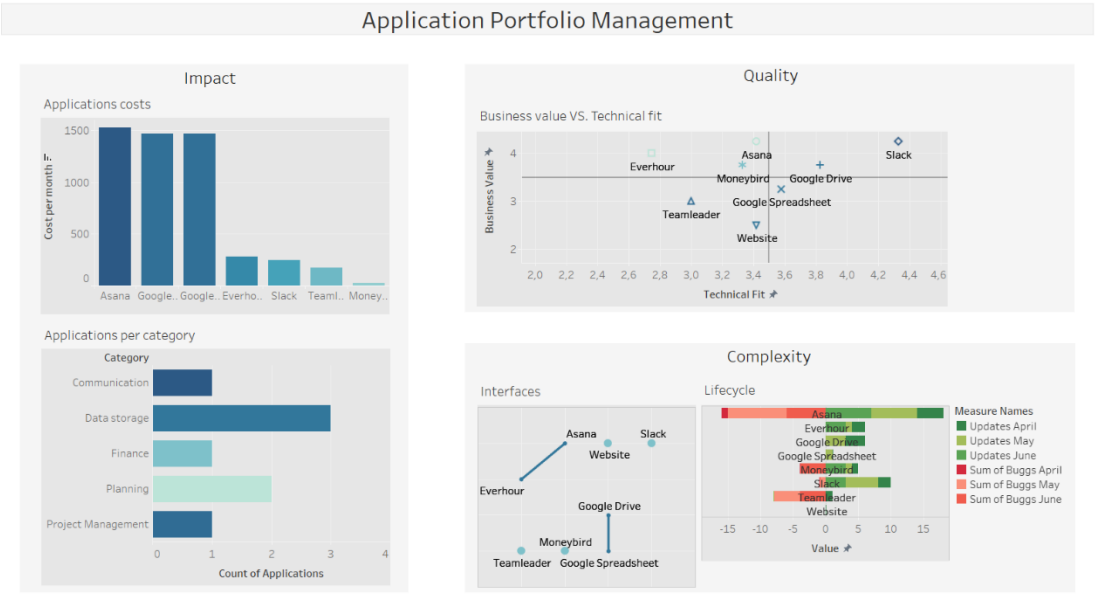

Figure 21: Main dashboard. This dashboard consist out of the most interesting KPIs.

Next to the main dashboard, an explanatory dashboard is created in which some extra details are shown, to give some more information about data. Here the business value and technical fit are shown with their values. These graphs have a colour scale from red to green since a score of zero is bad and a score of five is a perfect score. Besides that, the parameters of the technical fit are shown as well. This will make it clear if the data process is low whilst the quality is high for example. These are formatted with the same blue colour shades as in the main dashboard. Furthermore, the release dates are shown as well, which can help with the lifecycle to show if the high number of bugs and updates is caused by the old age of the application itself. When the costs over time are measured as well in the future, the graph stated in Appendix B.3 can be put in the lower right corner of the explanatory dashboard as well. This will make the explanatory dashboard complete. The explanatory dashboard is shown in Figure 22.

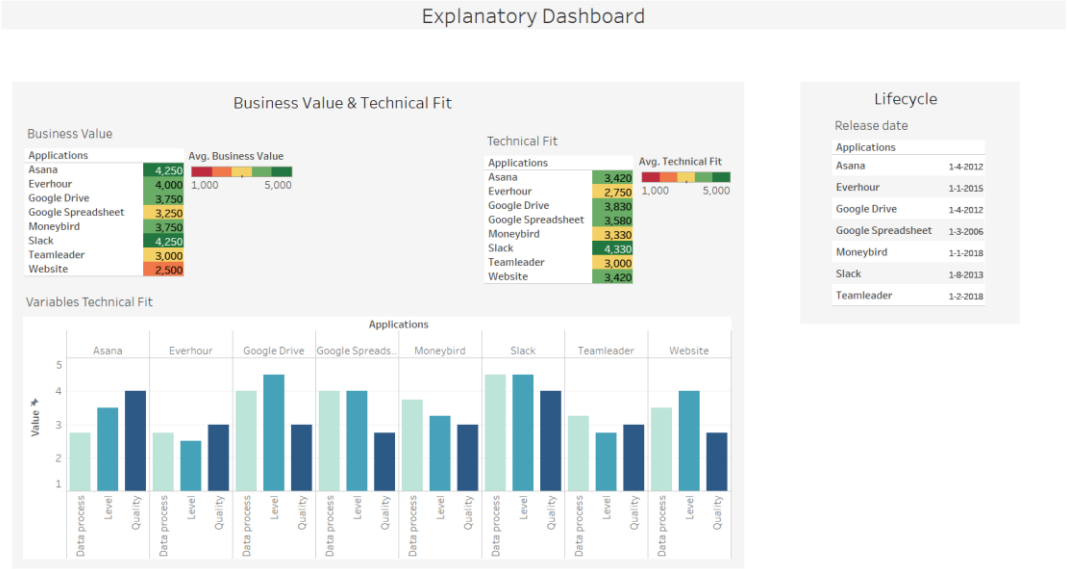

Figure 22: Explanatory dashboard. This dashboard is giving extra information about the KPIs shown in the main dashboard.

4.4 Concluding the results

This chapter discusses the results of the research. Firstly, is the survey analyzed. From this survey, it becomes clear that the participants find that too many applications are used at Traffic Today. On the other hand, do they think that the functioning of the applications is necessary to execute their work correctly. This shows that the applications should get more integrations between each other, to make the processes shorter. From the survey, it becomes clear that the website should be traded in for another application that is better functioning.

In order to create a dashboard, KPIs are defined. These KPIs are visualized into the main dashboard and an explanatory dashboard. From this dashboard, it becomes clear that Teamleader and the website should be replaced, according to their business value and technical fit. New interfaces have to be created as well, to make it easier for the employees to execute a process. Furthermore, is the lifecycle of Teamleader and Moneybird worse, which shows that these two applications have to trade in as well.

Chapter 5 Demonstration

In Chapter 5, the demonstration phase of the DSRP is entered. In this phase, it will be demonstrated how the previous research including the dashboard will help by searching for improvements. This will result in answering the fifth knowledge question:

5. *How to operationalize the application portfolio in order to create an optimal portfolio?*
    - *What can be improved from the current situation?*
    - *How can this be implemented?*

I will first search for points on how the current application portfolio can be rationalized, using the dashboard. During this rationalization, it will become clear what aspects of the application portfolio can be improved. After finding improvements, there will be examined how these aspects can be implemented. The improvements and how to implement these will be summarised into an advice for the company Traffic Today, which will be done in the next phase of the DSRP and will be stated in Chapter 6.

5.1 Potential improvements

The APR steps, as mentioned in Section 3.2, are already visualized into the APM dashboard. The lifecycle is visualized into the dashboard, which shows the data of the last three months and makes it possible as well to see if the number of bugs or updates is increasing or decreasing every month. The business value, quality, and costs are visualized into graphs too. In the main dashboard, the scatter plot of business value versus technical fit is shown, which makes it clear which applications should be replaced and which applications could improve their business value or technical fit. The explanatory dashboard exemplifies how the business value and technical fit is formed with the opinions of the employees considered as well. All the graphs shown in the dashboard are displaying important information about the functioning of the applications and this information can be used when searching for improvements.

5.1.1 Quality

The first graph that stands out is the 'Business value vs. Technical fit' when analyzing the dashboard. In this graph, four quadrants are shown and all the applications in the lower left quarter should be replaced. In the current situation are the applications Teamleader and the Website Traffic Today in the lower-left corner.

Since the results for Teamleader are for both business value and technical fit scoring a 3, which means that for both these aspects it is scoring neutral, Teamleader does not necessarily have to be replaced. Besides that, as analyzed in the survey's result not all the participants of the survey are using Teamleader. This makes it harder to know if Teamleader is neutral for both business value and technical fit. However, one of the participants does say: 'Teamleader does what it has to do, only all the information from Teamleader has to be filled in by hand in the other applications since Teamleader has no interfaces'. Therefore, Teamleader should get more interfaces or the application should be traded in by an application with the same function, and more interfaces.

The website Traffic Today is represented in the lower-left corner as well. For this application, the business value is even below neutral, which makes this application not suitable for the company Traffic Today anymore. Therefore, should there be looked at a different application in which the forms for a new client can be filled in and send to the team leaders for distribution.

In the explanatory dashboard for the business value, more applications are standing out. Besides the low business value of the website and Teamleader, Google Spreadsheet has been assigned a low value as well. The value for Google Spreadsheet is 3.25, which means that the participants think that this application has more of a neutral business value instead of a high business value. A business value of four and higher is preferred, since then the business value is high for the company Traffic Today. Therefore, it is convenient to search for better applications that can deliver a higher business value than Google Spreadsheet.

Everhour and Moneybird are noticeable as well in the explanatory dashboard. Everhour has obtained a score of 2,75 for the technical fit, which is even below neutral. Especially, the level aspect is scoring low for Everhour since the participants find the application difficult to use. Besides the level of difficulty, the application is unclear as well. It does not have a great overview, which makes it hard to work in this application. Therefore, a manual for the use of Everhour should be created by Traffic Today to make the application easier to use or there should be searched for another application with the same functioning but a better technical fit.

Moneybird is scoring below the expected high value as well. With a score of 3.33, the application is mainly scoring low on the quality of the application. Participants of the survey, mention that the output is not sufficient and the overview is lacking as well. This results in a lower score and there should be searched into the options of trading in the application for a better functioning application.

5.1.2 Complexity

Examining the interfaces graph of the APM dashboard results in the information that not a lot of connections are present between the applications. This is causing a lot of the same data entry in different applications in order to get the right information in all the applications, which is leading to a lot of labour time spent on data entry and a high margin of data entry error.

Combining the information of the applications per category and the interfaces demonstrates that the planning applications are connected and two out of three data storage applications are connected. From the survey and the conversations held with the company Traffic Today, the most important interface that is missing right now is, the interface between the categorized applications of data storage and project management. Between these two categories is a lot of equivalent data that has to be entered in different applications. Therefore, as an improvement, there should be looked into a system or technique that will link the application Teamleader, Website, Google Drive, and Google spreadsheet or the applications should be traded in for a better application with already existing interfaces.

The other graph that belongs to the category ‘complexity’ is the lifecycle of the applications. In this graph, it becomes clear how many bugs and updates occurred in the last

three months. From this graph, it becomes clear that Asana has by far the most bugs and updates.
Examining the explanatory dashboard gives us the information that Asana is the oldest application which makes it more logical that it contains the most bugs and updates. This is because the application is old and needs updates in order to keep up with the IT progress made during the past years. The lifecycle graph shows that the bugs increased over the past 3 months, but the updates are increasing as well. Therefore, there is no need to trade in Asana right now. When the number of bugs keeps increasing over a couple of months, there could be looked into possibilities to trade in Asana.

From the lifecycle graph, it becomes clear as well, that Everhour, Google Drive, and Google Spreadsheet should not have to be traded in based on the lifecycle. These applications do not have any bugs during the last quarter and they have a stable number of updates. This holds for Slack as well, which was having some bugs in May but none in June, and the number of updates exceeds the number of bugs.

On the other hand, do Teamleader and Moneybird have an increasing number of bugs. Both these applications are released in 2018, which makes them new and this should result in fewer bugs and updates. Unfortunately, is this not the case, since the number of bugs is increasing every month. For Teamleader the number of updates is very low as well, which makes the lifecycle of Teamleader worse. Analyzing the lifecycle of Teamleader shows us that the application should be trade-in. For Moneybird does the number of updates exceed the number of bugs, which gives it a good lifecycle. Therefore, should Moneybird not be trade-in by another application, but it would be recommended to keep an eye on Moneybird in the upcoming months.

5.1.3 Impact

The two KPIs that are represented in the category 'impact' are applications costs and applications per category. Applications per category are already discussed when comparing the interfaces with the categories in Section 5.1.2. The category data storage is the largest, which is logical since this category is the most important. When no data is stored, the work cannot be executed at Traffic Today. For project management could the category be larger, if this will make it faster for the project managers to enter the data into the different applications. Otherwise, the distribution is fine as it is in the current situation and no improvements are necessary.

The costs graph gives information about the monthly costs of the applications. In the current situation, the company Traffic Today does not have a problem with the prices of the applications, but when applications monthly costs are increasing there should be looked into cheaper applications with the same function.

5.1.4 Summarizing the possible improvements

In order to get a clear overview of the possible changes that could be made to improve the current situation, a table is created that summarizes the possibilities.

Applications	Complexity	Impact	Quality	Conclusion
Teamleader	Trade in or new interfaces	Keep	Trade in	This application scores low on lifecycle and business value. If new interfaces could be created the business value could increase a lot. Therefore, there could be looked in both options of trading the applications or creating interfaces with the application.
Website	New Interfaces	Neutral	Trade-in	The quality KPIs of the website is low. Therefore, there is recommended to trade in the website for an application with a better business value and that has more interfaces with the current applications.
Google Spreadsheet	New interfaces	Neutral	Trade-in	The business value for the Google spreadsheet is neutral, which could be improved by trading this application for an application with the same functioning and more interfaces.
Everhour	Adding a manual	Neutral	Good	For Everhour, participants of the survey find the application difficult to work with. Therefore, a manual should be created in order to decrease the difficulty. If the application then still scores low, the application should be trade-in.
Moneybird	Neutral	Good	Trade-in	Moneybird has a low technical fit since the overview and output are not always clear. Therefore, when there exists a better application, it could be traded in.
Asana	Keep an eye on	Neutral	Adding a manual	Asana is one of the oldest applications, which is leading to a lot of bugs and updates. Since the amount of updates is still exceeding the number of bugs, Asana can be kept. Furthermore, Asana is working with labels that are not always clear for the employees. Therefore, a manual should be created. This will increase the technical fit.

Table 22: Possible improvements based on the KPIs.

5.2 Implementing the improvements

Now that a summation of possible solutions is created, there is investigated how these solutions could be implemented and executed in the company. First, there should be searched for the applications that need to be traded in to create a new application overview. The next step is to look into the interfaces between the applications and what kind of solutions would suit the problem of a low number of interfaces.

5.2.1 Trading in applications

Teamleader is used for the project management part of the company. The application works well, but since there are no interfaces between other applications is the business value low. This business value could be higher when more interfaces are created or when the application is traded in for a better application.

When trading this application in, Airtable could be a good option. Airtable can be used for Google Spreadsheet as well to create an interface between the data storage function and the project management function. Furthermore, could Airtable be connected with Google Drive to create an extra interface.

As shown in Figure 23, Airtable has a lower number of bugs and a higher number of updates compared to Teamleader. This indicates that the lifecycle of Airtable is higher and will last longer than the lifecycle of Teamleader. The release date of Airtable is 2015, whilst Teamleader was released in 2018. Even with Airtable being three years older, the number of bugs is significantly lower than Teamleader which indicates that Airtable would be a great option to trade Teamleader in.

When comparing the costs, is Airtable more expensive than Teamleader. With Airtable, the subscription is per seat, whilst Teamleader is a monthly paid subscription. Since Airtable can be used for multiple functions within the company, the costs will be covering multiple business functions. Therefore, are the higher costs not a reason to not work with Airtable.

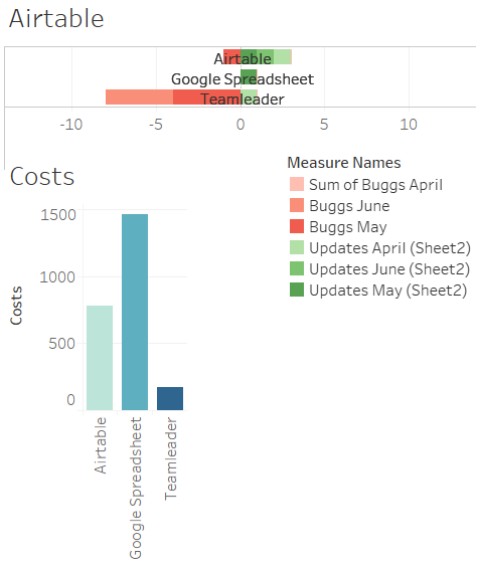

Figure 23: Airtable analysis. This figure shows how Airtable is functioning compared to Google Spreadsheet and Teamleader. Airtable is a possible application that can trade in both other applications. It had as better lifecycle compared to Teamleader and is lower in cost then Google Spreadsheet.

The website Traffic Today, was in the first instance a temporary solution to enter clients to the client base of the company. Therefore, are both business value and technical fit low of the quality KPIs and does the company want a different solution for the function client registration. A new application that could replace the website should have Customer Relationship Management (CRM). CRM is an application that automates the customer life cycle within an organization (Advice, 2021). There are existing a lot of applications that are only focussing on CRM. Traffic Today could choose to add such an application to their application landscape, but there are also existing company software applications that combine multiple functions including CRM.

An application that offers CRM is Silvasoft. Silvasoft is one of the highest reviewed company software applications, that can be used for accountancy, invoices, project management, hour registration, and client registration (Silvasoft, 2021). The application has multiple modules which can be switched off and on at the request of the client. With Silvasoft, new clients can be easily added and their information fields can be created to make the client form complete.

The Website Traffic Today has currently no costs or updates and bugs. Therefore, new applications will always have higher values at these aspects. In Figure 24, the lifecycle is shown of Silvasoft. Here it becomes clear that the application has had no bugs in the last three months and had 13 updates in April. Silvasoft updates once every quarter, which explains the high number of updates in April.

The costs for Silvasoft are not high as well, since with Silvasoft the payment is based on which modules the company is using. If Traffic Today chooses to use Silvasoft for CRM and for the finance part of the company, the costs are 28,30 euro per month for one user.

Google Spreadsheet is one of the key tools for businesses since it is a cloud-based spreadsheet application. Anywhere in the world, people can work on the same documents at the same time. This is a key factor for a business to make it possible that multiple employees can work together at the same time. Google Spreadsheets had very straightforward features, which makes it sometimes difficult if employees want to use more advanced options that Excel itself does offer. Therefore, is there looked at more advanced spreadsheet applications that are cloud-based as well.

When searching for cloud-based spreadsheets applications, there are five applications found: Microsoft Excel Online, Zoho sheets, Airtable, LibreOffice Calc, and Smartsheet. These applications have more advanced options than Google Spreadsheet, but not all of them can be connected to an online cloud. Since this is a very important aspect for Traffic Today, will some of the applications not be an option. When searching for the best replacement for Google Spreadsheet, Airtable is standing out. Airtable can be connected to Google Drive as well to store all the files in the same cloud as all the other files of the company. Besides that, does Airtable have an integration with Asana as well. This could make it easier to share data between applications since an extra interface is added.

As shown in Figure 23, Airtable is lower in costs than Google Spreadsheet and Teamleader summed. When analyzing the lifecycle of Airtable, Airtable has more updates than Google Spreadsheet. This is showing that Airtable is more up-to-date and that the lifecycle is higher than the lifecycle of Google Spreadsheet, which makes Airtable a good replacement for both Teamleader and Google Spreadsheet.

Moneybird has a low technical fit, as stated in Table 19. The overview is not clear and there are limited output possibilities. Therefore, it is recommended to trade the application in for another financial application with the same function but a better technical fit. Moneybird is specially made simple to make it for every business possible to do their accountancy (Moneybird, 2021). The business value for Moneybird is very high since Traffic Today is needing the financial application for their accountancy. Moneybird itself has said that the main feature of its application is its simplicity. If Traffic Today wants a more sophisticated program that has more output options, it should trade the application in.

An example of a more sophisticated program is Silvasoft. It is a more sophisticated application than Moneybird since there is a larger scale of options that can be used for example output and an extra plus is that the website could be traded in with this application well. When

using Silvasoft, the CRM and accountancy function is combined in one application instead of the website and Moneybird.

Traffic Today itself is already searching for a replacement for Moneybird as well. They are investigating if Payt is a good replacement. Payt is focussing on the accountancy factor only and is therefore a highly advanced program with a lot of features. Payt is a good application to trade in Moneybird, but cannot be combined with the function of adding client relationships.

Therefore, should Traffic Today decide if they want an application that is focused on accountancy or that they want an application that can function for the CRM part of the company as well.

When comparing Payt and Silvasoft to Moneybird, it becomes clear that both options are really good. The lifecycle of both Payt and Silvasoft are high, as shown in Figure 24 and the costs of both applications are lower than Moneybird. It is therefore up to the company to decide which features they want to use, and which applications fit best to the needs of Traffic Today.

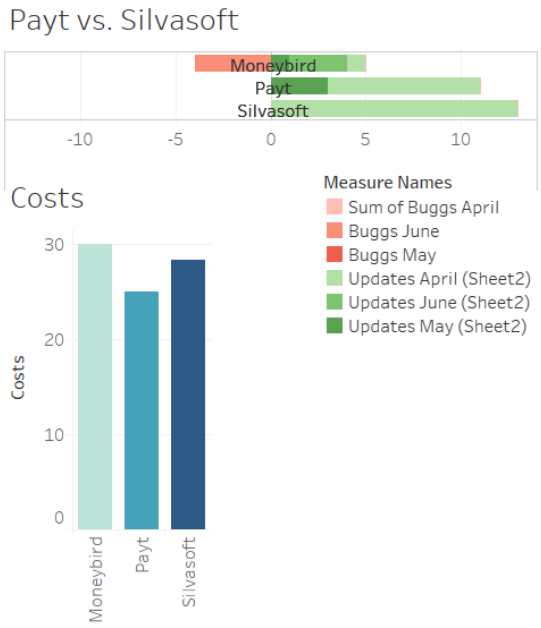

Figure 24: Silvasoft and Payt analysis. In this figure the replacement options for Moneybird are shown. Payt and Moneybird both have a better lifecycle. For the costs is Moneybird the most expensive, but this difference is minimal.

5.2.2 Interfaces

Now that there is looked at some options to trade-in applications, there is searched for a way to create more interfaces between applications. Interfaces are integrations between multiple applications that will share data automatically with each other to make sure that no labour time is wasted on entering the same data in different applications.

An easy way to create integrations without having Traffic Today programming everything for themselves is to use an already existing application that will create interfaces between applications for you. An example of such an application is Zapier. Zapier is an automation application that moves information between different applications. Subsequently, a company does not have to spend time entering extra data (Zapier, 2021). With Zapier, workflows can be created. A limitation of such an application is that it can only create workflows between an application that is stated in their database. From the current applications is only the website

Traffic Today not available in the database, which should not be a problem since this application will be traded in. If Zapier will be used to create interfaces, there should be taken into account if new applications are available in their database when trading in applications.

Another option to create interfaces is workflow programming. 'Workflow is the definition, execution, and automation of software processes where tasks, information or documents are passes from one program to another for action, according to a set of procedural rules.' (Hill, 2019). With workflow programming Traffic Today has to program code to create an automated workflow for the applications that will make sure the applications communicate when data is entered. This option is a lot harder to execute for the company, since they should program this by themselves, or they should hire an extra person that can program these workflows. An advantage of this option is that Traffic Today can choose their workflows instead of working with the standard workflows that are shown in an application such as Zapier.

The last option is to replace multiple applications for one application that contains all the functions needed. In this manner, there are no interfaces needed, since that one application covers all the functions, and the data is connected within the application. Not all the applications should be present in one application, but the applications within one category can be presented in one application.

In total there are three main solutions to create more interfaces: an automation application, workflow programming, or one overarching application. With an automation application or workflow programming are the applications connected through interfaces. With an overarching application are the integrations only in the application itself.

5.3 Concluding the demonstration phase

In the demonstration phase of the DSRP, are the potential improvements along with how to implement these discussed. From the dashboard, it becomes clear that the current application portfolio is not optimal. To optimize this dashboard, certain applications need to be traded in. These applications are Teamleader, the website, Moneybird and Google Spreadsheet. Furthermore, is there a need for more interfaces. There are three options given to create these interfaces. The first option is to add an automation application to the application landscape. This application creates interfaces between applications automatically. The second option is to workflow program. Here, the company Traffic Today needs to program the interfaces themselves. At last, can there be chosen to replace multiple applications with one overarching application. This will not create extra interfaces, but multiple functions will be present in one application instead of multiple applications.

Chapter 6 Evaluation

Evaluation is the last phase of the DSRP. Normally, in this phase, it will become clear how effective and efficient the dashboard and solutions were for the company. Since this research has a time limit of ten weeks, the solutions and dashboard are not implemented yet and only an advice is created. Therefore, is this phase used to show how the dashboard can be used and become valid for the company and to state the advice for improving the current application portfolio. In this phase is the last knowledge question answered:

6. *How can the dashboard be used in the company?*
    - *How to make the dashboard valid for the company?*

6.1 Validity of the dashboard

In order to make the dashboard valid to the company Traffic Today, it should be clear how to use the dashboard. The dashboard itself is created in Tableau with the data in an Excel file. This Excel file is stated in Appendix C.2. The dashboard is in the first instance created to show the current application portfolio for this research and to easily see where the applications can improve or need to be traded in. If the company wants to use the dashboard in the future, they need to update the excel sheet, which is automatically updating the dashboard in Tableau. Therefore, will there be explained how to update the Excel file.

6.1.1 The data of the dashboard

Most of the data in Excel is straightforward. The first row is the main header, which explains the data below. For example, 'Applications' contains the column with all the applications listed. The only data that is not straightforward is the data with the headers 'Line Y', 'Line X' and 'Circle Y'. This data is used to create the scatter plot of the interfaces. Line Y and Circle Y form the dual vertical axis and Line X forms the horizontal axis. The values for these headers are random numbers between 0 and 5 to make sure that the applications are stated somewhere in the graph. Circle Y and Line Y are containing the same data and it does not matter which values each application has, as long as the applications are shown in the graph. The header of the first row is explaining all the other data. When adding an application, the application can be stated below the last application in column A and the other information belonging to this application can be added in the same row. Data from already existing applications can be changed by simply editing the already existing data.

6.1.2 Analysing the dashboard

After entering the data, the dashboard can be analyzed. The impact KPIs are displaying general information about the application. The costs give a good insight into the distribution of the costs of the applications. If Traffic Today wants to reduce costs spend on applications, this graph will show which application is the most expensive. The other impact KPI is application per category. Here, it becomes clear which category is the largest represented in the company. When Traffic Today wants to focus more on a specific category, this graph will show if that category is highly represented with applications or that a new application should be added.

The next KPI category is Quality. The 'Business value vs. Technical fit' scatter plot from the main dashboard is divided into four quadrants. All the applications in the lower left quadrant should be replaced. The higher left and lower right quadrant applications can be updated, but do not have to be replaced immediately. When more information is needed on the business value or technical fit, the explanatory dashboard could be entered. Here it is shown, how high the business value is and the different aspects rated for the technical fit.

The last KPI category is impact. The interfaces graph shows the interfaces between different applications. If the company wants more integrations between applications, it can be shown in this graph which applications already are integrated and which applications are working on their own. The last graph of the main dashboard is the lifecycle. Here it is shown how many bugs and updates the applications have had during the last three months and if these amounts are increasing or decreasing. If Traffic Today is in doubt if the applications lifecycle is still sufficient, the explanatory dashboard could get entered in which the release dates of the applications are shown. If the application is released a long time ago and the number of bugs is increasing, the lifecycle of the application will not be sufficient anymore and the application should be replaced.

6.2 The advice

The main question of this research is: *'How to create a portfolio of the applications at Traffic Today and how to operationalize this portfolio?'.* In this advice, it will become clear how the portfolio can be operationalized and what implementations Traffic Today could carry out to create a better application portfolio. The advice will be based on the findings of this research, especially on the improvements and implementation plan for these improvements as stated in Chapter 5.

6.2.1 Trading in applications

When analyzing the application landscape and the application management portfolio dashboard, it becomes clear that the application portfolio can be optimized in the current situation. From the eight main applications that this research is focusing on, four could be replaced for a better application. These four applications are:

1. *Teamleader*
2. *The website Traffic Today*
3. *Google Spreadsheet*
4. *Moneybird*

This research analyses for every application, one option to trade in the current application. When the company chooses to trade in these applications, there should be looked into more than one option for the applications. Traffic Today has to decide which features are the most important to them and what kind of aspects are weighing heavier than others. If there is for example a maximum to the costs per month or is the lifecycle more important than the costs. An analysis of all the possible options should be made and the dashboard can be used during these analyses to compare the current application with the several options.

6.2.2 Interfaces

Analyzing the APM dashboard and the application landscape, it becomes clear that not a lot of interfaces exist between the applications. According to the survey is this a problem as well, since

this leads to a high labour time spend in the applications entering data. For this problem, three possible improvements can be chosen by the company:

1. Use an already existing automation application. With an automation application, application workflows will be created between multiple applications without having the company program itself. An example of such an application is Zapier. An advantage of such an application is that workflows are easily and fast created. Disadvantages are that another application has to be added to the company's application landscape, which will cost more money. Besides, the application is working with a database of applications, which does not contain all existing applications. Therefore, Traffic Today should first look if the applications that they want to create a workflow with are present in the database. Otherwise, no workflow can be created.
2. The second option is for Traffic Today to create the workflows by themselves with workflow programming. Workflow programming is a way of programming that creates workflows between applications to make the applications start working together. In principle does this work the same as the first option, but Traffic Today is not bound to a fixed database which is an advantage. A disadvantage is that this option will take up a lot of time and Traffic Today should hire an extra employee that is experienced with workflow programming.
3. The last option is to replace multiple applications for one overarching application. With this method, no new interfaces are created, but applications are merged which will have the same effect. An advantage of this option is that the application landscape will become less complicated and a lot of data can be entered into just one application. A disadvantage is that there should be first looked if such an application exists. Normally, an application with a lot of functions has a few outstanding features and a few features that get less attention and therefore are working less. Therefore, Traffic Today should make sure to analyze the new application options very well, before trading in their current applications.

It is recommended for Traffic Today to carry out at least one of the options, to optimize their application portfolio. I recommend carrying out a combination of the first and third options. For the applications that need to be trade-in, there can be searched for an overarching application. For the other applications, the first option will fit the best, since an automated application is easy to use and has already existing integrations between applications. It will take less time to execute, compared to programming the workflows by yourself. Furthermore are the integrations already existing, which is limiting the amount of error between integrations. These errors can occur more when there is chosen to workflow program integrations by Traffic Today themselves.

6.2.3 Recommendations for applications

For the four applications that do not need to trade-in, some recommendations are created in order to optimize their functioning as well.

Asana is an application that has a high business value and a neutral technical fit. From the survey, it became clear that there are no guidelines on which labels to use. This results in inconsistency with creating labels. This can make it harder to work with Asana. Therefore, is it recommended to create a manual with guidelines for which labels to use in Asana. This will make sure that every employee within Traffic Today uses the same labels and no misunderstanding will be created. Furthermore, Asana has a function in which it can work together with Gmail, which is used by the company as well. Not a lot of employees are aware of are using this function, which could optimize the technical fit of Asana. It is therefore recommended to update the employees on this function of Asana. This can be done by email, but it is advised to do this during a live event such as the weekly knowledge lunches of Traffic Today.

Everhour has a low technical fit as well since it became clear from the survey that employees find it difficult to work with Everhour because of lacking knowledge. Therefore, is it recommended to write a manual, which employees could refer to when encountering difficulties.

Google Drive is one of the main applications from Traffic Today. The main aspect that makes Google Drive so important is working in the cloud. Every employee can work in it at the same time. This is a disadvantage at the same time since a lot of mistakes are made with copying and changing existing files. The overview is therefore getting lost sometimes. A recommendation will therefore be, to create a clear manual as well on how to use Google Drive. An explanation on how to change existing files and how to save these to drive can be stated here as well as the categories used to sort the Google Drive. This will make it clear where which files need to be saved and where to find certain files.

The final application left to discuss is Slack. Slack is a communication application that is working as supposed. Therefore, is there no need to change the application or the way that Traffic Today is working with Slack.

6.2.4 Further recommendations

Now that the recommendations regarding changes to the applications and interfaces are discussed, further recommendations are stated. These recommendations are more focused on the general functioning of the applications portfolio instead of the applications themselves.

In order to keep the application portfolio up to date, the dashboard should be updated on a regular time-based. Traffic Today can choose to do this at any time, but it is recommended to update the dashboard at least every quarter. When updating the dashboard, it will become clear if the current application portfolio can be optimized. If it becomes clear that the application portfolio is not optimal anymore, there should be looked at the possible improvements.

Most of the data can be simply filled in the Excel sheet, but for the technical fit and business value, a survey should be held first. To make this easier, a recurrent reminder can be set every quarter which will send the survey automatically to the employees. It is recommended to send the survey to every employee in order to count in all the opinions in the analyses. The survey is made in Survio, but to make it easier it can be created in Google Forms to immediately save the results in Google Drive.

Since operationalizing the application portfolio can take up a lot of time and needs a certain level of technical knowledge, it is recommended to hire an extra employee that will work

on the application portfolio. This employee can help with all the IT problems within Traffic Today and can keep the dashboard up to date as well as solving bugs. Especially since Traffic Today is a fast-growing business, it is important to keep operationalizing the application portfolio. This will help the company to not spend too much labour time or costs on applications that are not worth it anymore. When Traffic Today chooses to workflow program the integrations between applications by themselves, it can be recommended to hire a student for this as well. A Business Information Technology (BIT) student is specialized in creating workflows between applications and can work on this during a graduation assignment or an internship. The advantage of hiring a student instead of an employee is that students will have lower costs and they have extra guidance from the school.

6.3 Research validity

In this section of the research, the validity of the research for the company is stated. Research validity means how accurately a method measures something and will show if the research helps to improve the company Traffic Today. The goal of this research was to create an application portfolio to improve the applications in the current situation and in this section, it will become clear if this research actually will help the company.

During the research, meetings were held with the company supervisor. In these meetings feedback was asked from Traffic Today, to make sure that the research will be valid for the company and that Traffic Today can indeed use this research to optimize their applications. The logbook of these meetings, including the feedback of the company supervisor is stated in Appendix D.1.

As mentioned before, the goal was to optimize the applications at Traffic Today by creating an application portfolio and an accessory dashboard with KPIs. Since the time limit of ten weeks, there was decided in consultation with the company itself, to not implement the research its improvements and recommendations. Instead, this research is offering an advice that the company can consider carrying out to optimize the applications and rationalize the application portfolio. Therefore, the research is not optimizing the current application portfolio. The research is only stating an advice that will improve the current application portfolio when carrying it out.

A final meeting with the company will ensure the research validity, in which all the improvements and recommendations stated in the advice are discussed and explained. From this meeting, it becomes clear that the company finds the research valid since an application portfolio is created and the advice will help improve the current application portfolio. Traffic Today will use the created application portfolio, to search for further improvements in the future.

Furthermore, Traffic Today will spend more time operationalizing the application portfolio, starting with researching the possibilities to use Zapier as an automation application to create interfaces. The company does find the advice for hiring an employee too impulsive to execute right away, and will therefore first try to operationalize the application portfolio by themselves. Besides that it is impulsive, will hiring an employee include costs as well. Therefore

the company needs to make a financial analysis as well, to research if an extra employee will be profitable. When in the future it appears that it is indeed too complicated or is taking up too much labour time, the company will consider hiring an extra employee that is focussing on rationalizing the application portfolio.

At last, Traffic Today will analyze multiple options to replace the four mentioned applications, that are not functioning well enough anymore, in this research. For Moneybird they are already searching into replacement options.

All aspects considered, is this research proved to be valid for the company Traffic Today. The research did reach the goal of creating an application portfolio that will optimize the current situation when the recommendations and improvements are carried out by the company.

6.4 Concluding the advice

This chapter contains the advice for Traffic Today. Firstly, how to use the dashboard is explained with the belonging data included. Secondly, the recommendations are stated. Besides the recommendations of trading in applications and creating more interfaces, are there general recommendations as well. It is recommended to write a manual for certain applications, which will make it clear how the applications should be used. Furthermore, is it recommended to update the dashboard every quarter and to hold a survey as well. At last, is there recommended to assign the task application portfolio rationalization to a team or person. This will make sure that the portfolio will be optimized often. APR is an ongoing process that will never stop and it is therefore important to assign employees that can investigate this subject.

Chapter 7 Discussion and conclusion

This chapter is the final chapter of this research. In this chapter is the discussion and conclusion stated. The discussion exists out of the limitations, the physical relevance, and the alternatives of this research. In the alternatives, is it explained what future works can do differently as well. The conclusion consists out of a summary of this research. The final section of this chapter consists out of a reflection, which includes guidelines for other researchers that want to execute such a study as well.

7.1 Discussion

In this discussion, the limitations of this research are addressed. The goal of this research was to create an application portfolio of the applications used in the current situation at Traffic Today. A survey is held and a dashboard with KPIs is created to reach this goal. Furthermore, the physical relevance of this research is stated in the discussion. The physical relevance of this research will show how this research influences the stakeholders. At last, will the alternatives of this research be discussed in the discussion as well. This will give an overview of other methods to execute this research.

7.1.1 Limitations

The first limitation of this research is the time limit. Since the research is executed within a time limit of ten weeks, not all applications are analyzed in this research. The eight main applications of the company are used in this research, but when continuing with application rationalization all applications should be analyzed and put into the dashboard. This will include the external used applications as well, which are the applications that are connected to stakeholders outside the company.

Furthermore, the time limit has as a consequence, that the improvements are not implemented in the company yet. There is only an advice stated with recommendations and the company itself has to implement these recommendations if wanted. To implement these recommendations it is necessary to execute an in-depth analysis for the applications that need to be trade-in. A company cannot just replace multiple applications at once, since the applications form the basis of the company. Therefore there should be made an analysis on the effects on how these replacements will influence the company and if those effects are worth it to replace the application or if it is more profitable to hold on to the application for now.

Another limitation is that this research was executed during COVID-19. This meant that a lot of work had to be done from home and in the beginning, offline meetings were not possible to schedule. Therefore, was there chosen to hold a survey instead of online meetings, to let the participants choose for themselves when to fill in the survey. If COVID-19 was not existing, more meetings would be held to gain information about how the employees look at the currently used applications. Therefore, is it recommended to hold the survey at all the employees working at Traffic Today, when the company will execute future research on this subject. This will make the results of the survey more applicable and accurate to Traffic Today since now all the answers will be taken into account.

The third limitation is that the data for the dashboard is not based on the past. Since for a lot of KPIs the data is measured for the first time, the dashboard can only show the current situation. In the future, all the past, current, and future data should be saved to let the dashboard show the changes over time for the KPIs as well. Graphs shown as in Appendix C.1 can then be created and shown in the explanatory dashboard as well. When all this data is saved, it will also become clear how much data-entry errors are made during the execution of a process. This can then be added to the dashboard as a new KPI since the data-entry error is an important aspect of the functioning of the applications.

In the end, did these limitations not get in the way of reaching the goal. However, if Traffic Today is going to rationalize the application portfolio, the limitations should be addressed and there should be looked for a way to eliminate these. For all limitations, there is stated how the limitations could be avoided in future research and this should be taken into account when continuing this research.

7.1.2 Physical relevance

The physical relevance discusses the influence of this research on the stakeholders. The stakeholders of this research are the company Traffic Today, the employees, the clients, and the system providers of the applications.

The company Traffic Today is the main stakeholder since its internal applications are researched and optimized. This research is mapping the applications into an application portfolio and is stating recommendations that will optimize the application portfolio. The company Traffic Today needs to discuss how they will use this research and what the follow-up steps will be. When they choose to replace multiple applications, as stated in this research, the current way of working will change for the company. New applications will be added to the application portfolio, which will cause changes in the processes that have to be executed. It is therefore important that Traffic Today will invest time into getting to know the new applications, which will make the transition to a new application easier. Furthermore, will the costs change as well when new applications are added to the application landscape and when a new employee is hired to keep the application portfolio rationalized. Therefore, is it important that Traffic Today has a clear overview of what amount of money and time they want to invest in application rationalization and what the most important aspects are for the company, regarding the KPIs.

Another stakeholder that is very important in this research, is the employees. The employees are the persons that have to work with the application portfolio. Optimizing the application portfolio will have a positive influence on the employees, since executing processes will be easier and more clear. To count in the opinion of the employees, the survey is held. As stated in the recommendations, is it recommended to hold this survey every quarter. Therefore, will this research has as an effect on the employees that a survey needs to be filled in at a regular time base. This will cost the employees around 30 minutes, but it will have as a result that their opinion is counted in when researching how to optimize the application portfolio.

The third stakeholder is the clients. This research will not affect the clients in the beginning. They will be affected, when some of the recommendations are carried out at Traffic

Today. At first, will the effects not be measurable, since Traffic Today needs to adjust to a new application portfolio. However, when the application portfolio is rationalized and the processes are executed easier and faster, will this affect that the work of Traffic Today can be executed better. The clients will notice this as well since they will receive a better product of Traffic Today.

The system providers of the applications are the last stakeholders. These stakeholders are only affected by this research when Traffic Today chooses to execute some of the recommendations. When Traffic Today is going to replace current applications, these system providers will lose one of their clients. This will result in less profit for the system providers.

All the stakeholders are positively affected by this research, except the system providers. The system providers will lose a client or there will be no effect when Traffic Today chooses to keep the applications.

7.1.3 Alternatives

In this section, the alternatives for this research are discussed. This research can be executed in different ways and as shown in the SLR in Chapter 2, has this subject already been researched by other researchers.

I have chosen to create six KPIs in this research from which the data was already known. Instead of creating KPIs of data that already exist, an alternative is to create the data for a KPI. For example, measure the time an average employee is working in a certain application. In this way, the labour time that an employee spends in an application can be measured and this can show if too much time is spend in certain applications. Another KPI that can be created is the data entry error. This KPI can show how many data-entry errors are made in an application within a certain time. This can show if some applications have a high margin of data-entry error and such applications can then be replaced. Data for these KPIs are not existing yet and should be created by researching these KPIs. These KPIs can give a lot of interesting and valuable information about the functioning of an application, but it will take up a lot of time to create the data and measure this. Therefore, are there in this research only KPIs created with already existing data. When a researcher has not limited time for executing research, KPIs such as labour time and data-entry error can be created as well.

Furthermore, can the research be elaborated more on the effects of the recommendations. This research is mainly focusing on mapping the applications and how to operationalize the application portfolio. In the future, the effects on the company should be included as well. Replacing applications will be a major change for the company and its employees. The way of working will change and a new application needs to be worked into the current system of applications. Besides the technical effects of the improvements, will these have a financial effect as well. To elaborate more on the effects of the recommendations, a financial analysis should be included as well. Aspects such as, ‘what will it cost to replace applications?’, will be discussed in this financial analysis. The costs of hiring a new employee can be added to this analysis as well and the analysis can show if it is profitable to hire a new employee or if the company should choose to not hire an extra employee for now.

At last, an alternative is to analyze what the minimal values for an application have to be according to the company and to base the research on these values. I first started with mapping the applications, followed by creating a dashboard, and from this dashboard, I searched for improvements. Another option is to start with creating minimal values that the applications need to have for the company. After creating these values, there can be researched if the applications meet these criteria and if not, the applications can be replaced. A disadvantage of this approach is that an application is limited when it is not meeting the minimal values of one KPI, even when an application is excelling in the other KPIs. If for example, the amount of bugs is in one month high for a particular reason, the application is not meeting the minimal value and should be replaced. However, this can be a one-time event and the application could still be functioning well for the company. Therefore it is recommended to look at all the values for the application and make a decision based on all the KPIs, instead of one.

7.2 Conclusion

In this section, the main findings of the research are discussed. This research is held since I have a high interest in making companies more efficient. Furthermore, do I want to prove that IEM is not only focusing on IT-focused companies but is also applicable to other markets such as online marketing.

7.2.1 Problem identification

This research started with researching the current situation. In the current situation are a lot of applications used, is there a high data-entry error, is a lot of labour time spent in the applications, and is there no overview of the applications. Therefore is there a problem cluster created, which shows the core problem: 'There is a lack of overview of the intern applications'. The lacking overview is resulting in a lot of time spent in the applications and a high-data entry error. Therefore, a research question is created to get a clear overview of the intern applications. The research question is:

'How to create a portfolio of the applications at Traffic Today and how to operationalize this portfolio?'

To answer this research question, knowledge questions are answered. The knowledge questions that are answered during this research are stated below.

1. *How to use Application Portfolio Management (APM) to create a portfolio of the applications?*
2. *How to create a good survey and how to analyze the results of a survey that will take into account the points of view of the employees regarding the current situation?*
3. *How does the current application portfolio look like?'*
4. *How to create a dashboard that will show the functioning of the internal applications?*
    - *How does a good dashboard look like?*
    - *How can the dashboard help with optimizing the application portfolio?*
    - *Which KPIs will be shown in the dashboard?*
    - *How to visualize the KPIs in the dashboard?*
5. *How to operationalize the application portfolio in order to create an optimal portfolio?*

- *What can be improved from the current situation?*
- *How can this be implemented?*

6. *How can the dashboard be used in the company?*
    - *How to make the dashboard valid for the company?*

After defining the problem and the knowledge questions, I investigated if there is already existing research on this subject. The SLR came up with three scientific articles that execute a research that operationalized an application portfolio.

7.2.2 Design and development

The next step is to enter the design and development phase of the DSRP. This phase starts with the research design. This research is an exploratory research with both quantitative and qualitative research. In this research, a survey is held to count in the opinions of the employees regarding the current situation. Furthermore, is there an artefact created, which is a dashboard based on KPIs.

After the research design, the current situation is mapped. Firstly, a list of applications and who owns the application should be compiled, to create an application portfolio. There is chosen to focus on the eight main applications used by Traffic Today. The BPM of new clients displays that a lot of different steps in different applications need to be executed to execute one process.

The last step is to hold a survey with the management team and two team leaders. These employees are the bones of the company and work with all the applications, which will give a good impression of the view of the employees regarding the current situation. In the survey, general questions will be asked and specific questions related to the applications are asked as well.

7.2.3 Results

The next phase of the DSRP is the phase with the results. This phase starts with analyzing the results of the survey. From the survey, it becomes clear, that all the participants think that too many applications are used. However, they think that the functions of the applications are needed to execute their work. This indicates that the processes need to be more simplified, by adding interfaces or replacing multiple applications with one overarching application. Besides the general results, is it becoming clear that the website needs to be replaced. The website is a temporary solution, that is not functioning well anymore. Furthermore, are Everhour, Asana, and Google Drive in need of a manual that will make it easier to work with the applications.

The results phase includes creating the artefact as well. In this research is the artefact the dashboard and the KPIs. Six KPIs are created and visualized into the dashboard, consisting out of one main dashboard and an explanatory dashboard. The six KPIs are as follows:

1. Costs
2. Application per category
3. Business value
4. Technical fit
5. Number of interfaces
6. Lifecycle

The dashboard needs to be analyzed, to rationalize the application portfolio. This analysis is executed in the demonstration phase of the DSRP.

7.2.4 Demonstration

The results are followed up by the demonstration phase of the DSRP. From the dashboard, it becomes clear that four out of eight applications could be traded in. These applications do not have a good lifecycle, business value, or technical fit anymore and Traffic Today should look for a replacement of these applications. The first application that should be replaced is Teamleader. Teamleader has a low business value and technical fit. Furthermore, is the lifecycle of Teamleader worse as well. The second application that needs to be replaced is the website of Traffic Today. As mentioned before, this was a temporary solution. The third application that should be replaced is Moneybird. Moneybird is becoming too simple for Traffic Today and they should replace Moneybird with a more sophisticated application. At last, should Google Spreadsheet be replaced. The replacement should be a cloud-based application as well but has to have more features.

Next to trading in several applications, interfaces should be created as well. There are three ways to create interfaces that are recommended to the company. The first is working with an automation application, which will automatically create workflows between applications. Secondly, Traffic Today could choose to workflow program the integrations themselves and the last option is to trade in multiple applications for one overarching application. It is recommended to combine the first and last options. The application that should be replaced, can be replaced with an overarching application. For the other applications is it convenient to use an automation application that will program the workflows, since this is the easiest way to create interfaces between applications.

7.2.5 Evaluation

The last phase is evaluation and in this phase is the dashboard made valid for the company and final recommendations are stated. A manual, on how to use the dashboard and how to enter data is added to the advice. This manual will make sure that Traffic Today can use the dashboard after this research is ended and that they can analyze the dashboard by themselves. The final recommendations are to create manuals for certain applications, in order to make the work process easier and to make sure that all the employees are using the application equivalently. It is recommended to update the dashboard every quarter as well, to search for improvements that appear over time. Application rationalization is a never-ending progress and technology is growing faster every day. Therefore, is the last recommendation to hire a student or employee that can work with the application portfolio, to keep the application portfolio updated.

7.2.6 Final conclusion

Summing up all these steps provides the answer to the research question of this research. In order to create a portfolio of the application, there should be created a list of the applications and who owns the applications. Afterward, a dashboard with KPIs should be created, followed by the step of researching for improvements and recommendations. The last step is to make the dashboard valid and to search for final recommendations. When all these steps are conducted, an application portfolio is created and is rationalized.

7.3 Reflection

In this section, I reflect on the research and what I should do differently if I could do it all over again. This reflection can be used as a guideline for researchers that want to execute such a study as well.

First of all, I would not make the survey anonymously. I have chosen to make the survey anonymously during this research because employees could answer the questions without feeling the pressure to give 'correct' answers. A disadvantage of making the survey anonymous is that follow-up meetings cannot be held, since it is not known who answered the questions. Therefore, do I think that the survey should not be anonymous next time. The answers can be published anonymously, but they should not be anonymous for the researcher.

Secondly, I would add an analysis of the features of the applications into the current situation. At the end of this research, it became clear that some of the applications have already built-in features that can connect multiple applications or that create a new function within the application. These functions can be really helpful when rationalizing the application portfolio and it is therefore convenient to list all these features at the beginning of the research. This will make it clear, which features are already existing but not yet used by the company and these features can make an application score better in the dashboard.

At last, would I hold more meetings with different employees of Traffic Today during the research. The main contact person for this research is my company supervisor. Especially at the end of the research, it would be more convenient to hold meetings with different employees, to include different opinions in this research. Different people can come up with different points of feedback, which will make the research more complete.

In conclusion, would I change some parts of my research if I needed to execute it again. The main part of the research would remain the same, but certain details of the research would I change to make the research even better.

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Appendix A

Appendix A.1: Gantt Chart

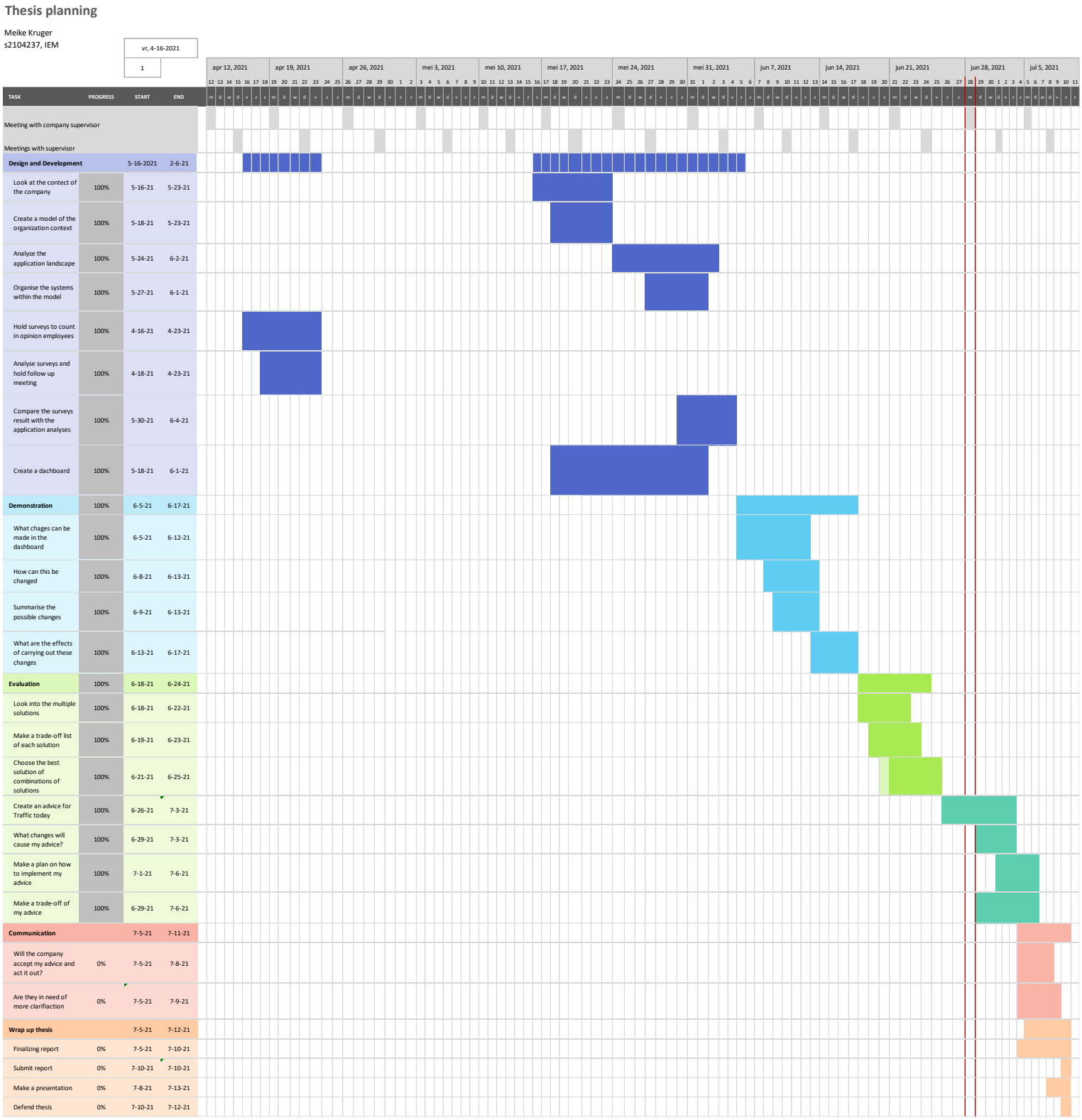


Figure 25: Gantt chart. This Gantt chart shows the planning for the 10 weeks of this research. The planning is divided into the different phases of the DSRP.

Appendix B

Appendix B.1: Reliability and validity

Section	Discuss
Literature review	Investigate the methods of other researchers that executed reliable and valid research with the same data collection method that I'm going to use.
Research Methodology	How am I going to be certain that my measures are reliable and valid? Specify the populations, conditions, and techniques.
Results	Show that the results are reliable and quantifiable. Show that the result of the analysis and the survey implicate the same decisions.
Discussion	Reflect on how reliable and valid the results were.
Conclusion	Mention how reliability and validity played a role in my research.

Table 23: Reliability and validity (Middleton, 2020)

Appendix B.2: Function table applications

Application	Subscription	Function
Asana	Business 50 Users	Asana is a planning application. It coordinates tasks and shows deadlines. Teams can work together in Asana so that it is clear what still needs to be done and is finished already. Team leaders can put in personal tasks that need to be finished. In short, Asana keeps track of the progress made.
Slack	40 Users	Slack is a business communication platform (Slack, 2021). It has multiple chat features such as chatrooms, private groups, and direct messages. Slack is mainly used for intern communication but is used for some clients as well. Especially with the COVID-19 outbreak, is Slack becoming more important.
Everhour	All-in-one Yearly	Everhour is a team-oriented time tracking application (Everhour, 2021). The application tracks time for budgeting, client invoicing, and payrolls. It can be connected to multiple planning applications, such as Asana.
Google drive	Google Workspace Business	Google Drive is an application to store files and synchronizations service. General and specific files are saved in folders so that a clear overview can be created. Multiple employees can work together at the same time in the same file and Google drive can be used offline as well.
Google spreadsheet	Google Workspace Business	Google spreadsheet is an application connected with Google drive since this is a feature of Google drive. It is a simple version of Excel, but it is online and multiple employees can work in a file at the same time.
Teamleader	CRM	Teamleader is a project management application. In Teamleader, clients can be managed, offers can be made, projects can be managed, hours can be registered, invoices can be created and it keeps tracking the money inflow. Especially the project managers are working with this application.
Website Traffic Today	-	The website Traffic Today is mostly an application for attracting clients, but sales are using it as well to fill in the form with new clients that are sent to project managers. Therefore, is in this research the website seen as an application to fill in the form and communicate new clients to project managers.
Moneybird	Unlimited subscription	Moneybird is an accountancy application. With this application, offers can be made and transactions can be done fast. It gives an overview of all the offers and costs made. It is an application for financial administration.

Table 24: Application information

Appendix B.3: BPM process new client

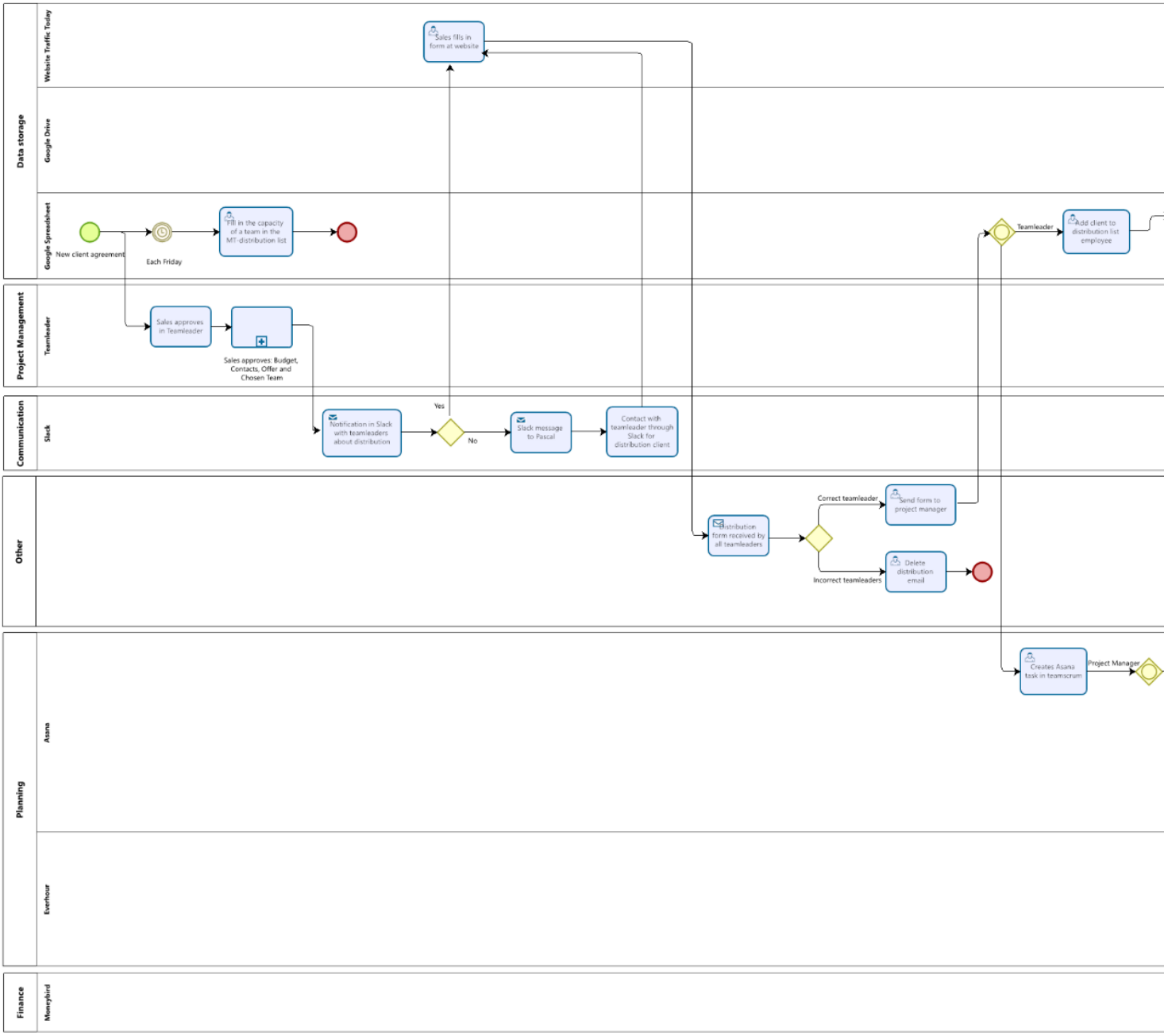
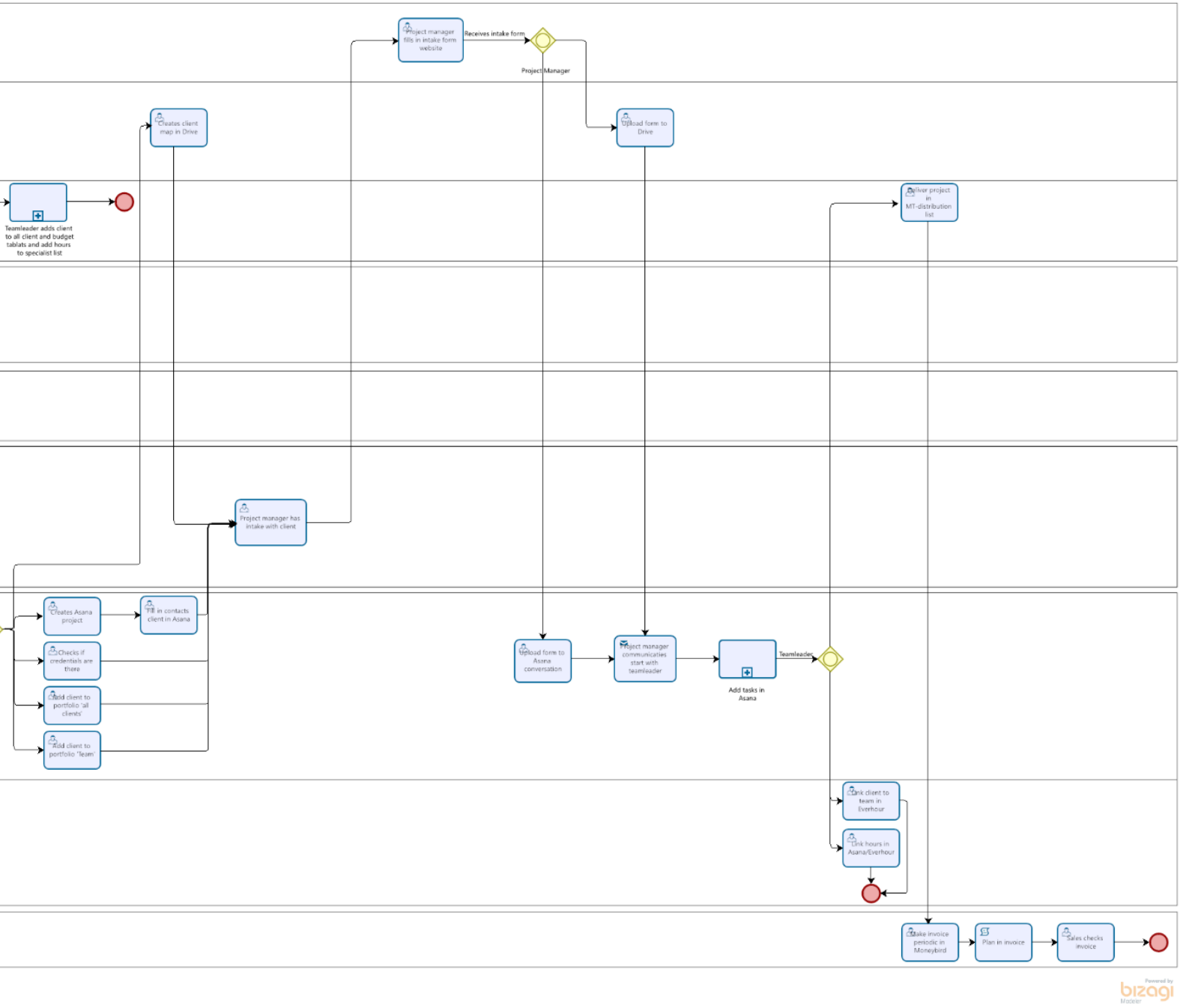


Figure 26: Business Process Model new client. This process shows the steps that has to be taken and the applications in which these steps are executed.


Project manager fills in intake form website
Receives intake form
Project Manager
Creates client map in Drive
Upload form to Drive
Teamleader adds client to all client and budget tablats and add hours to specialist list
Deliver project in MT-distribution list
Project manager has intake with client
Creates Asana project
Fill in contacts client in Asana
Checks if credentials are there
Add client to portfolio 'all clients'
Add client to portfolio 'Team'
Upload form to Asana conversation
Project manager communicates start with teamleader
Add tasks in Asana
Teamleader
Link client to team in Everhour
Link hours in Asana/Everhour
Make invoice periodic in Moneybird
Plan in invoice
Sales checks invoice

Appendix B.4: Survey (Dutch)

Algemene vragen:

1. Wat vind u van de hoeveelheid applicaties die Traffic Today gebruikt?
    a. Veel meer applicaties worden gebruikt dan nodig
    b. Meer applicaties worden gebruikt dan nodig
    c. Precies genoeg applicaties worden gebruikt
    d. Minder applicaties worden gebruikt dan nodig
    e. Te weinig applicaties worden gebruikt dan nodig
2. Kunt u dit antwoord toelichten?
3. Zie je de applicaties die je gebruikt als nodig voor het uitvoeren van je werk?
    a. Alle applicaties die ik gebruik zijn nodig voor het goed uitvoeren van mijn werk
    b. Een groot deel van de applicaties is nodig voor het goed uitvoeren van mijn werk
    c. De helft van de applicaties die ik gebruik zijn nodig voor het goed uitvoeren van mijn werk
    d. Een klein deel van de applicaties is nodig voor het goed uitvoeren van mijn werk
    e. Geen van de applicaties is nodig voor het goed uitvoeren van mijn werk
4. Kunt u het antwoord toelichten?
5. Hoeveel van de applicaties zijn verouderd en moeten ingeruild worden? (Bestaan er betere applicaties die dezelfde functie hebben)
    a. Alle applicaties kunnen vebeterd worden
    b. Een groot deel van de applicaties kan vebeterd worden
    c. De helft van de applicaties kan verbeterd worden
    d. Een klein deel van de applicaties kan vebeterd worden
    e. Geen van de applicaties kan vebeterd worden
6. Kunt u het antwoord toelichten?
7. Kunnen er applicaties samengevoegd worden? (Applicaties die hetzelfde doel hebben kunnen samengevoegd worden)
    a. Alle applicaties kunnen samengevoegd worden
    b. Een groot deel van de applicaties kunnen samengevoegd worden
    c. De helft van de applicaties kunnen samengevoegd worden
    d. Een klein deel van de applicaties kunnen samengevoegd worden
    e. Geen van de applicaties kunnen samengevoed worden
8. Kunt u het antwoord toelichten?
9. Hoe ervaart u de tijd die u in de applicaties spendeert?
    a. Te veel tijd dan nodig wordt er in de applicaties gespendeert
    b. Veel tijd wordt er in de applicaties gespendeert
    c. Precies de tijd die nodig is wordt er in gespendeert
    d. Weinig tijd wordt er in gespendeert
    e. Te weinig tijd wordt er in gespendeert
10. Kunt u het antwoord toelichten?
11. Hoe ervaart u het invullen van data in de applicaties?

   a. Moeilijk, waardoor er veel data fouten worden gemaakt
   b. Soms lastig, waardoor er af en toe fouten worden gemaakt
   c. Neutraal
   d. Vrij simpel, waardoor er bijna nooit fouten worden gemaakt
   e. Makkelijk, waardoor er nooit fouten worden gemaakt
12. Kunt u het antwoord toelichten?
13. Welk antwoord past het best, kijkend naar de hoeveelheid data dat opgeslagen wordt na gebruik? (Data die dus niet meer nodig is)
   a. Alle data wordt opgeslagen voor de zekerheid, zelfs als we het niet meer nodig hebben
   b. Veel data wordt opgeslagen
   c. Precies genoeg data wordt opgeslagen, zodat er op sommige cases teruggekeken kan worden indien nodig
   d. Weinig data wordt opgeslagen
   e. Geen data wordt opgeslagen, wat ervoor zorgt dat we niet kunnen terugkijken naar de data fouten die gemaakt zijn in het verleden
14. Kunt u het antwoord toelichten?

Volgende vragen zijn voor elke applicatie identiek:

15. Hoe vindt u het data proces van deze applicatie?
   a. Makkelijk: Ik vul alle data probleemloos in en heb geen introductie nodig gehad over het gebruik van deze applicatie
   b. Vrij simpel: Ik vul alle data probleemloos in nadat ik een introductie heb gehad over het gebruik van deze applicatie
   c. Neutraal: Ik vul alle data vaak probleemloos in en problemen die ontstaan kan ik oplossen
   d. Vrij lastig: Er ontstaan wel eens fouten en problemen met het invullen van data en ik zou graag een betere introductie over deze applicatie gehad hebben toen ik hierin begon met werken
   e. Moeilijk: Ik heb veel last van problemen met de data en maak vaak fouten
16. Wat vindt u van de kwaliteit van deze applicatie?
   a. Heel hoog: Ik denk dat er geen applicaties zijn met dezelfde functie die een betere kwaliteit zouden hebben
   b. Hoog: De kwaliteit is goed genoeg dat er geen beter applicatie voor hoeft te komen
   c. Neutraal: De applicatie mag ingewisseld worden, maar mag ook zo blijven
   d. Laag: Een nieuwe applicatie zou ervoor zorgen dat ik beter werk vericht
   e. Heel laag: Deze applicatie moet ingewisseld worden
17. Wat is de bedrijfswaarde van deze applicatie?
   a. Heel hoog: Deze applicatie is een aanwinst voor het bedrijf
   b. Hoog: Deze applicatie zorgt voor een meerwaarde in het bedrijf
   c. Neutraal

   d. Weinig: Deze applicatie geeft weinig meerwaarde aan het bedrijf
   e. Geen: Deze applicatie is overbodig

18. Wat is het niveau van deze applicatie?
   a. Te ingewikkeld
   b. Moeilijk, maar wel eigen te maken
   c. Neutraal
   d. Makkelijk

19. Wat vindt u van de hoeveelheid tijd die besteed wordt in deze applicatie?
   a. Te veel van mijn tijd wordt in deze applicatie besteed
   b. Veel van mijn tijd wordt in deze applicatie besteed
   c. Precies genoeg van mijn tijd besteed ik in deze applicatie
   d. Weinig van mijn tijd wordt in deze applicatie besteed
   e. Te weinig van mijn tijd wordt in deze applicatie besteed

Kunt u de antwoorden toelichten?

Appendix C

Appendix C.1: Costs changing over time

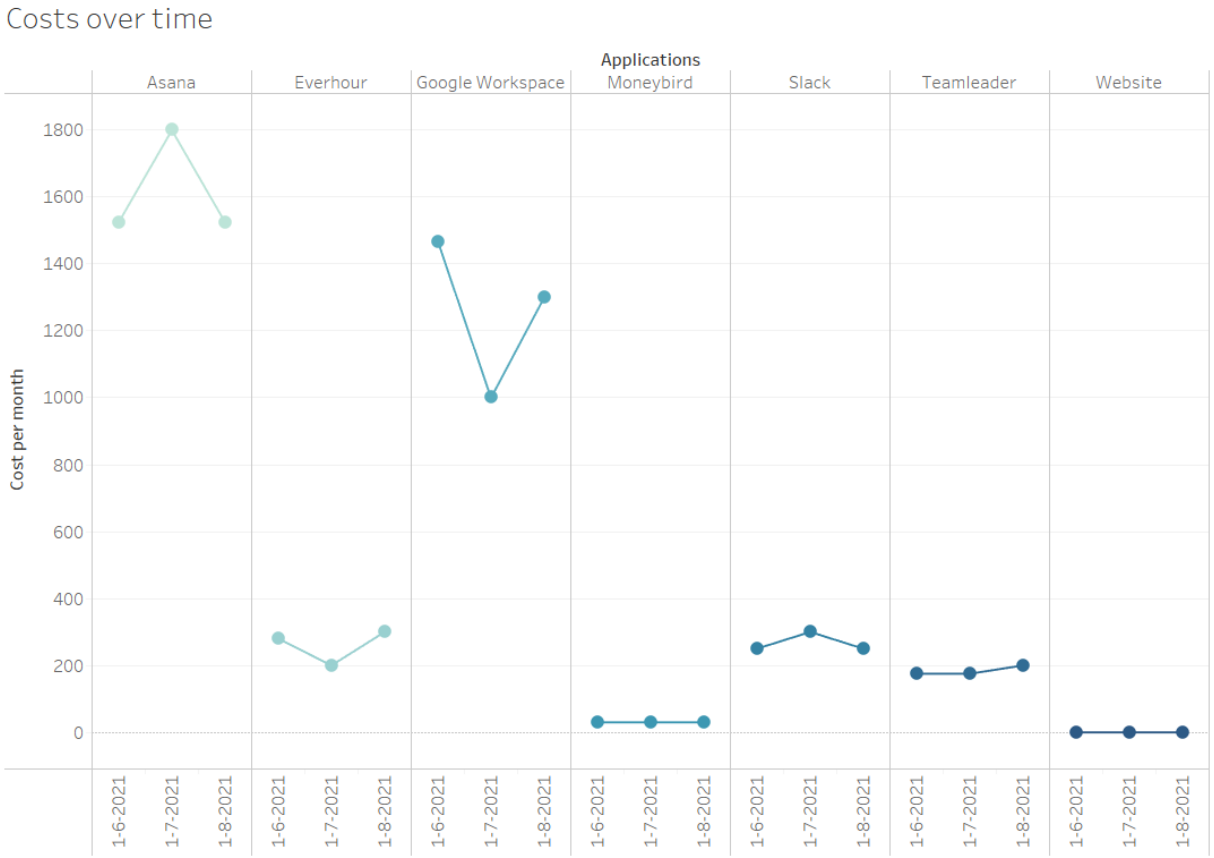


Figure 27: Applications costs over time

Appendix C.2: Excel file dashboard

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Applications	Cost	Category	Business Value	Technical Fit	Data process	Quality	Level	Interfaces	Line Y	Line X	Circle Y	Release date	Bugs June	Bugs May	Bugs April	Updates June	Updates May	Updates April
2	Asana	€ 1.524,50	Planning	4,25	3,42	2,75	4	3,5	Asana	4	2	4	apr-12	-6	-9	-1	7	7	4
3	Slack	€ 250,00	Communication	4,25	4,33	4,5	4	4,5	Slack	4	4	4	aug-13	-	-1	-	3	5	2
4	Everhour	€ 280,00	Planning	4	2,75	2,75	3	2,5	Everhour	3	1	3	jan-15	-	-	-	3	1	2
5	Google Drive	€ 1.467,35	Data storage	3,75	3,83	4	3	4,5	Google Drive	2	3	2	apr-12	-	-	-	-	3	3
6	Google Spreadsheet	€ 1.467,35	Data storage	3,25	3,58	4	2,75	4	Google Spreadsheet	1	3	1	mrt-06	-	-	-	-	1	-
7	Teamleader	€ 175,00	Project Management	3	3	3,25	3	2,75	Teamleader	1	1	1	feb-18	-4	-4	-	-	-	1
8	Website	€ -	Data storage	2,5	3,42	3,5	2,75	4	Website	4	3	4	-	-	-	-	-	-	-
9	Moneybird	€ 30,00	Finance	3,75	3,33	3,75	3	3,25	Moneybird	1	2	1	jan-18	-4	-	-	3	1	1

Figure 28: Excel data for the dashboard

Appendix D

Appendix D.1: Feedback company during the research

Day and Time	Location	With who?	What?	Feedback
4-6-2021 13:00	Google Meetings	Dominique Bouwmeester & Meike Kruger	BPM of a new client is made and an application portfolio is created. The survey is analyzed.	BPM looks great! Traffic Today will use the BPM to see how their workflows look like.
18-6-2021 13:00	Google Meetings	Dominique Bouwmeester & Meike Kruger	KPIs are stated and Dashboard current situation is made.	The KPIs give the right information so that it can be seen which application should be replaced. The dashboard looks great and gives a clear overview of the KPIs
24-6-2021 13:00	Through Slack messages	Dominique Bouwmeester & Meike Kruger	For the improvements, is it enough to give an example of one application that can be used to replace a current application that is not functioning well anymore? Show list of improvements	The list of improvements is clear and gives a good overview of changes that need to be made. One application is sufficient for a replacement option since Traffic Today can decide for themselves which values a new application needs to have and can look for replacements themselves.
2-7-2021 13:00	Google Meetings	Dominique Bouwmeester & Meike Kruger	The improvements and recommendations are discussed.	The summation of improvement in Section 5.1.4 is Asana missing. Furthermore, are the improvements and recommendations very interesting. We as a company have to invest more time in application portfolio rationalization so that we can keep improving our application portfolio. We do think that starting to hire an employee is a big step, so we will first look into the other possibilities to improve our application portfolio and will then look if hiring an employee is still necessary.

Table 25: Logbook