

Optimizing the Internal Processes by Implementing a Project Management Software System at ASG Nederland



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Preface

Dear Reader, in front of you is the culmination of my three years as a Bachelor Industrial Engineering and Management student at the University of Twente. These years were incredibly interesting because of the variety of subjects that were taught, however they were also quite difficult because of the COVID-19 pandemic.

Finding a company to collaborate with for my thesis was also not an easy task, as, at the time of my search for a graduation assignment, many companies were recovering from the repercussions of the pandemic and were thus not eager on spending their resources on students. From the hundred or so companies, to which I submitted an application, above seventy rejected me on the spot due to COVID-19 related reasons. Another twenty never answered and the remaining invited me for interviews, which were unsuccessful. The only company that gave me a chance was ASG. This was an incredible opportunity for me, since the graduation assignment they offered me was in the area of project management, which was something I had been interested in throughout my education.

ASG not only accepted me, an international person, in their fully Dutch company, but also provided me with the necessary guidance for the development and completion of my research. Moreover, ASG stimulated and supported my personal and professional growth. Therefore, I greatly enjoyed my time at ASG and I learned a lot, not only about project management, but also about the intricacies of working in a Dutch company.

Further, as I put a tremendous amount of effort into this thesis during the past few months, it has become my passion project. Therefore, I can only hope that my research and advice would really prove beneficial for ASG and the report, based on this research, would be a pleasant and educating reading material.

Lastly, some acknowledgements are due, as I could not have completed this thesis without the support of my family and loved ones, the impeccable guidance of my supervisors at the university and at ASG, the lovely people at the company, who welcomed me in their daily work activities, and everyone that aided me with my personal progress throughout my education. Thank you!

Lia Kondova
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Executive Summary

This research was conducted under the supervision of ASG, a data analytics and consultancy company based in Delft, the Netherlands. The aim of the research was to find a way to increase the data reception rate that ASG's heat- and water-allocation meters emit. This, however, was not an isolated issue that the company was experiencing. This fact was established by identifying and exploring the company's problems and finding relationships between them. These issues, in ASG's belief, could be optimized or eliminated via the adoption of a project management software system.

As tens or hundreds such systems exist, the question was which one to select and based on what criteria to make such a selection. To understand the processes preceding the selection, a literature study was conducted. It revealed that there were certain aspects, such as the type of system source code and supported management methodology, that should be taken into account before the selection of a software system begins. Further, the study indicated towards the vast amounts of opportunities that existing systems offer, which later aided eliciting the requirements different stakeholders within the company had for a software system. These requirements were elicited through individual interviews with the help of a goal-oriented analysis and were later used in formulating the different criteria for finding a suitable software system for ASG.

After establishing the criteria, the following step was to select a limited amount of project management software systems for evaluation. This included gathering information on the different systems through research and testing and later subjecting the selected systems to a comparison against each other, which indicated how each of them performed on the formulated criteria. The results were conclusive in favor of Monday.com, which was adopted by a few of the company's employees.

After some time, these employees were interviewed individually about their experience with the use of Monday.com. The results were primarily positive when it came to the user experience aspect of the system. Moreover, the interviewees were unanimous about the potential they saw of the system in aiding ASG with achieving their objective.

Lastly, recommendations were provided for ASG, which revolved around the establishment of certain guidelines for the successful use of the software system. The aim of these guidelines was to ensure that every employee would be ready to welcome the change in their daily activities, would be motivated to participate in it and would have sufficient knowledge on how to use the system in a way that would help them. Eventually, the general idea is that this collective work would create a more unison working environment, which would eliminate ASG's problems to a certain extent, thus saving them time and money.

Table of Contents

- Preface..... iii
- Executive Summary iv
- List of Figures..... vi
- List of Tables vii
- List of Abbreviations vii
- Chapter 1 Introduction 1
 - 1.1 Context Description 1
 - 1.2 Motivation 1
 - 1.3 Research Approach..... 1
 - 1.4 Problem Identification 2
 - 1.4.1 Problem Cluster 2
 - 1.4.2 Core Problem 5
 - 1.5 Solution Planning 5
 - 1.5.1 Main Research Question 5
 - 1.5.2 Sub-Research Questions 5
 - 1.5.3 Research Design 6
 - 1.5.4 Scope and Limitations 7
 - 1.5.5 Assessment of Validity and Reliability 7
 - 1.5.6 Deliverables 7
 - 1.5.7 Thesis Structure 7
- Chapter 2 Theoretical Framework..... 8
 - 2.1 Project Management 8
 - 2.2. Project Management Methodologies 8
 - 2.2.1 Agile Project Management (APM) Methodology 8
 - 2.2.2 Traditional Project Management (TPM) Methodology 9
 - 2.3 Project Management Software Systems (PMSSs) 9
 - 2.3.1 Types of Project Management Software Systems (PMSSs)..... 9
 - 2.3.1.1 Open (OSS) and Closed Source Software (CSS) Systems 9
 - 2.3.1.2 Agile (APM) and Traditional Project Management (TPM) Systems..... 10
 - 2.3.2 Project Management Software System (PMSS) Availability..... 10
 - 2.4 Change Management 11
 - 2.5 Requirements Engineering 11

2.5.1 Requirements Elicitation through Interviews.....	12
2.5.2 Goal-Oriented Requirements Analysis (GORA)	12
2.5.3 The iStar Language	13
2.5.4 Criteria Selection	13
Chapter 3 Method Implementation	15
3.1 Requirements Elicitation Process	15
3.1.1 Data gathering method	15
3.1.2 Company Goals.....	15
3.1.3 Company Requirements	17
3.2 Defining Comparison Criteria	18
3.3 Project Management Software Systems (PMSSs) Consideration, Comparison and Selection.....	18
3.3.1 Consideration	18
3.3.2 Comparison.....	19
3.3.3 Selection and Testing.....	23
Chapter 4 Results and Evaluation.....	25
Chapter 5 Conclusion, Recommendations and Future Work.....	28
5.1 Conclusion	28
5.2 Recommendations.....	29
5.3 Future Work.....	30
BIBLIOGRAPHY	31
APPENDIX	34
Appendix A: Systematic Literature Review (SLR)	34
Appendix B: Interview Questionnaire Template	38
Appendix C: Interview Questionnaire Results.....	39
Appendix D: Additional Information	43

List of Figures

Figure 1: MPSM cycle (Heerkens et al., 2021).....	1
Figure 2: Problem cluster	3
Figure 3: Overview of steps.....	15
Figure 4: Goal diagram	16
Figure 5: Legend of the relevant iStar language elements (Dalpiaz et al., 2016).....	16
Figure 6: Monday.com pricing plans comparison (monday.com, n.d.).....	24
Figure 7: Interview questionnaire template.....	38

Figure 8: Energy Manager feedback (used Monday.com for about a month).....	39
Figure 9: Project Coordinator feedback (used Monday.com for about two weeks).....	40
Figure 10: Brand Designer feedback (used Monday.com for about three weeks)	41
Figure 11: Head of Billing Department feedback (used Monday.com for about a week)	42
Figure 12: The usage of PMSSs in the US (Vukomanović et al., 2012)	44
Figure 13: The usage of PMSSs in the Middle East (Vukomanović et al., 2012)	44
Figure 14: The task overview section of Monday.com (Security Check, n.d.-e)	44
Figure 15: The updates section of a task within Monday.com (Security Check, n.d.)	44
Figure 16: Creating an update in Monday.com (Security Check, n.d.).....	44
Figure 17: The file upload section of Monday.com (Security Check, n.d.).....	44
Figure 18: Possible integration between Monday.com and other platforms (Security Check, n.d.-b).....	44
Figure 19: Possible automations between Monday.com and other platforms (Security Check, n.d.-b)	44
Figure 20: Possible automations in Monday.com	44

List of Tables

Table 1: Research design	6
Table 2: NASA requirements for a PMSS (Centeno-Gomez et al., n.d.)	14
Table 3: Comparison criteria	18
Table 4: Legend of symbols	20
Table 5: Summary of the performances of the PMSSs compared against the criteria	22
Table 6: Summary of the results of the closed-ended questions.....	25
Table 7: Summary of the results of the open-ended questions.....	26
Table 8: Inclusion and exclusion criteria	34
Table 9: Confusion matrix.....	34
Table 10: Search log.....	35
Table 11: Concept matrix	36
Table 12: Additional articles	37
Table 13: Comparison Open Source software systems (Abramova et al., 2016)	43
Table 14: Comparison Close Source software systems (Abramova et al., 2016)	44

List of Abbreviations

APM	–	Agile Project Management
ASG	–	Adviesgroep Strategisch Gebouwbeheer
CSS	–	Closed Source Software
GORA	–	Goal-Oriented Requirements Analysis
MPSM	–	Managerial Problem-Solving Method
OSS	–	Open Source Software
PMSS	–	Project Management Software System
REA	–	Requirements Elicitation Analysis
SLR	–	Systematic Literature Review
TPM	–	Traditional Project Management

Chapter 1 Introduction

The purpose of this chapter is to give a brief introduction of the chosen company. Moreover, this chapter will provide relevant background information, regarding the history of the company, as well as the problems it currently faces.

1.1 Context Description

This thesis will be executed in collaboration with ASG Nederland. Located in Delft, ASG is a relatively new company with less than ten years of experience, but with an ambition to still be prosperous in thirty years. In its core, ASG is a climate technology company that employs smart algorithms to contribute to relevant climate goals. By analyzing data from people and earthly resources, ASG contributes to the creation of more insight into energy consumption. In this way, ASG's customers can manage their energy consumption more optimally and thus reduce their costs. This reduced consumption ultimately contributes to ASG's conscious mission to reduce exhaustion of energy resources (*Uitdager Energiebeheer Sinds 2014 | ASG Nederland, n.d.*).

1.2 Motivation

In the beginning ASG's scope was rather limited – they operated in a single city in very few residential buildings. However, currently ASG has expanded to multiple cities all over the Netherlands, executing multiple projects simultaneously. Yet, some parts of the projects are either done manually, or with lack of coordination between the different departments of the company. Moreover, there is no clear guideline, with which the employees are familiar and which they follow when executing the projects. Lastly, since the different departments use different software systems in their daily activities, there is no clear overview of the progress made on the different tasks within the projects. All of this culminates in a low level of responsibility, transparency and collaboration among the employees and departments, which ultimately results in financial losses for ASG. Therefore, the goal of this research is to find a way to help ASG manage the different aspects of the company more smoothly, as well as to have an overall better understanding and insight of the execution of their processes.

1.3 Research Approach

This research is designed in accordance with the principles of the Managerial Problem-Solving Method (MPSM) (Figure 1) (Heerkens et al., 2021). The MPSM provides engineers with an adaptable framework, which combines creativity with systematism, and helps them find the most optimal solution by ticking the boxes of a methodological checklist. (Heerkens et al., 2021).

The MPSM is suitable for this research, since it consists of seven phases, which are focused on systematically unravelling the underlying issues and their causes around a single core problem. The problem is identified in the first phase and an appropriate approach is formulated in the second one. In the third phase, the

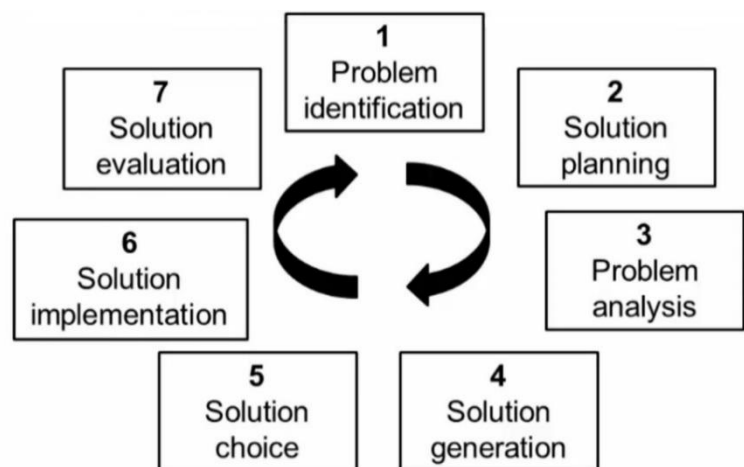


Figure 1: MPSM cycle (Heerkens et al., 2021)

problem is analyzed and, if it does not manifest itself as initially considered, the process should restart from phase one with a review of the initial diagnosis. Else, the cycle continues in step four, where an attempt is made at generating possible solutions to the problem. Subsequently, these solutions are analyzed and the most adequate one is chosen in phase five. Lastly, in the last two phases of the MPSM, the chosen solution is implemented and evaluated, which is later followed by a conclusion and recommendation for the use of the chosen solution (Heerkens et al., 2021).

Overall, the MPSM contributes to the better understanding of the gap between the current situation (the reality) and the desired situation (the norm) (Heerkens et al., 2021). Currently, as aforementioned, ASG struggles with the lack of overall control of their processes, which include managing materials, equipment, time and personnel. In an ideal situation, they would have more grip of these aspects and would thus be able to manage their projects more optimally and have fewer financial losses.

1.4 Problem Identification

To achieve a higher level of understanding of the ASG's underlying issues, it is important to begin this research with a problem identification phase. The investigation identifies several issues, and later establishes a cause-and-effect relationship between them. This is done to identify the core problem, the solution of which is the main objective of this research.

1.4.1 Problem Cluster

When considering the different problems that the company is facing, it is important to distinguish three types of problems – action problems, knowledge problems and core problems. An action problem is any situation that is not desired, or in other words – it is the discrepancy between the desired norm and the identified reality, as it is perceived by the problem owner, which in the context of this thesis is ASG. As for the knowledge problem, its purpose is to define the research population, the relevant variables and, if necessary, the relations that need to be investigated. Lastly, the core problem is the problem which needs urgent attention, and whose solution will make the real difference for the company (Heerkens et al., 2021).

To identify the core problem, an inventory of all problems is created, and later refined and visualized in the form of a problem cluster (Figure 2). The purpose of the problem cluster is to bring organization among the identified problems, as well as to help visualize the cause-and-effect relationships between them and to help select a core problem (Heerkens et al., 2021).

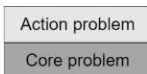
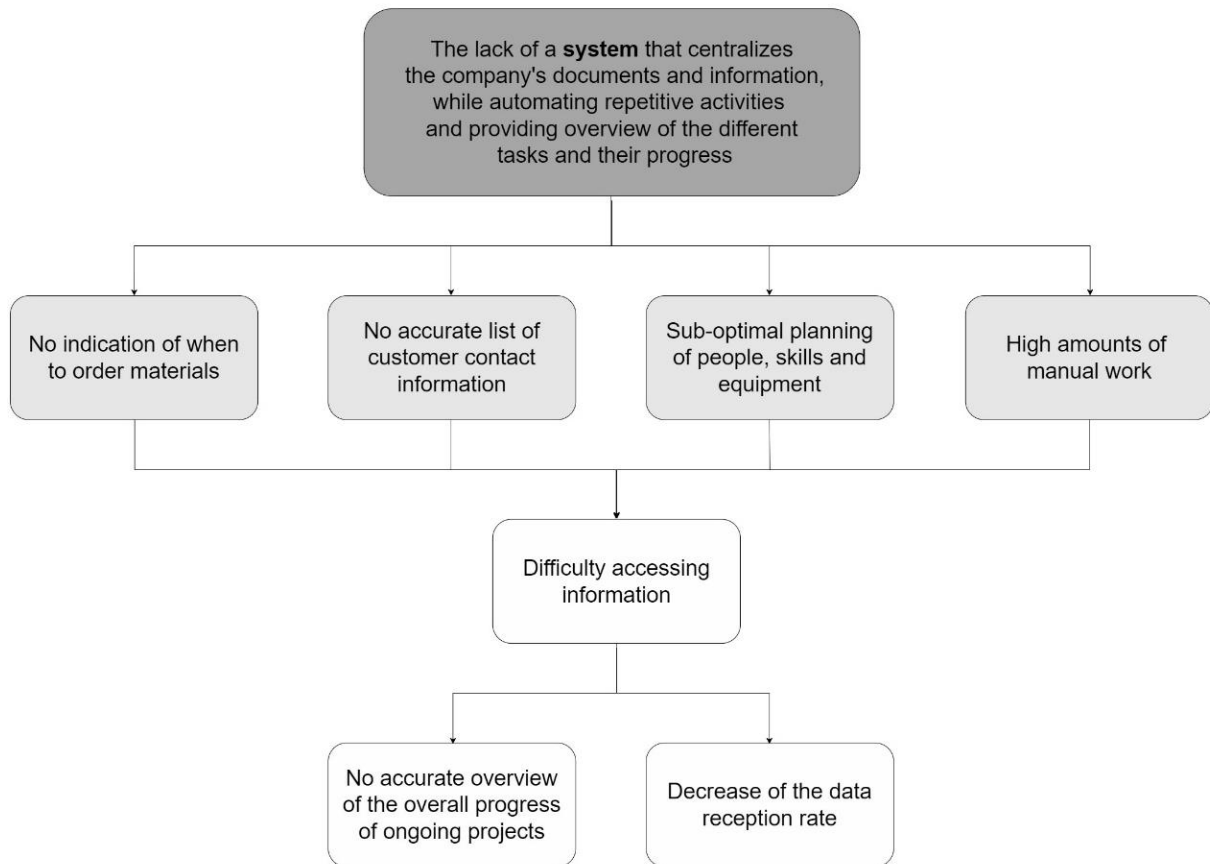


Figure 2: Problem cluster

Some of the very first issues experienced in the data reception process is that there is **no indication of when to order the materials and parts**, necessary for assembling the heat- and water-allocation meters. These parts must be ordered at the right time, or else the programmed due-date of the meters expires and they have to be reprogrammed upon arrival, which costs ASG unnecessary money, time and effort. It becomes evident, that the ordering of materials is influenced by the starting date of a project, which can only be set after ensuring that several requirements are completed.

Such a requirement is **obtaining contact with every resident**, which is crucial, since ASG's energy data collection process will be inaccurate unless they are able to install meters in each of the buildings' apartments. Establishing this contact is in itself problematic, since residents' phone numbers or emails are sometimes **outdated or completely missing**. This means that ASG cannot notify residents about the possible dates when the installation team will visit the building for the first time, which results in the necessity of a second visit. This visit, and any other additional visits mean financial losses for ASG, which should ideally be minimized as much as possible.

The visits of the installation team are also problematic because of the **sub-optimal planning of people, skills and equipment** in the sense that installing different types of meters requires different types of mechanics. For instance - some meter types may be installed by an employee with no professional education, however, other meters require a certified mechanic. And in case a certified mechanic is hired to install a meter that could be installed by a regular non-certified employee, the installation ends up costing more to the company, since certified mechanics cost ASG more than non-certified ones.

Moreover, different equipment is needed, based on the type of meter, the existing infrastructure, the type and location of the building and other situational factors. Some installations require bringing heavier equipment, for which a car is needed, yet it is sometimes not planned. In other words – mechanics are not well informed about the project and may thus make an inaccurate estimation of the type of transport necessary to reach the location of the building in time.

This sub-optimal planning, non-timely arrival of materials and the difficulty of obtaining the contact with residents, means that in some cases ASG cannot install their meters in every part of a building. Since the **data reception rate** depends on the percentage of meters that would be installed, ASG would not be able to receive all the necessary data to have an overview of the consumed energy. Thus, ASG would not be able to offer the lowest prices of energy to its customers, as well as advice on better consumption habits. This means that ASG cannot fulfil its purpose and promise, that they make to their customers, which is evidently not optimal for the company.

All of these problems are related to a deeply rooted internal issue that ASG faces, which is the **high amounts of manual work**. What this means is that internal operations, such as the inventory of materials, the list of customer contact information, the planning of the installation team, billing customers and more, are still executed in an old-fashioned manner using Microsoft Excel, or sometimes even a piece of paper. All of ASG's documents are kept in specific locations on a local disc, meaning that **information is difficult to access** since employees have to search in folders within folders to reach what they need. The accuracy of the information is also difficult to track, since Microsoft Excel does not reflect changes live, which can result in employees overwriting the existing information.

Further, since information is kept in separate files and files are scattered in different folders, it becomes lose to impossible for higher management to have an **accurate overview of the overall progress of ongoing projects**. Therefore, it becomes difficult to have a grip of the company's external operations, as well as to identify weak spots in the planning, management and execution of activities and to design time-sensitive solutions for them. This means that such problems can go undetected and thus remain untreated.

Lastly, as ASG's projects follows a similar timeline of activities, there are a lot of repetitive steps which employees have to take to execute their objective. This means that the responsibility for the correct execution of certain activities still falls on the employees and their manual labor, which was sufficient in the past, when the company was smaller and had a limited amount of projects and employees to manage. However, as ASG is rapidly growing, such manual labor is not feasible anymore, since machines are capable of more precision during the execution processes. By achieving a **higher level of automation**, human error would be minimized and possibly eliminated, but also employees would feel less overwhelmed by their daily activities and would be able to stay focused on the tasks that actually require their attention. Moreover, automating certain tasks could mean automatic reminders about deadlines, changes in documents, updates and much more.

1.4.2 Core Problem

The analysis of the problem cluster indicates that the aforementioned action problems emerge from the lack of a concise way of managing the different phases of the company's projects, as well as the people, responsible for their execution. Therefore, the **lack of system that centralizes the company's documents and information, while automating repetitive activities and providing an overview of the different tasks and their progress** is namely the identified core problem.

1.5 Solution Planning

In order to solve the core problem, a main research question, as well as additional sub-research questions, also known as knowledge questions, have to be formulated. These questions are essential when attempting to answer the main research question, since they split it up in smaller portions, therefore making it more accessible (Heerkens et al., 2021).

1.5.1 Main Research Question

Considering the identified action problems and the deduced core problem, it becomes evident that ASG aims at having more control of their overall process in each of its aspects. Thus, the following main research question can be formulated:

How can ASG have a better grip of their data reception process?

1.5.2 Sub-Research Questions

There are two types of sub-research questions – descriptive and explanatory. Descriptive questions aim at describing or defining the topic at hand by answering “Who?”, “What?”, “When?”, “Where?”, and sometimes “How?” questions. On the other hand, with explanatory questions the goal is to explain why particular phenomena, observed in a descriptive study, occur in a given manner (Blumberg & Cooper, 2014). The formulated sub-research questions are described below.

1. *How does the current project management strategy at ASG influence the successful execution of their projects?*

This question is related to the first phase of the research, namely – the analysis of the current situation at ASG. This question is of importance, since it gives insight into how projects are handled currently. This insight provides an overview of the problems that the company is experiencing.

2. *What are the requirements for an efficient PMSS?*

Since hundreds of software systems are already in existence, it is important to understand which software systems are adequate to use for this type of company. Ideally, the literature study would yield criteria that would eliminate the majority of systems that cannot be considered suitable.

3. *What are the requirements that ASG has for a PMSS?*

When answering the previous question, a list of generally accepted requirements for adequate and efficient project management software systems is compiled. The next step is to understand what criteria ASG has for a potential software system, which is the purpose of this question. At the end, the two lists are combined to create a new list of requirements, that is tailored to ASG's needs, yet is general enough to include existing software systems.

4. Which of the existing PMSSs fulfills best the identified requirements?

After the new list of criteria is generated in the previous question, the following step would be to compare a few chosen project management software systems against each other, using these criteria. In this way, many such software systems would potentially be eliminated, leaving those systems that satisfy ASG’s needs best and are generally accepted by experts.

5. To what extent would the employees be motivated to use the PMSS?

This question is of importance, since the implementation of a project management software would only be meaningful if every employee participates in its use. Else, it would be impossible to draw conclusions on whether the implementation of the solution was a success.

1.5.3 Research Design

The purpose of this section is to provide a general overview of the research questions formulated in the previous section (Table 1). Two terms have been used when referring to the different types of data gathering, namely – cross-sectional, which refers to the virtually simultaneous conduct of certain measurements; and longitudinal, which is a type of research, involving conducting measurements over a given period of time (Heerkens et al., 2021).

SUB-RESEARCH QUESTION	TYPE OF RESEARCH	RESEARCH POPULATION	DATA GATHERING	DATA PROCESSING	ACTIVITY SCHEDULE
1. How does the current project management strategy at ASG influence the successful execution of their projects?	Descriptive	Employees of ASG	Observation, Expert interviews (cross-sectional)	Qualitative	1. Observe the processes 2. Conduct expert interviews
2. What are the requirements for an efficient project management software?	Descriptive	-	Literature study (longitudinal)	Qualitative	1. Conduct literature study 2. Compare findings from different studies 3. Eliminate irrelevant criteria 4. Compile list of relevant criteria
3. What are the requirements that ASG has for a project management software system?	Descriptive	Employees of ASG	Expert interviews, Observation (cross-sectional)	Qualitative	1. Conduct expert interviews 2. Observe processes 3. Based on findings, compile list of requirements
4. Which of the existing project management software systems fulfills best the identified requirements?	Descriptive	-	Literature study	Qualitative	1. Conduct literature study 2. Compare findings from different studies 3. Check the company requirements and KPIs 4. Eliminate inadequate software systems
5. To what extent would the employees be motivated to use the project management software?	Explanatory	Employees of ASG	Observation, Individual interviews, Experimentation (longitudinal)	Qualitative	1. Conduct individual interviews or a survey 2. Observe how the employees interact with the software 3. Draw conclusions

Table 1: Research design

1.5.4 Scope and Limitations

The scope and limitations of a research are often used together to describe the constraints of the research, i.e., the breadth and depth of the topic coverage, the time period, any relevant geographical limitations and the criteria for information inclusion (Blumberg & Cooper, 2014). Since this project is Bachelor thesis, a possible limitation might be its time frame of just ten weeks, which might not be enough time to fully implement the project. Moreover, since ASG only operates in the Netherlands, the conducted research, as well as the solution implementation, will be limited to the Netherlands.

1.5.5 Assessment of Validity and Reliability

Validity and reliability are important characteristics of a good research. The term “validity” describes the extent to which the same results can be achieved if the measurement is repeated under the same conditions, while “reliability” refers to the accuracy and precision of the measurement procedure (Blumberg & Cooper, 2014).

There are two types of validity – internal and external. Internal validity is related to the design of the experiment, posing the question whether the conclusions, drawn about the demonstrated experiment truly imply cause (Blumberg & Cooper, 2014). In the context of this research, the data-gathering methods were chosen in the early stages of the research and were based on existing knowledge, which guarantees the internal validity of the research. Moreover, these methods will be thoroughly researched, planned and executed in standardized conditions, in order to minimize the variation of the results and, thus, to ensure the reliability of the research.

External validity, on the other hand, questions whether the observed causal relationship can be generalized across persons, settings and times (Blumberg & Cooper, 2014). In this context, external validity could potentially be achieved if the implemented solution generates the same results in other companies, that have similar issues to ASG. This implies that the generalization of results might be possible.

1.5.6 Deliverables

The purpose of this section is to provide an overview of the deliverables of this research. These deliverables will be listed below.

- Theoretical framework, literature study and review of the relevant criteria of an adequate project management software system
- Selection of an adequate project management software system, based on the formulated criteria, as well as the requirements of the company
- Conclusions and recommendations on the implementation of the PMSS in the company, as well as recommendations for future work

1.5.7 Thesis Structure

Beside the introductory chapter, this thesis is composed of the following chapters: Chapter 2 discusses the theoretical framework, which thoroughly explains the method of selecting a PMSS. Chapter 3 elaborates on the different aspects of the implementation of this method and Chapter 4 presents the results of the implementation, as well as how their evaluation was conducted. Lastly, Chapter 5 discusses the conclusions made and the recommendations drawn for the company and for future work.

Chapter 2 Theoretical Framework

The theoretical framework is the foundation upon which knowledge is constructed in a research study. It explores the theory that is necessary to solve the identified core problem and provides clarity about the structure and vision of the study (Grant & Osanloo, 2014b). Thus, this chapter will provide an overview of the information, acquired during and after the SLR, the process and results of which will be presented in Appendix A. It begins by providing a context for the reader, which is done by defining concepts such as project and project management. These concepts are later useful when attempting to provide a broader perspective on the necessity of a project management software system and the methods, used for its selection.

2.1 Project Management

A project can be defined as a “temporary endeavor, undertaken to create a unique product, service, or result”. It is a complex set of tasks, which have a defined duration. This duration can be further broken down into phases, working packages and subtasks, which require scope, time, coordination, and control and budget planning (Stoshikj et al., 2014). Moreover, a project involves organizational constraints, resources and costs and large numbers of people, which are involved in the it (Puška et al., 2020).

Project management is the “application of knowledge, skills and techniques to execute projects effectively and efficiently” (Abramova et al., 2016, p.177). Project management contains the aspects of planning, organization, monitoring and control of every part of projects, given that project goals can be achieved in a safe manner and are possible within an agreed schedule, budget and performance criteria. In other words, project management is constrained by factors such as time, cost, and quality, also known as the “iron triangle” (Radujković & Sjekavica, 2017). The effective usage of project management techniques usually results in the success in qualitative improvements of products and services (Stoshikj et al., 2014).

2.2. Project Management Methodologies

Project management can be differentiated by the type of methodology used. There are two distinctive methodologies, namely – agile project management (APM) and traditional project management (TPM), which will be discussed in the following sections.

2.2.1 Agile Project Management (APM) Methodology

The agility of an organization can be defined as its ability to quickly react to the ever changing dynamic business environment. Moreover, agility represents the optimal balance between the needs for stability within an organization and its adequate level of flexibility. Despite emerging as a concept for software development, APM today represents one of the basic competitive advantages that contemporary organizations should strive to achieve. APM is becoming desirable as a response to the fast-changing and challenging business environment, since it takes into account the unpredictability of the project execution and the customer's changing requirements. APM is considered more reliant when it comes to adapting the project management process and methodology to the problem at hand. APM emphasizes on the delivery of parts of the project, or product, with considering quick adjustments if needed (Ciric et al., 2019).

2.2.2 Traditional Project Management (TPM) Methodology

In contrast, TPM involves detailed and comprehensive planning and control, with the importance placed on defining the client's requirements at the beginning of the project, without the possibility of any subsequent changes during the project. In other words, TPM assumes that the project circumstances are predictable and that the requirements are clear and well understood by the responsible parties. However, in reality, projects rarely follow sequential flow during their implementation phase. Moreover, clients are rarely able to define all the necessary requirements at the beginning of the project (Ciric et al., 2019).

2.3 Project Management Software Systems (PMSSs)

Presently, if companies want to compete in today's turbulent market, it is essential that they become more adaptive, fast and collaborative. This can be achieved via the implementation of a project management software system (PMSS) (Vukomanović et al., 2012). As PMSSs are a powerful tool for project management, they can be used at every project level to organize tasks, to track project status, to allocate resources and responsibilities, and more (Centeno-Gomez et al., n.d.).

The main goal behind such a software system is to facilitate the business operations, related to project management, that companies have. This type of software system can be used to plan, monitor and control projects, thus allowing them to run more effectively and efficiently (Puška et al., 2020). It is important to note that, to implement such a software in an organization, the intricacies of change management have to be well understood. This aspect will be discussed in Section 2.4.

Further, when selecting a PMSS, the decision-makers must ensure that it is aligned with the companies' policies with regard to resources, time and cost management. Since these aspects are evidently company-specific, it becomes unlikely that an off-the-shelf solution is applicable to all companies (Stoshikj et al., 2014).

Lastly, it is important to understand that the implementation of a PMSS would be to support the project manager(s), not to replace them as a whole. Such software systems should be seen as tools that provide repository data, perform logical calculations, and create signals. Their overall satisfactory performance is proportionate to the level of skill they are handled with (Stoshikj et al., 2014).

2.3.1 Types of Project Management Software Systems (PMSSs)

These are multiple ways to differentiate software system types, some of which will be discussed in the following sections.

2.3.1.1 Open (OSS) and Closed Source Software (CSS) Systems

The service of customization of a project management software system has a different importance to each company, according to the company needs (Stoshikj et al., 2014). Based on the level of customization, two distinctive PMSSs can be identified, namely open source software systems (OSSs) and closed source software systems (CSSs), also known as proprietary software systems.

OSSs are software systems that have publicly accessible software design, which means that available content may be freely modified by its users (Abramova et al., 2016). This makes OSS more flexible as it allows its users a higher level of creativity and more opportunities for customization.

In contrast, CSSs are designed in such a way that their source code cannot be modified by anyone besides the organization who created it. The creators maintain exclusive control over the software system (Abramova et al., 2016), which means that CSSs are not customizable and their users have to rely on the software developers for providing them with upgrades and updates.

2.3.1.2 Agile (APM) and Traditional Project Management (TPM) Systems

As discussed in Section 2.2, there are two distinct project management methodologies, namely – agile and traditional. Therefore, the same logical distinction can be applied to the project management methodology, supported by a software system, categorizing PMSSs as either agile or traditional. This will be an important aspect later, when it comes to considering selecting a PMSS.

2.3.2 Project Management Software System (PMSS) Availability

The availability of PMSSs is overwhelming, as tens or even hundreds of them exist. Therefore, it is unsurprising that the different research articles, explored in this study, discuss a variety of different software systems.

For instance, Liberatore & Pollack-Johnson (2003) conducted a survey, the goal of which was to determine the “most frequently” used software system in the past 12 months. The results, from ascending to descending, are as follows: Microsoft Project (with nearly 50% of respondents’ votes), Primavera (with about 20%), unnamed others (with nearly 20%), and, lastly, Project Scheduler, Work Bench and Timeline with 5% or less.

A similar survey was conducted by Stoshikj et al. (2014), which listed Microsoft Project as the most used software system with almost 50% of the respondents’ votes. Primavera took second place with about 20%, and other unnamed software systems were on the last place with almost 30% of all votes.

Mellentien & Trautmann (2001) considered a different set of software systems in their research, namely - Acos Plus.1 8.2, CA SuperProject 5.0a, CS Project Professional 3.0, Microsoft Project 2000, and Scitor’s Project Scheduler 8.0.1, naming Acos Plus 1 and Scitor’s Project Scheduler as the top performing platforms for heuristics. An important note is made, however, stating that none of the packages offer an exact algorithm for resource allocation. Moreover, an exact solution of a project requires “extensive” computational time, which fails to provide the user with the desired interactivity of the software system.

Another set of software systems is provided by Abramova et al. (2016), where a clear distinction between the functionalities of open and closed source software systems is made. Such systems are, respectively, OpenProject, Project Libre, Redmine, LibrePlan; and Bitrix24, JIRA, Microsoft Project and Asana. A comparison is made between the selected systems from each of the two types, the results of which are displayed in Tables 13 and 14 in Appendix D. These results show that, although Redmine is one of the most popular OSSs, most of its non-basic features are not open source. Further, Open Project is “too limited”, since it depends on the Linux operating system. Overall, Project Libre can be considered the best alternative for them, however, it is not web-based and thus requires the use of a local disk, which is suboptimal. When it comes to proprietary systems, JIRA works similarly to Redmine with its constant necessity for add-ons. Microsoft Project, on the other hand, is known as the “proprietary version” of Project Libre, because of its similarity in features, as well as its use of a local disk. Asana, which considered as more suitable for agile and task-based teams., is mentioned as an adequate alternative for them.

Further, Vukomanović et al. (2012) reviews the usage of Microsoft Project and Primavera in the US and the Middle East. The results show that for both the US and the Middle East, the usage of Primavera and Microsoft Projects exceeds 58% and 23%, respectively, while other software systems, such as OPLAN, Microsoft Excel, Government Proprietary Software, CBCM and CA Super Project are used in under 20% of the time. These results are visualized in Figures 12 and 13 in Appendix D.

Lastly, it is important to note that, despite being conducted in different sectors, the discussions around the different PMSSs remains relevant. The reason for this is because PMSSs can be used for project tracking, project scheduling, portfolio management, and other elements of project management in any type of project.

2.4 Change Management

Change management can be defined as “the process of continually renewing an organization’s direction, structure, and capabilities to serve the ever-changing needs of external and internal customers” (Moran and Brightman, 2001). Change is thus a crucial aspect for the growth of organizations (Hussain et al., 2018).

Organizational change encompasses an organization’s progress from the known (“current state”) to the unknown (“desired future state”). As the future of this change is uncertain, it may raise concerns about employees’ worth, competency and coping abilities. Unsurprisingly, this might result in the employees’ hesitancy towards the intended implementation. This is problematic, since employee involvement is among the oldest and most effective strategies in change implementation. It allows for their input to be considered when making decisions in the organization, which leads to the increase of employee well-being level (Hussain et al., 2018), as well as to high-quality results when the change is implemented (Vroom & Yetton, 1973).

To facilitate employees’ involvement in the change, leadership plays a crucial role, as it accelerates the implementation in organization (Hussain et al., 2018). To stimulate the process, leaders must address the employees about change, by educating them, communicating with them, allowing and encouraging their opinions and involvement, and providing emotional support and incentives (Pierce et al., 2002). This would eventually lead to enhancing the employees’ trust of the change process, by making them feel heard and supported, thus achieving a better sense of control (Morgan and Zeffane, 2003).

2.5 Requirements Engineering

There are various software systems for automated project management in existence. Often, it is assumed that these software systems perform the same range of functions and, hence, a choice is sometimes made, based on price alone (Ahmad & Laplante, 2006). However, this assumption is incorrect, since these software systems differ to a certain extent in the features they provide and the methodologies they support. Moreover, not every system is suitable for every company (Puška et al., 2020). Thus, it becomes necessary for prospective users to perform a detailed selection analysis of the existing PMSSs, taking into account the feature sets they provide, in order to select the most appropriate one for the company in question (Ahmad & Laplante, 2006). This is namely the process of requirements elicitation and analysis (REA), which is a part of the requirements engineering process. REA is designed to take into account the needs of the different stakeholders, by discovering their requirements, classifying and organizing them and later prioritizing them (Gobov & Huchenko, n.d.). These requirements can be derived from the goals of the relevant stakeholders (Aljahdali et al., n.d.), which will be further discussed in the following section.

2.5.1 Requirements Elicitation through Interviews

There are numerous requirements elicitation techniques, the most prevalently used of which are interviews (Gobov & Huchenko, n.d.). Interviews are effective for eliciting relevant aspects from the stakeholders' requirements, thus becoming an undisputed part of automation and innovation processes (Pacheco et al., 2018).

Interviews should be conducted under specific conditions for obtaining better results. Such a condition, for instance, is that they should include expert stakeholders in the relevant domain and should be held at an available for them time. It is also important that during these interviews, the researcher remains open-minded, patient and respectful to the information being shared with them (Pacheco et al., 2018).

There are three main types of interviews – structured, unstructured and semi-structured, which is a combination of the other two types (Pacheco et al., 2018) and thus will not be discussed separately.

Unstructured Interviews

This method consists of eliciting requirements without following a specific interviewing protocol and asking open-ended question to encourage unconstrained answers. Questions are not prepared in advance – instead, there is a general direction, decided upon by the researcher, and questions are based on the information received during the interview. During this type of interviews, the researcher should take the role of a courteous active listener and improves the general understanding of the discussion by summarizing and rephrasing (Rueda et al., 2020).

Structured Interviews

In a structured interview mostly closed-ended questions are asked. Open-questions can also be asked, however, they will not be followed by an enquiry for further explanations. Structured interviews provide more consistency across different participants and allow for more questions to be asked. The structured type is the more effective technique, as more questions can be asked during the interview and the same questions can be asked across all participants. This type is also easier to analyze as questions are usually in a multiple-choice style (Courage & Baxter, 2005).

2.5.2 Goal-Oriented Requirements Analysis (GORA)

Goals represent high-level objectives of the business, organization or system. Goals have a prominent role in the requirement engineering process, as they support the elaboration of the different requirements. The emphasis of goal-oriented requirements engineering is to guide decisions at various levels within the organization (Aljahdali et al., n.d.) and in the case of this research, to provide understanding as to why a software system is necessary.

The GORA process begins with identifying the initial stakeholder goals, after which these goals are refined and reduced to alternative collections of functional and non-functional requirements, where each of which is supposed to be able to satisfy the initial goals (Aljahdali et al., n.d.). Stakeholders' participation is essential to the process as stakeholders have different knowledge and experiences and can identify potential sub-goals from various viewpoints (Ohshiro et al., 2005). The identification and classification of these goals will be the focus of the following section, where the iStar (*i**) language, which is one of the most well-known supporting methods for requirements elicitation (Ohshiro et al., 2005).

2.5.3 The iStar Language

The iStar modeling language is a goal- and actor-oriented modeling and reasoning framework and it focuses on the intentional (“why?”), social (“who?”), and strategic (“how? how else?”) dimensions. It also provides reasoning techniques for analyzing the created models, and it is used by the research community in fields such as requirements engineering and business modeling (Dalpiaz et al., 2016).

The iStar language operates using basic constructs such as actors, goals, and others, which are connected to each other via dependency links. An *actor* represents a stakeholder in a given domain or a role in an organizational setting. A *goal* represents the strategic interests that *actors* want to achieve (Guizzardi & Perini, 2005), that have clear-cut achievement criteria (Dalpiaz et al., 2016). A *soft goal* (also referred to as a *quality* by some sources (Dalpiaz et al., 2016)), on the other hand, is an attribute that an actor desires some level of achievement.

To model relationships between different *actors*, *dependency links* are used, where a *dependor* is the term for the former *actor* and *dependee* – for the latter. The *goal*, around which the dependency is built, is called a *dependum* (Guizzardi & Perini, 2005). Further relationships can be built via generic relationships such as the *refinement* feature, which links *goals* and tasks hierarchically, where one element becomes a *parent*, and its subtasks (which have to be at least two) become its *children*. Refinements can be of two types – *AND*, which ensures that the fulfillment of all of the *children* tasks will result into the fulfillment of the *parent* task; and *OR*, which indicates that the fulfillment of at least one *child* task will result into the *parent* task’s fulfilment (Dalpiaz et al., 2016). These concepts are used to create a graphical visualization, called a “goal diagram”, which illustrates the goals and objectives through the different perspectives of the stakeholders (Guizzardi & Perini, 2005).

2.5.4 Criteria Selection

After eliciting stakeholders’ requirements, the following step is to convert them into criteria for selecting an adequate PMSS. Before that, however, it is important to understand the existing criteria, which determine the effectiveness of a software system.

Literature offers multiple sets of criteria, which sometimes differ slightly from each other, depending on the authors. For instance, Ahmad & Laplante (2006), Eastham et al. (2014), Gerogiannis et al. (2010) and Puška et al. (2020) agree on more general criteria concerning collaboration, resource management, reporting, integration, the system’s interface, and many more. All of these criteria align with the aforementioned aspects of project management. However, none of these authors provides a more detailed list of criteria.

Fortunately, such a list can be found in Centeno-Gomez et al. (n.d.). The list (Table 2) provides the reader with all of general criteria groups, discussed by the authors, however it goes further to list sub-criteria per criteria group, thus diving deeper into the specificities of the different criteria.

Requirement Statement	
1.0 Open Database Connectivity & Architecture	calculate percentage of task performed when the start date, end date, and work is entered or start date, duration, and work is entered
allow user/project level access and update control.	allow user to elect to keep, change or delete the original estimate (baseline)
allow multiple users to share same project file(s).	provide view of actual work by user-specified period
performs global updates across multiple projects	perform trend analysis
platform independent, i.e. deployable on multiple desktop platforms or provide Web-enabled/Internet-enabled access.	
provide multiple views across multiple projects	8.0 Resource Features
allow user(s) to share centralized repository	assign costs to resources
use Open DataBase Connectivity (ODBC) standards to read/write to other databases.	perform resource scheduling
use Dynamic Data Exchange (DDE)/Object Linking & Embedding (OLE) to link to other applications.	provide flexibility in defining multiple resource types, i.e. dollars, government, and contractor
allow import large blocks of data.	display resources that are over-(under)-allocated
able to interface with institutional legacy systems.	allow multiple resource assignments per task
	display all tasks using a resource
	allow resource sharing among multiple projects
	allow user to create and assign calendars to resources
2.0 Workgroup Capabilities	
send project reports via E-mail utilizing Simple Mail Transfer Protocol (SMTP) and Multi-part Multi-media (MIME) Protocol.	9.0 Calendar Features
have import and export capabilities	allow user to set work and non-work periods for calendars (holidays, rest periods, etc.)
capture report output to files so that they may be incorporated into other documents.	allow multiple user-defined calendars within a project use system in increments of hours, days, weeks or months.
provide the capability of saving data, information and files such as MPX files.	allow user to set starting day of week and/or starting month of the fiscal year.
	allow calendar sharing among multiple projects
3.0 Network	allow user to set calendar to user-defined time periods
allow for multi-user licensing not tied to an individual by name	allow distinctive task calendars and resource usage calendars
compatible with a variety of networks, i.e. TCP/IP and output devices.	
	10.0 Cost Management features
4.0 Ease of Use	calculate a cost to complete the project
capability of easily making changes to data	associate multiple cost accounting codes to a project
easy to use and not require extensive training for the every-day user.	provide earned value analysis
easy to show progress in a task or project	
provide a Graphic User Interface (GUI)	11.0 Risk Management Features
consistent with other desktop tools	assign uncertainty to schedule parameters
intuitive and quick to learn	calculate schedule parameter uncertainty
provide on-line, context-sensitive help on screens and fields and an on-line tutorial.	perform risk analysis functions
	provide cost estimating capabilities for both risk impact and mitigation
5.0 Project Scheduling Methodology	assign uncertainty to cost parameters and cost estimates
perform basic scheduling/PERT functionality	provide capability for user defined performance metrics
allow variable scaling (month, week, day, hour) for task duration	able to perform risk simulations, e.g. Monte Carlo, or at least utilize risk simulation data.
perform Full Critical Path Method (CPM) functionality including capability of showing multiple critical paths (positive and negative) in output reports	
allow user to designate logical relationships, i.e. start-to-start, start-to-finish, finish-to-start, and finish-to-finish.	12.0 Project Reports
allow user(s) to customize tables and views	view and print Gantt charts, PERT Charts and histograms
allow user(s) specific defaults and create project templates	display actual vs. projected information
generates an Organizational Breakdown Structure (OBS) and a Work Breakdown Structure (WBS) or allow user to impose a WBS	adjust Gantt chart window view (user-selected start and end dates)
allow user(s) to assign positive or negative lag/lead times on logical relationships	allow user to customize bar styles and milestone styles for Gantt charts
perform resource leveling and smoothing	create schedules in user-defined increments (e.g. hours, days, weeks)
have the capability of "de-linking" percent complete from remaining duration.	indicate current time
allow user(s) to define and assign constraints to tasks and milestones.	generate PERT charts; consider time-phased vs. non-time phased and plotter requirements
	allow user to add free text to graphs
6.0 Project Task/Field Features	allow user to determine task label placement (left/right of bar, on bar, above, below)
allow user(s) to specify tasks or milestones to be rolled-up	create schedule tracking and projection graphs/reports
allow user(s) to define fields for each project/task/resource	create resource over-(under-) utilization graphs/reports
roll-ups multiple projects into a master schedule	display negative slack time
define a task with the duration being automatically calculated based upon its dependency with another task, i.e., hammock task	display actual time for organization, project, resource, or contract company by user-specified period, i.e. year-to-date, fiscal year, current month, etc
incorporate a large comment/notes field for the project for entry of soft information	report resource requests by project and by filled or unfilled status
define task start and end dates as fixed, resource-driven, or effort-driven	
allow user(s) to create a read-only version of project (fields, tables, resources, calendars)	13.0 Management Reporting
allow the capability to restrict user access to specified fields	provide standard reports
	select data for reporting based on user defined criteria
7.0 Baselineing and Tracking Progress of the Project	generate cost projection graphs/reports
create baseline plan to be used for comparisons	allow user to customize or create reports via a report writer
report ahead/behind original or revised schedule estimate	provide project level summary reports
allow user to re-baseline multiple times	allow user to add free text to reports
	provide the capability for reporting estimated vs. actual work for resources by user-specified period
	allow schedule tracking/reporting from common resource pool
	have the capability to categorize and report projects by their project status, i.e. active, complete, dropped, pending project start date, etc
	identify sub-projects within one project file for reporting purposes

Table 2: NASA requirements for a PMSS (Centeno-Gomez et al., n.d.)

Chapter 3 Method Implementation

The focus of this chapter is on the selection, implementation and testing of a PMSS and the steps preceding those actions. To make their sequence clearer, a model of these steps is shown in Figure 3.

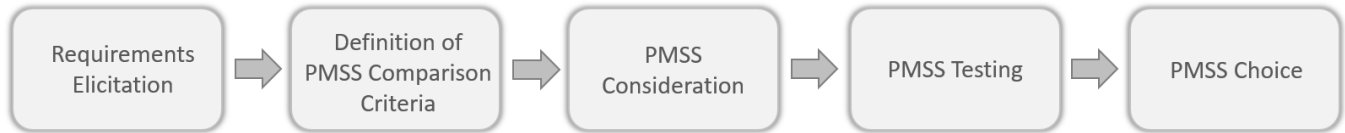


Figure 3: Overview of steps

3.1 Requirements Elicitation Process

The necessity of reliable PMSS is tremendously increasing. In response to the growing demand, software companies produce various distinct software systems. This diversity, however, creates chaos among decision-makers when they attempt to select an appropriate software system for their organization. An incorrect selection may adversely influence the business process and overall work of the organization. Moreover, it can turn out to be a costly and it is a time-consuming decision-making process (Kannan et al., 2021).

Therefore, when selecting a PMSS, it is crucial to understand the different requirements that the company has for such a software system, as well as to understand what goals they wish to achieve with the use of such a software system. Thus, as discussed in section 2.5.1, the most effective way to do this is through interviewing stakeholders individually for better results of the requirements elicitation process.

3.1.1 Data gathering method

Multiple interviews were conducted with about five employees of ASG, among which were the CEO and the managers of the company. The interviewing process took place over the span of a month, to ensure that stakeholders would be able to elaborate on the most recent information, gathered through the research. The interviews did not follow a strict structure, as the goal was that the interviewees would feel unconstrained in their answers. The interviews contained general questions about the experiences of the interviewees with the current project management style, their opinions on what could be improved and their ideas about the functionalities a PMSS must offer to be considered adequate for the company.

3.1.2 Company Goals

Before proceeding with the selection of a software system suitable for ASG, a summary of the main goals of the company is required. Such goals for instance are ASG's ambition to have a more smoothly-running team, more optimal planning and management strategies and overalls, more structure of their everyday activities. All these goals are essential for reaching the main objective of the company, namely – having an overview about what is happening in the company, what can be improved and thus, where can time and money be saved and put into better use.

All of these goals and their relationships illustrate the need for the implementation of a PMSS and are visualized with the help of a goal diagram (Figure 4), which is the product of the goal-oriented analysis. To aid the reader with interpreting the diagram, a legend is provided in Figure 5.

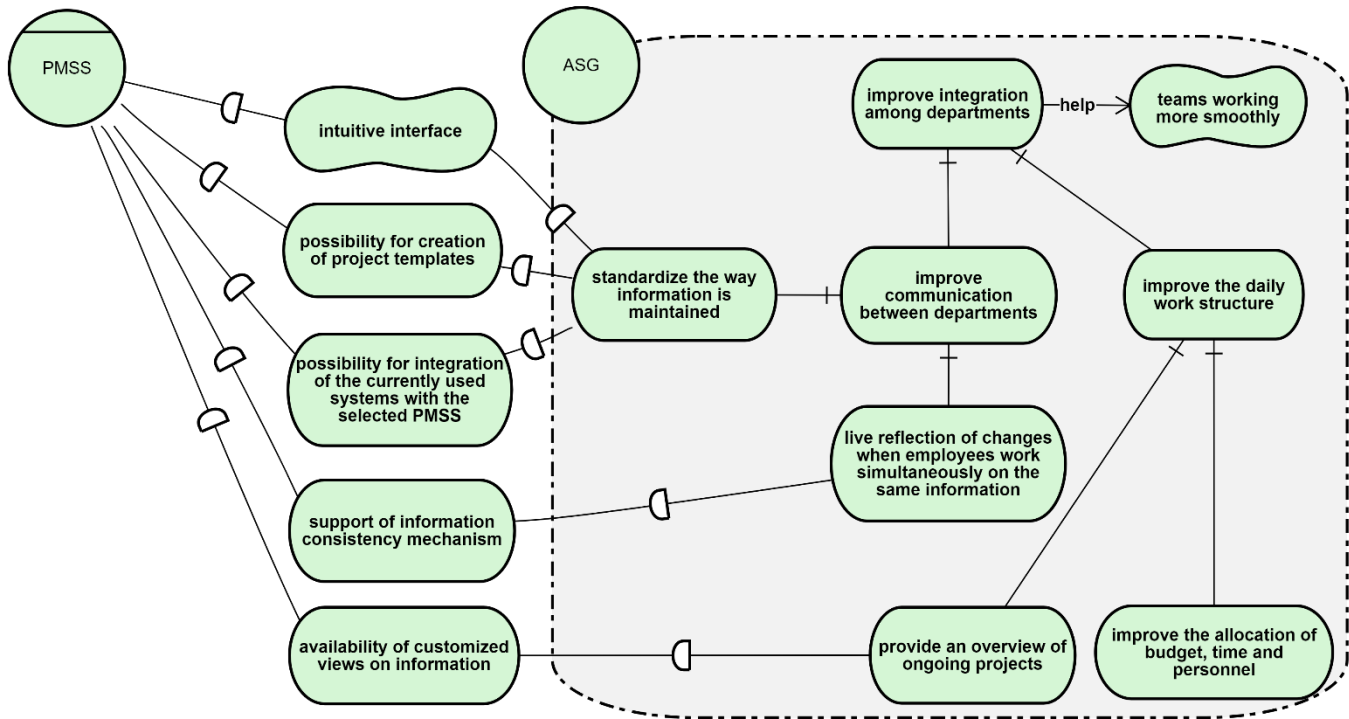


Figure 4: Goal diagram

Legend		
Symbol	Meaning	Description
	Actor	An active autonomous entity that aims at achieving their goals by exercising their know-how, in collaboration with other <i>actors</i> .
	Agent	An actor with concrete physical manifestations.
	Actor boundary	A graphical container of <i>actors'</i> intentionality.
	Goal	A state with clear-cut criteria of achievement, that an <i>actor</i> wants to achieve.
	Quality	An attribute, also known as <i>soft goal</i> , for which an <i>actor</i> desires some level of achievement.
	Goal dependency	Links <i>goals</i> within different <i>actor boundaries</i> . The "D" symbol acts as an arrowhead ">", indicating the direction of how <i>dependee</i> , <i>dependum</i> and <i>dependee</i> elements are linked.
	AND refinement	A <i>child goal</i> is a sub-state affair of the <i>parent goal</i> . The fulfilment of all $n \geq 2$ <i>children goals</i> makes the <i>parent goal</i> fulfilled.
	Help	Weak positive evidence for the satisfaction of the target.

Figure 5: Legend of the relevant iStar language elements (Dalpiaz et al., 2016)

3.1.3 Company Requirements

While all of the requirements in Table 2 have been taken into account while selecting a PMSS, some of them have higher importance for ASG. This was established via eliciting requirements from the relevant stakeholders and comparing those requirements to the ones in Table 2.

An important requirement, for instance, is the ability for multiple users to be able to work in the software system at the same time and their updates to be reflected in real-time. This is especially important for them, since their current way of working with Microsoft Excel does not offer this functionality, leading to miscommunications, confusion among employees and overall complication of their work.

As discussed before, currently different documents are kept in different folders or platforms, resulting in employees having to search to find the needed information. Thus, it is evident that being able to export, import and edit documents in the PMSS are necessary features for ASG.

Another important feature for ASG is the ease of use, namely – the software interface and intuitiveness. As the employees do not have previous experience with a PMSS, a more intricate system is not the best option for them, since the level of complexity of the system might result into the employees spending too much time learning how to use it, thus wasting time and money. On the other hand, they might get demotivated to use it and might revert back to their old habits of performing operations manually or via Microsoft Excel, if the PMSS is too complex. To counter this, it is important that there is sufficient support such as customer online support, online tutorials, FAQ forums, etc. to help guide the employees on how to effectively and efficiently use the PMSS.

Customization is also a desired functionality, since it allows for the employees to create custom views, tables, charts, activities and much more, depending on what their objective or goal is.

The creation of project templates is also a necessary feature that ASG would like to see in the selected PMSS, since they have a standard procedure, that they apply when implementing a project. Therefore, it is crucial that they can save time by reusing the same template for each project, instead of having to create the project procedure from scratch every time, as this is a time-costly activity.

Another crucial feature that ASG is looking for in a PMSS, is its ability to aid in budget management by allowing employees to assign costs to activities, as well as to calculate the costs for completing a project.

Lastly, during and after the implementation of a project, it is important for ASG to be able to analyze their work, for instance to view reports on project progress, task completion, estimated versus actual work, resource utilization and more in the form of Gantt charts, histograms, Pie charts, etc.

3.2 Defining Comparison Criteria

After considering the different requirements, elicited from the relevant stakeholders, Table 2 was reduced so it can represent the set of criteria that were most important for ASG. This set can be found in Table 3.

allow user/project level access and update control.
allow multiple users to share same project file(s).
performs global updates across multiple projects
have import and export capabilities
capability of easily making changes to data
easy to use and not require extensive training for the every-day user.
intuitive and quick to learn
provide on-line, context-sensitive help on screens and fields and an on-line tutorial.
allow user(s) to customize tables and views
allow user(s) specific defaults and create project templates
assign costs to resources
calculate a cost to complete the project
view and print Gantt charts, PERT Charts and histograms
provide standard reports
select data for reporting based on user defined criteria
provide the capability for reporting estimated vs. actual work for resources by user-specified period
easy to show progress in a task or project
create resource over-(under-) utilization graphs/reports
calculate percentage of task performed when the start date, end date, and work is entered or start date, duration, and work is entered

Table 3: Comparison criteria

3.3 Project Management Software Systems (PMSSs) Consideration, Comparison and Selection

After understanding stakeholder’s goals and requirements better, and after discussing ASG’s criteria for a PMSS, the next step is to actually select the most suitable software system for them.

Despite the rapid increase in number of PMSSs, most of the articles that were discovered focus on PMSSs such as Primavera (Liberatore & Pollack-Johnson, 2003), Basecamp (Puška et al., 2020), JIRA (Abramova et al., 2016), Asana (Puška et al., 2020) and Microsoft Project (Mellentien & Trautmann, 2001) (Stoshikj et al., 2014) (Vukomanović et al., 2012). Surprisingly, limited research was discovered on the more modern PMSSs, such as Monday.com, Wrike and others. For this reason, the following sections will provide an overview of a few PMSSs, discussing the reason they were considered in the first place, as well as their performance against the selected criteria. A summary of the discussion can be seen in Table 5.

3.3.1 Consideration

Most authors praise Microsoft Project, regarding it as the “top package” (Liberatore & Pollack-Johnson, 2003) that has been a “popular tool among the project managers” since “its birth” (Vukomanović et al., 2012) and is one of the software systems that is “most appreciated globally among practitioners” (Puška et al., 2020). However, while Microsoft Project completely conforms with Windows and the rest of the

Microsoft Office product family (Mellentien & Trautmann, 2001), it proved to be an unpopular option when presented to the company, as they regarded it as quite outdated and impractical in the context of the company. This contrast between the theory from the research and the reality experienced by the company made it interesting to include Microsoft Project in the comparison between different PMSSs and to use it as a benchmark.

The second PMSS to be included in the research was Monday.com, a modern flexible platform with a colorful interface, that visually attracts the user's attention. The reason behind the consideration of this software system is because during one of the conducted interviews, the energy manager of the company suggested that it should be included, since he had previous experience with it and was curious on how it would perform against the selected criteria and the other PMSSs.

The third software system, Wrike, is a robust project management tool, used by companies all around the world, for instance – Siemens, Walmart, Nickelodeon and others (*Wrike - Customer Success Stories*, n.d.). Wrike was selected in a similar way as Monday.com – it was recommended by the project manager of the company during an interview.

Further, the fourth selected PMSS is JIRA, which is part of the Atlassian group. The reason behind its selection is that it was not only praised in the literature (Abramova et al., 2016), but was also suggested by the project coordinator during one of the conducted interviews.

The last two PMSS that were considered for this study were Asana and Basecamp, respectively, as they were mentioned in the literature as worth considering when it comes to adequate project management tools (Puška et al., 2020).

3.3.2 Comparison

This section will compare the aforementioned six PMSSs against the criteria that was established with the help of the literature, as well as interviews conducted in the company. The information about the performance of the selected PMSSs against the criteria was found through interviews with relevant employees of ASG, through the researcher's personal experience with testing the features of the different PMSSs, through communication with customer support or through information posted on official online forums.

Firstly, before the comparison begins, it is important to provide an explanation of the symbols used in Table 5 via a legend (Table 4). The "✓" symbol on a green background indicates that the feature is offered by the PMSS and can be used unproblematically. The same symbol on a yellow background indicates that the feature is offered, however its use might be obstructed in a certain way. This however, does not increase the overall complexity around the use of the feature, but serves as an indication that the functionality of the feature is not as smooth as the functionality of a feature marked with a "✓" symbol on a green background.

The "✗" symbol, on the other hand, indicates that a feature is not included within the functionality set of a PMSS. When the symbol appears on a yellow background, it indicates that a workaround is possible – either via an integration or via a third party or other. On a red background, however, the symbol denotes the complete inability to use the feature even with a workaround, or its inexistence.

Lastly, the “?” on a gray background means that no information was found on the topic and the abbreviation ART denotes the average response time of the customer support.

Legend	
Symbol	Meaning
✓	Offered feature without obstacles
✓	Offered feature with obstacles
✗	Non-offered featured, which can be achieved in another way
✗	Non-offered featured, which cannot be achieved in another way
?	No information

Table 4: Legend of symbols

It is important to provide the legend before the actual discussion, in order to clarify to the reader as to why the discussion will not take into account every single cell of Table 5. Some of the cells, especially the ones containing a “✓” symbol on a green background, are in most cases self-explanatory and do not need further explanation. Moreover, as it will be shown in the following section, the selection of the most adequate PMSS for ASG, was done using the method of exclusion. For this reason, it is also most suitable for this section to discuss mainly the weaker points of the six PMSSs, and to include only the most worthy-of-mention strengths.

Beginning with the first criterion – the type of software source, only Wrike scores well, which is indicated by the green background color, as it is the only open source software (OSS). This means that it allows for a higher level of customization, which is an important aspect to ASG.

The next criterion is the type of management methodology, supported by each of the PMSSs. On this criterion, Microsoft Project and Basecamp are the only two that support traditional style methodology and thus score low for ASG. This is because ASG operates using agile principles and approaches and thus needs the selected software system to match that style.

The following criterion is the ease of use, which takes into account both the interface aesthetic and the intuitiveness of the software. On this criterion, Microsoft Project scores the lowest as the company considers it to be the least intuitive, as well as the least visually engaging software system.

When it comes to the automation criterion, only Monday.com and Wrike are able to perform unproblematic automations and thus score higher than the rest of the software systems. Microsoft Project is also able to provide automations, however, they have to be manually coded into the program’s VBA code, which is inconvenient for ASG, as their goal is to be able to work easily and smoothly with the selected software system. For Asana, it is not known whether the automations are a paid feature. Automation is possible with JIRA, however it is not a functionality offered directly by the platform. Instead, it is offered by its parent company Atlassian as a paid subscription. This is a recurring problem with JIRA as it offers only basic features and the rest has to be added via add-ons through Atlassian for a fee. This is also noted by Abramova et al. (2016). Therefore, JIRA only works if multiple subscriptions are made for Atlassian add-ons, which dramatically increases the price of conducting project management with JIRA. This is also the main reason why JIRA scores so poorly against so many of the criteria and the other PMSSs.

Further, the customer support criterion is especially important for ASG, since they have no previous experience with a PMSS and they will imaginably have many questions about the use of the different functionalities of the selected software system. Therefore, Wrike achieves the highest score, considering it is the only PMSS to have a live chat, where live people reply within a minute. Monday.com and Basecamp have the second best score with an average response time (ART) of an hour or less, which is an acceptable response time, according to ASG. On third place are JIRA and Asana with over four hours of ART, which is unfortunately too much time to wait, considering ASG's employees might have numerous questions every hour. It is important to note that these response times might decrease when purchasing a higher-level subscription plan. Last scores Microsoft Project with an indefinite ART, since contact with them could not be established at all.

The next criterion concerns the supported languages. As ASG is a Dutch company, it is most preferable for them to be able to receive customer support in Dutch. This is possible only with Monday.com and Asana.

Further, since ASG works closely with the platform ZenDesk, the possibility of its integration was also included as a criterion. The only two software systems, which allow for a smooth integration with ZenDesk are Monday.com and JIRA. The rest of the PMSSs also could be integrated with ZenDesk, however only via a third-party platform for an extra fee.

The last relevant criterion is the price of the different PMSSs should also be taken into consideration before a choice is made. Most of the software systems offer different pricing plans, depending on the functionalities they offer, as a tendency can be observed that each plan builds upon the previous plan by adding additional features. Since these pricing plans include long lists of supported features, it will be more convenient to discuss which plan per software system would suit ASG most, instead of discussing all possible supported features (Atlassian, n.d.) (Basecamp, n.d.) (monday.com, n.d.) (*Plans and Pricing*, n.d.) (*Plans Comparison Table | Wrike*, n.d.) (*-prijzen | Prijzen voor Premium-, Business-, & Enterprise-abonnementen •*, n.d.).

Neither of the pricing plans of Microsoft Project are recommended, since it is only used as a benchmark for comparison, as discussed previously. For Monday.com, the recommended plan is the "Pro" plan, as it includes time tracking, a formula column and a task dependencies column. These features are important as they would aid ASG with time and budget management and with understanding better how tasks are related, which would possibly help them identify bottlenecks.

When considering Wrike, its "Business" plan is recommended, as it offers real-time reports, workload charts, resource management features, project and task approvals, effort and time allocation features, calendar view, automation features and other functionalities that would be useful to ASG. On the other hand, JIRA's "Premium" plan is recommended as it offers automation functionalities across multiple projects, as well as better support.

Further, the recommended pricing plan for Asana is the "Business" plan, as it is the most adequate plan for repeating tasks and projects and includes approvals, proofing and workload charts. Lastly, Basecamp's "Business" plan is recommended, as its free plan does not offer team projects, project templates, priority support and others.

More details about the pricing plans are shown in Table 5, where the abbreviations "u", "m", "y" represent the entities "user", "month" and "year", respectively. The recommended pricing plans are in bold letters.

REQUIREMENTS & POSSIBILITIES		PROJECT MANAGEMENT SOFTWARE SYSTEMS					
		Microsoft Project	Monday.com	Wrike	JIRA	Asana	Basecamp
Source type		CSS	CSS	OSS	CSS	CSS	CSS
Management methodology		Traditional	Agile	Agile	Agile	Agile	Traditional
Ease of use	Interface	✗	✓	✓	✓	✓	✓
	Intuitiveness	✗	✓	✓	✗	✓	✓
API (Application Programming Interface)		✓	✓	✓	✓	✓	✓
App	Desktop app	✓	✓	✓	✗	✗	✓
	Mobile app	✓	✓	✓	✓	✓	✓
Features	Gantt chart of all projects	✓	✗	✗	✗	✗	✗
	Automation	✗	✓	✓	✗	✓	✗
	File import	✓	✓	✓	✓	✓	✓
	Automatic reports generation	✓	✓	✓	✓	✓	✗
	Creation of project template	✓	✓	✓	✗	✓	✓
	Repeating tasks	✗	✓	✓	✗	✓	✓
	Resource management	✗	✓	✓	✓	✗	✗
	Portfolio management	✗	✓	✓	✗	✓	✗
	Budget management	✓	✓	✓	✗	✗	✗
Support	Live chat	?	✗	✓	✗	✗	✗
	Email support	?	ART > 1 hour	✓	ART > 4 hours	?	ART > 20 minutes
	Supported languages	?	English, Spanish, French, German, Portuguese, Russian, Chinese, Dutch, Italian	English, French, German, Italian, Spanish, Portuguese, Russian, Japanese	English	English, Russian, Dutch, Polish, Italian, Swedish, Korean, French, German, Portuguese, Spanish, Japanese, Traditional Chinese	English
Integration possibilities		?	Outlook, MS Teams, DropBox, Slack, Zoom, Google Calendar, Google Drive, MS Excel, OneDrive, Zapier, Zendesk (and others)	MS Excel, Outlook, MS Office 365, Zendesk (via a third-party) (and others)	Slack, MS Teams, MS Outlook, Zendesk, Google Sheets, Zoom, CircleCI, Zeplin, Figma (and others)	Zendesk (via a third-party) (and others)	Zendesk (via a third-party) (and others)
Price		cloud-based for up to \$55/u/m or a license for up to \$1030 one-time	Student = € 0/u/m (max 2 users) Standard = € 10/u/m (annual plan) or €12/u/m (monthly plan) (Recommended) Pro = € 16/u/m (annually) or € 20/u/m (monthly) Enterprise = unknown	Free = \$ 0/u/m Professional = \$ 10/u/m (Recommended) Business = \$ 25/u/m Enterprise = unknown	Free = \$ 0/u/m Standard = \$ 8/u/m (Recommended) Premium = \$ 15/u/m Enterprise = unknown	Basic = € 0/u/m or y Premium = € 11/u/y or €14/u/m (Recommended) Business = € 25/u/y or €30/u/m Enterprise = unknown	Personal = \$0/m (max 20 users) (Recommended) Business = \$ 99/m (for all users)

Table 5: Summary of the performances of the PMSSs compared against the criteria

3.3.3 Selection and Testing

Based on the discussion in the previous section, it becomes evident to the reader that some of the researched PMSSs would not be adequate to be used in the context of ASG. For instance, after testing, it was established that Basecamp is closer to a to-do list application with a paid subscription, than to an actual project management tool. JIRA was perhaps the most inadequate choice, as the subscription fees for Atlassian add-ons start to pile once more advanced functionalities are needed, thus increasing the price of conducting project management via JIRA. This makes conducting project management with JIRA highly insufficient, as there are other software systems that offer the same functionalities for a much lower price.

Further, Asana was eliminated as it performed slightly worse than Monday.com and Wrike, in the sense that it did not offer as many features or had slight issues with the smooth use of some features. This was disappointing as its recommended plan had a higher price than the ones of Monday.com or Wrike. Eventually, Monday.com and Wrike were left. Initially, a decision was made in favor of Wrike, as it had the best score, compared to the rest of the PMSSs. It was chosen over Monday.com since the project management team at ASG preferred Wrike's interface and its fast customer support response time of under a minute.

Wrike was then tested for a week by the management team of ASG via a free trial plan. This experience yielded the realization that its complexity level was perhaps exceeding the abilities of the employees at ASG, as they had no previous experience with a similar software system. Despite this fact, contact was made with Wrike's Sales Team to enquire about purchasing the "Business" pricing plan. This communication led to the discovery that, although Wrike's official website states that the plans can be made per user per month (*Plans and Pricing*, n.d.), that was not the truth and they were in reality offered as an annual subscription. This was not ideal for ASG, as they wanted to test the selected software system for a few months and a year-long commitment was not a desired situation for them.

This revelation was concerning and disappointing, as it seemed that Wrike's pricing plans were a fraudulent, or at least that was the impression left by their misinforming website. After further communication with Wrike's Sales Team, a general consensus was reached that the Wrike's services might not be needed if miscommunication and, to a certain extent, deception was their preferred way of work.

Therefore, a uniform decision was made to reevaluate Monday.com, as it was the second best graded PMSS after Wrike. Initially, Monday.com was not a favorite because of its simplistic-looking interface. However, after a trade-off analysis between Monday.com and Wrike, it was established that the interface was of lesser importance in the face of the established issues with Wrike. Additionally, Monday.com provides support in Dutch and could be directly integrated with ZenDesk, which is a tool already used in ASG to handle customer's questions and complaints. Thus, such integration may be beneficial for ASG in the near future. Therefore, switching to Monday.com was a logical, as well as timely decision, as it would have been problematic if the issues with Wrike had been discovered after a plan had been purchased. As for Monday.com, the recommended pricing plan for ASG is the "Pro" plan, since it offers additional features such as dependencies between tasks, a formula column, more automations, private boards and more. These features are important to ASG, since they aim at decreasing the level of manual work and aim at having a better overview of the dependencies between tasks and projects and how they react to changes in dates, timelines, statuses, assignees, etc. Figure 6 provides a comparison between the different pricing plans and better illustrates via red ellipses why the "Pro" plan is recommended to the company.

	Student Try for free	Standard €12 / month or €10 / month <small>seat / month</small> <small>Total €60 / month billed annually</small>	Pro €20 / month or €16 / month <small>seat / month</small> <small>Total €100 / month billed annually</small>	Enterprise Contact us		Student Try for free	Standard €12 / month or €10 / month <small>seat / month</small> <small>Total €60 / month billed annually</small>	Pro €20 / month or €16 / month <small>seat / month</small> <small>Total €100 / month billed annually</small>	Enterprise Contact us
Maximum number of seats	Up to 2 seats	Unlimited	Unlimited	Unlimited	Map view		✓	✓	✓
Items	Up to 1000	Unlimited	Unlimited	Unlimited	Chart view	✓		✓	✓
File storage	500 MB	20 GB	100 GB	1000 GB	Workload			✓	✓
Activity log	1 week	6 months	1 year	5 years	Self-serve knowledge base	✓	✓	✓	✓
Unlimited boards		✓	✓	✓	24/7 customer support	✓	✓	✓	✓
Unlimited docs	✓	✓	✓	✓	Daily live webinars	✓	✓	✓	✓
Over 20 column types	✓	✓	✓	✓	Dedicated customer success manager				✓
200+ templates	✓	✓	✓	✓	99.9% uptime SLA				✓
iOS and Android apps	✓	✓	✓	✓	SOC 2 Type II Compliance	✓	✓	✓	✓
Unlimited free viewers		✓	✓	✓	Two-factor authentication	✓	✓	✓	✓
Embedded documents	✓	✓	✓	✓	Private boards and docs			✓	✓
Whiteboard collaboration	✓	✓	✓	✓	Google authentication			✓	✓
Updates section	✓	✓	✓	✓	Single Sign On (Okta, One login, Azure AD, Custom SAML)				✓
Zoom integration		✓	✓	✓	HIPAA Compliance				✓
Guest access		4 guests billed as 1 seat	Unlimited	Unlimited	Integration Permissions				✓
iOS and Android apps	✓	✓	✓	✓	IP restrictions				✓
Shareable forms	✓	✓	✓	✓	Content Directory				✓
Customizable notifications	✓	✓	✓	✓	Maximum number of seats	Up to 2 seats	Unlimited	Unlimited	Unlimited
Integrations		250 actions/month	25,000 actions/month	250,000 actions/month	Board administrators			✓	✓
Automations		250 actions/month	25,000 actions/month	250,000 actions/month	SCIM provisioning				✓
Premium Integrations				✓	Audit log				✓
Time tracking			✓	✓	Session management				✓
Formula column	✓		✓	✓	Panic mode				✓
Dependency column			✓	✓	Private workspaces				✓
Activity log	1 week	6 months	1 year	5 years	Advanced account permissions				✓
Dashboards	10 boards per dashboard	5 boards per dashboard	10 boards per dashboard	50 boards per dashboard	Work performance insights				✓
Kanban view	✓	✓	✓	✓	Dashboard email notifications				✓
Timeline view	✓	✓	✓	✓	Pivot analysis & reports				✓
Calendar view	✓	✓	✓	✓					

Figure 6: Monday.com pricing plans comparison (monday.com, n.d.)

Chapter 4 Results and Evaluation

Monday.com was tested by the energy manager, the project coordinator, the head of the billing department and the brand designer of the company for different amounts of time, varying between two weeks and a month. Their experiences with using the software system were recorded in writing during individually-conducted interviews. The structured interviewing style was selected and each employee was interviewed once. The process itself took two weeks, in which the composition of the questionnaire, as well as the interviews and their analysis, took place. Most questions were in a closed-ended format to ease the analysis of the answers. There were very few open-ended questions, which allowed for more free and unconstrained answers among the interviewees.

A template of the questionnaire and the detailed results of the conducted interviews can be found in Appendix B and C respectively. Table 6 provides an overview of the prevalence of each answer of the closed-ended questions. Table 7 summarizes the advantages and disadvantages of the software system, as expressed by the employees via the open-ended questions.

CLOSED-ENDED QUESTIONS	ANSWER PREVALENCE	
1. How do you feel about the implementation of Monday.com in the company?	Very positive	4
	Somewhat positive	
	Neutral	
	Somewhat negative	
	Very negative	
5. How would you rate the interface of Monday.com?	Very intuitive	2
	Somewhat intuitive	1
	Neutral	1
	Not very intuitive	
	Not intuitive at all	
6. How would you rate the difficulty level of the use of Monday.com?	Very difficult to use	
	Somewhat difficult to use	1
	Neutral	2
	Somewhat easy to use	1
	Very easy to use	
7. How motivated are you to use Monday.com in your daily activities?	Very motivated	3
	Somewhat motivated	1
	Neutral	
	Not very motivated	
	Not motivated at all	
8. How helpful do you think Monday.com will be in your daily activities?	Very helpful	3
	Somewhat helpful	1
	Neutral	
	Not very helpful	
	Not helpful at all	
9. How would you rate your overall experience with using Monday.com?	Very satisfied	2
	Somewhat satisfied	1
	Neutral	1
	Somewhat dissatisfied	
	Very dissatisfied	
10. How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?	Very likely	3
	Somewhat likely	1
	Neutral	
	Not very likely	
	Not likely at all	

Table 6: Summary of the results of the closed-ended questions

OPEN-ENDED QUESTIONS	ADVANTAGES	DISADVANTAGES
<p>2. How do you think Monday.com performs, compared to the previous project management method?</p>	<p>Monday.com centralizes documents, scheduling, budgeting, communication and more in one place.</p> <p>With Monday.com employees can work in the cloud, instead of on the local disc, which is old-fashioned.</p> <p>Monday.com reflects changes live, unlike to old programs that were used in the company.</p> <p>With Monday.com employees can easily create templates or use a variety of preset templates.</p> <p>Monday.com can easily automate tasks and assign deadlines, unlike the current way of working.</p>	
<p>3. Has Monday.com helped you in your daily activities so far and if yes, how?</p>	<p>Compared to the current way of working, Monday.com is amazing as it shows everything that has to be done, including relevant documents, projects, updates, etc. Monday.com helps employees do their job on time. It structures the tasks and provides an overview of the daily, weekly, monthly activities. It combines all of the information in one place.</p> <p>Monday.com has the potential of allowing the employees to be more focused on their priorities.</p>	<p>Employees should work with Monday.com for more than a couple of weeks before they get the feeling that the system helps them.</p>
<p>4. What concerns related to the use of Monday.com do you have?</p>	<p>Monday.com is very customizable and allows for a wide range of possibilities.</p> <p>Using Monday.com will become easier with time and use.</p>	<p>Convincing the management of the company to use Monday.com may be difficult, since everyone is so busy and employees are struggling to fit Monday.com on their busy schedule.</p> <p>If Monday.com is hacked, it is unsure what happens to the uploaded confidential documents and information.</p> <p>Employees might not use Monday.com according to the same logic, which would not be beneficial for overviews, reporting and analyzing data.</p>
<p>11. What do you hope to achieve with Monday.com?</p>	<p>Since Monday.com is a tool for collaboration, the hope is that everyone will start using it.</p> <p>Monday.com gives an overview of what has to be done and when, thus time can be saved and allocated to other tasks, thus saving the company money.</p> <p>Another hope is that Monday.com can make the company's work more productive and efficient, allowing for task prioritization, quicker feedback loops, more overview which would help with employees feeling overwhelmed by their work and feel like they don't have so much on their mind.</p>	<p>Monday.com might be difficult to learn in the beginning.</p>

Table 7: Summary of the results of the open-ended questions

The outcome of the questionnaire was mainly positive, with a few instances of neutral or negative remarks. The general notion was that the implementation of Monday.com was the right way to go for achieving the company's objective of creating a more unison work environment, thus making employees' work more effective and efficient. The implementation of Monday.com, according to the interviewees, was a desired and much needed change in the company, as the current method of work, namely – with Microsoft Excel or manual work, was outdated and very sub-optimal. Unsurprisingly, all interviewees were very open to this change and claimed that change is the only way to stay afloat and to prosper in the much changing and advancing world. This is a crucial aspect for the implementation of Monday.com, since, as discussed in Section 2.4, to successfully introduce change, employees must be motivated and enthusiastic to participate in it.

Further, even after working with Monday.com for a short time, the interviewees claimed that it was already helping them have more structure in their daily activities, one of the interviewees stating that it makes her life "easier". Each of the interviewees was satisfied to a certain extent with their experience with using Monday.com and recognized the software's potential, stating that they are motivated to keep using it in the future, after this research has been concluded.

When it came to the intuitiveness and the ease of use of the software, which were crucial aspects of the adoption of the software, the results from the interviews varied the most. The observed pattern was that the longer Monday.com was used, the easier and more intuitive it became for the user. Moreover, as the company is currently undergoing internal changes, some of the interviewees had overly busy schedules, which resulted into them viewing Monday.com as yet another task on their already full agenda, thus making it seem as more difficult that it is in reality. This explains why some of the interviewees overestimated the difficulty level of Monday.com. Hopefully, this belief will change as employees get more experienced with working with the platform.

However, despite the positive attitude towards Monday.com, the interviewees expressed some concerns regarding the software system, for instance – as the company's documentation is currently stored on a local disk, there were concerns as to the potential cyber security threats, as Monday.com is a web-based system. Moreover, there was a shared concern about the deployment of the software throughout the company departments, as the interviewees believed that the use of the tool will not be effective, unless the entire company uses it.

Overall, however, the general tone of the feedback was positive, and all four interviewed stakeholders believe the use of the system will be very beneficial in the company. These benefits are discussed in depth in the following chapter.

Chapter 5 Conclusion, Recommendations and Future Work

5.1 Conclusion

Throughout the duration of this research, the direction of the thesis alternated. Originally, the goal of the company was to increase the meter data reception rate, which was a task for the installation and project management team. As the project developed, however, it became more and more evident that the issues around acquiring a higher level of data was part of a bigger process that needed improvement. More stakeholders were interviewed, causing the focus of the research to deepen into the underlying issues of the company, as well as to expand over more of the departments. It became clear that the company had some structural issues in the planning and execution of tasks of any sorts, as well as the collaboration between employees and departments. These issues had to be addressed and thus a change was necessary. The general understanding was that a new way of work was necessary, something that would unite the company in their work, as well as provide a better overview of its ongoing operations. The solution was simple – a project management software system.

The selection of such a system was not an easy process, however, as many aspects had to be considered before the selection began. A systematic literature review was conducted, in order to expand the researcher's understanding of the variety of factors that had to be considered for a successful selection of a system. Different types of software were discovered based on the source code type or the type of management methodology they supported. Moreover, it was important to understand the wide range of functionalities that systems could offer, which was expressed through the authors' views on the criteria for such systems.

Further, after having a better overview of the types of software systems that were in existence, it was essential to understand what the company's needs for functionalities of a software system would be and how they interacted with the author's criteria. Thus, a process of requirements elicitation and analysis was performed via interviewing relevant employees at ASG and, based on the gathered information, a goal-oriented analysis was created with the aid of the iStar language. These processes gave a sufficient idea of the goals of the company and thus indicated towards the criteria ASG would have for the features of the software system.

Eventually, it was time to search for a software system, that would be the most adequate choice for ASG. Different systems were researched, tested and compared against each other, based on the afore established criteria. Based on the results from the comparison, a Wrike was selected, as it aligned best with the company's views and needs. However, after unsuccessful communication with Wrike's team, a decision was made in favor of the second best choice, namely – Monday.com, which initially came as a very close second to Wrike. After this decision, it was time to implement Monday.com in the company and a date was set.

Fortunately, ASG's employees were open to change and were motivated to participate in it, which made it easier to begin the implementation process, as a few of the employees started using the system. Their shared belief was that Monday.com would make the company's work more optimal and would be of help in solving some of ASG's more evident issues, such as the suboptimal meter data reception rate, which is also the focus of this research. This information was gathered through individual feedback interviews, which were conducted after the employees had used Monday.com for a period of time, and revealed not only their experiences with the system, but also their concerns about its implementation and use. These concerns revealed how important it was to establish certain guidelines in the forms of recommendations for the further implementation stages of Monday.com in ASG.

5.2 Recommendations

The aim behind these recommendations, as agreed with ASG, is to keep them as realistic as possible, even if that means downscaling them to a certain extent, as it is important for the company to receive adequate, achievable and beneficial advice for the use of the newly adopted software system.

Encouraging participation across the entire company

As Monday.com is primarily a collaboration software system, the advice for ASG is that every employee should participate in the implementation of the system. This will ensure that everyone is on the same page about what tasks have to be executed, when they have to be finished and who is responsible for them. These aspects are effortlessly visualized with the help of Monday.com, as can be seen in Figure 14 in Appendix D.

Integrating Monday.com with other systems and creating automated actions

As communication within the company is scattered through multiple platforms, such as Gmail, Outlook, Slack and others, Monday.com would serve as the main communication channel, as it allows for updates to be made inside the system, as well as files to be uploaded, as can be seen in Figures 15, 16 and 17 in Appendix D. Moreover, updates can be reflected across platforms with Monday.com's integration and automation options, which would be highly beneficial for ASG. The reason behind this is because with integrations, a bridge can be created between Monday.com and different platforms (Figure 18 in Appendix D), which bridges are then activated with the automations feature. This feature creates triggers for actions, for instance – when a new task is created in Monday.com, to automatically send an email or Slack notification to the assignee(s). However, the automations go further – automated actions inside the system allow for tasks to automatically be created and assigned a status, priority, dates and more. It is important to note that, although these automations take time to be set up, once this is done, they spare much time, as they can automatically remind people of due dates, notify them about changes in tasks and much more, which can be set with the custom recipe automation feature. An example of some of the possible automation and integration possibilities can be seen in Figures 19 and 20 in Appendix D.

While these seemingly limitless opportunities for integration and automation are impressive, it is important to realize that it can also prove to be overwhelming, which was also a concern, expressed during the feedback interviews. In a world of constant notifications from numerous devices and countless platforms, it is important to not overburden employees with too many integrations, as at a certain point, they would just become part of the internet noise and spam. In other words, the advice for ASG is to try to achieve as many of their objectives as possible via the use of Monday.com and to only integrate with other platforms if necessary.

As for automations, the recommendation for ASG is to explore the different possibilities and to use as many as possible, as long as they help them achieve their goals. However, it is important to note that, as automations take time to learn and get used to, it would be suboptimal if every employee would have to educate themselves on their use. This is namely the next advice for ASG, which is to limit the automation and other fundamental steps to one person, or in the best case – to the heads of the different departments. It is important that employees can log into Monday.com and have a readily-built model of their tasks and projects with all automations, dependencies and other core features already preset. In this way, the employees' main focus can be on the daily objective, instead of on trying to make sense of the platform, thus wasting time.

Building projects according to the same logic

Lastly, to ensure that Monday.com would really be beneficial for ASG, it is crucial that every department uses the same logic when building projects into the system, else statistical information would differ. The reason for this is because Monday.com allows for an impressive range of customization and its building blocks such as workspaces, folders, boards, groups, tasks, etc. can be interpreted and utilized differently by different individuals and departments. Therefore, it is recommended that when Monday.com is further implemented, an educational course is provided for the employees, thus ensuring that everyone understands the logic of the different building blocks. To further ensure the unison logic, it would be beneficial to have an employee double check whether newly implemented in the system projects follow the agreed upon structure. In this way, all employees will have an in-depth understanding of the system, which would thus result in a more harmonious work atmosphere, which would allow employees to work more efficiently. Eventually, if the implementation of Monday.com is a success, issues such as the meter data reception rate would be brought to a more satisfactory level.

5.3 Future Work

As aforementioned, the testing period of Monday.com among the four employees was quite limited, ranging from a week to up to a month. Thus, this research fails to explore the employees' experiences in more depth. This could be an interesting point to be explored in the future, when ASG's employees have had more time to work with the system, to learn its functionalities in more detail and to have a better idea of whether it actually helps them in their everyday work. After these experiences have been recorded, a thorough analysis could be performed to validate the impacts of the use of the software system within the company. The objective of this future work would be to verify whether the long-term effects of the system on the management process are positive and if not, what actions could potentially be taken to improve the use of the system.

Further, as there were concerns among employees about whether everyone within the company would start using the system, it could be a potential objective for future research to find out the reasons behind that reluctance and to possibly devise a plan of mass implementation. It is important to note that this implementation should not be forced upon employees, rather – they should feel motivated themselves to join their colleagues in the Monday.com experience. For this reason, more research could be done in the future about the most adequate and effective way to introduce everyone to the system and its benefits.

Lastly, during the first round of feedback interviews, the employees expressed valid concerns about the cyber security of the platform. As the current documentation is preserved on a local disk, it is understandable how uploading confidential information to the cloud might raise concerns within the company. These concerns could be further investigated at a future point in time and a possible plan of action could be designed that could ensure that information would not be leaked in a potential cyber-attack.

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APPENDIX

Appendix A: Systematic Literature Review (SLR)

The aim of the SLR is to provide an answer to this question. This is achieved by exploring relevant literature, which describes similar scenarios or processes, and how they can be optimized. The search was conducted via a couple of databases, such as Scopus and Web of Science. However, it was quickly established that using the same combination of search terms, Boolean operators and sorting in both databases yields tens of thousands of results in Google Scholar, while in Scopus there were just a couple hundred results. For this reason, Google Scholar will not be used at this stage of the research. The inclusion and exclusion criteria for the search are shown in Table 8. The confusion and conceptual matrices can be seen in Table 9 and Table 11, respectively. An overview of the search log can be seen in Table 10.

QUESTION	CONSIDERATION CRITERIA			
	INCLUSION CRITERIA	COMMENTS	EXCLUSION CRITERIA	COMMENTS
3. Which of the existing project management software systems fulfills best the identified requirements?	Articles published after the year 2000, taking into account any mention of methods of selecting an efficient project management software system. Comparisons or recommendations of project management software systems from before the year 2010 will not be considered.	Since technologies expand rapidly, a software system that was relevant 20 years ago, may not be efficient today. This is the reason why mention of such software systems will be taken into account from only after the year 2010 on.	Articles published before the year 2000	Older articles might contain outdated information.
	At least 5 citations	Articles with less than 5 citations may not be very credible and thus should not be considered 100% trustworthy. Thus they will not be cited.	Unavailable articles	Articles that were not available due to a paywall or an unwilling author were left out.
	-	-	Articles that were not in English, or did not offer an English translation	Not applicable for adequate search.

Table 8: Inclusion and exclusion criteria

SLR	SEARCH LOCATION								TOTAL
	Scopus				Web of Science				
SEARCH NUMBER	#1	#2	#3	#4	#5	#6	#7	#8	
1. Found results after initial search (with year and subject criteria applied)	193	6	112	102	4757	20	77	29	
2. Removal of articles with irrelevant names	150	4	107	87	skipped	10	skipped	skipped	
3. Removal of unavailable articles	3	0	1	0	skipped	0	1	0	
4. Removal of articles with less than 5 citations	4	0	1	7	4739	7	59	24	
5. Removal after reading the abstract	34	0	3	6	18	1	16	5	
6. Added from references of relevant articles	1	2	0	0	0	0	0	0	
Removal of duplicates	1								
Final set of articles	3	4	0	2	0	2	1	0	11

Table 9: Confusion matrix

SEARCH NUMBER	DATE OF SEARCH	DATA BASE	SEARCH TERMS				RESULTS	COMMENTS
			KEY WORDS & BOOLEAN OPERATORS	YEAR(S) OF PUBLICATION	SUBJECT AREA	SORTING		
1	18.04.2022.	Scopus	requirement* OR criteria AND good OR adequate "project management software" OR "project management tool" OR "project management program" AND select* OR choos*	After 2000	Engineering; Business, Management and Accounting; Decision sciences; Social sciences; Environmental science; Multidisciplinary	relevance	193	After reading the titles, some articles will be eliminated, since they are not relevant. From the remaining articles, all unavailable articles are removed. From the remaining, all articles with less than 5 citations are removed. The remaining articles will be checked for relevance by reading their abstract. What articles remain after these steps will be included in the SLR.
2	19.04.2022.	Scopus	criteria AND choos* AND select* AND "project management software" AND compar* AND survey*	After 2000	Engineering; Business, Management and Accounting; Decision sciences	relevance	6	The steps from search 1 were repeated here.
3	30.05.2022.	Scopus	requirement* OR criteria AND efficient AND "project management" AND "software" OR "software system" OR "tool" OR "program"	After 2000	Engineering; Business, Management, Accounting; Decision Sciences	relevance	112	Upon reading the names of the articles, I established that the search terms were probably not the best, since most of the results did not come close enough to what I was actually searching for.
4	30.05.2022.	Scopus	requirement* or criteria AND efficient AND "project management software" OR "project management software system" OR "project management tool" OR "project management program" OR "project management software"	After 2000	Engineering; Business, Management, Accounting; Decision Sciences	relevance	102	As in the previous search, the search terms did not yield results that were close enough to what was being searched for.
5	30.05.2022.	Web of Science	requirement* or criteria AND efficient AND "project management software" OR "project management software system" OR "project management tool" OR "project management program" OR "project management software"	After 2000	Computer science information systems; Computer science interdisciplinary applications; Engineering multidisciplinary; Operations research management science; Management; Business	relevance	4 757	This search yielded too many results before citation criteria was applied. With it, the number of articles declines drastically.
6	30.05.2022.	Web of Science	requirement* AND select* AND efficient AND "project management software system" OR "project management tool" OR "project management program" OR "project management software"	After 2000	Computer science information systems; Computer science interdisciplinary applications; Engineering multidisciplinary; Operations research management science; Management; Business	relevance	20	The steps from search 1 were repeated here.
7	31.05.2022.	Web of Science	"Project management" AND "Microsoft Project" OR "MS project" AND "Monday.com" OR "Wrike" OR "Jira"	After 2000	Computer science information systems; Computer science interdisciplinary applications; Engineering multidisciplinary; Operations research management science; Management; Business	relevance	77	The search terms did not yield results that were close enough to what was being searched for.
8	31.05.2022.	Web of Science	"Project management" AND "Monday.com" OR "Wrike" OR "Jira"	After 2000	Computer science information systems; Computer science interdisciplinary applications; Engineering multidisciplinary; Operations research management science; Management; Engineering industrial; Multidisciplinary sciences	relevance	29	The search terms did not yield results that were close enough to what was being searched for.

Table 10: Search log

SEARCH NUMBER	ARTICLE		CONCEPT						
	NAME	CITATION	Criteria-Based Decision Making (CBDM) / Multiple-Criteria Decision-Making (MCDM) / Multiple-Criteria Decision Analysis (MCDA)	Analytic Hierarchy Process Method (AHP) / Hierarchal Decision Modelling (HDM)	Measurement of Alternatives and Ranking According to Compromise Solution Method (MARCOS)	Teaching-Learning Based Optimization (TLBO)	Technique for Order Preference Similarity to Ideal Solution (TOPSIS)	Criteria / Requirements for Evaluating a Software	Comparison Between Existing Softwares
#1	Software Project Management Tools: Making a Practical Decision Using AHP	Ahmad & Laplante, 2006		✓				✓	
#1	A Novel Software Package Selection Method Using Teaching–Learning Based Optimization and Multiple Criteria Decision Making	Kannan et al., 2021	✓	✓		✓	✓		
#1	Project Meanagment Software Evaluation by Using the Measurement of Alternatives and Ranking According to Compromise Solution (MARCOS) Method	Puška et al., 2020	✓	✓	✓		✓		
#2	Application of the AHP in project management	Al-Harbi, 2001	✓	✓					
#2	A case study for project and portfolio management information system selection: a group AHP-scoring model approach	Gerogiannis et al., 2010	✓	✓				✓	
#2	Factors Influencing the Usage and Selection of Project Management Software	Liberatore & Pollack-Johnson, 2003							✓
#2	PLM Software Selection Model for Project Management Using Hierarchical Decision Modeling With Criteria From PMBOK® Knowledge Areas	Eastham et al., 2014		✓				✓	
#4	Efficient Managing of Complex Programs with Project Management Services	Stoshikj et al., 2013						✓	✓
#6	Resource allocation with project management software	Mellentien & Trautmann, 2001							✓
#6	The use of project management software in construction industry of Southeast Europe	Vukomanović et al., 2012							✓
#7	Open Source and Proprietary Project Management Tools for SMEs	(Abramova, Pires et al. 2016)							✓

Table 11: Concept matrix

The tables above present the results of the SLR, as it was conducted initially. Later, as the thesis kept developing, it was established that the topics of MCDM, AHP, TLBO, TOPSIS and MARCOS were no longer needed. And additional search was conducted, which is not resulted in the tables above. This search yielded information on Requirement Engineering and its approaches. This follow-up search was conducted via using Google as a search engine, and from the results yielded, only the ones referring to Scopus articles were considered. An overview of these later discovered articles will be presented in Table 12 below.

Autor(s)	Article name	Year of publication
Centeno-Gomez, D., Alexander, A., Anderson, D., Cook, D., Poole, K., & Findlay, O.	PROJECT MANAGEMENT TOOL ANALYSIS AND RECOMMENDATIONS WHITE PAPER	n.d.
Ciric, D., Lalic, B., Gracanin, D., Tasic, N., Delic, M., & Medic, N.	Agile vs. Traditional Approach in Project Management: Strategies, Challenges and Reasons to Introduce Agile	2019
Gobov, D., & Huchenko, I.	Software Requirements Elicitation Techniques Selection Method for the Project Scope Management	n.d.
Ohshiro, K., Watahiki, K., & Saeki, M.	Integrating an idea generation method into a goal-oriented analysis method for requirements elicitation	2005
Radujković, M., & Sjekavica, M.	Project Management Success Factors	2017
Aljahdali, S., Bano, J., & Hundewale, N.	Goal Oriented Requirements Engineering—A Review	n.d.
Dalpiaz, F., Franch, X., & Horkoff, J.	IStar 2.0 Language Guide	2016
Guizzardi, R. S. S., & Perini, A.	Analyzing Requirements of Knowledge Management Systems with the Support of Agent Organizations	n.d.
Hussain, S. T., Lei, S., Akram, T., Haider, M. J., Hussain, S. H., & Ali, M.	Kurt Lewin's change model: A critical review of the role of leadership and employee involvement in organizational change	2018
Pacheco, C., García, I., & Reyes, M.	Requirements elicitation techniques: A systematic literature review based on the maturity of the techniques	2018
Rueda, S., Panach, J. I., & Distant, D.	Requirements elicitation methods based on interviews in comparison: A family of experiments	2020
Courage, C., & Baxter, K.	Understanding Your Users: A Practical Guide to User Requirements Methods, Tools, and Techniques	2005

Table 12: Additional articles

Appendix B: Interview Questionnaire Template

This is a template of the questionnaire, presented to some of the employees. It is important to note that questions 3 and 8 are similar, with the only difference that they regard the past and the future, respectfully.

- 1. How do you feel about the implementation of Monday.com in the company?**
 - Very positive
 - Somewhat positive
 - Neutral
 - Somewhat negative
 - Very negative

- 2. How do you think Monday.com performs, compared to the previous project management method?**

- 3. Has Monday.com helped you in your daily activities so far and if yes, how?**

- 4. What concerns related to the use of Monday.com do you have?**

- 5. How would you rate the interface of Monday.com?**
 - Very intuitive
 - Somewhat intuitive
 - Neutral
 - Not very intuitive
 - Not intuitive at all

- 6. How would you rate the difficulty level of the use of Monday.com?**
 - Very difficult to use
 - Somewhat difficult to use
 - Neutral
 - Somewhat easy to use
 - Very easy to use

- 7. How motivated are you to use Monday.com in your daily activities?**
 - Very motivated
 - Somewhat motivated
 - Neutral
 - Not very motivated
 - Not motivated at all

- 8. How helpful do you think Monday.com will be in your daily activities?**
 - Very helpful
 - Somewhat helpful
 - Neutral
 - Not very helpful
 - Not helpful at all

- 9. How would you rate your overall experience with using Monday.com?**
 - Very satisfied
 - Somewhat satisfied
 - Neutral
 - Somewhat dissatisfied
 - Very dissatisfied

- 10. How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?**
 - Very likely
 - Somewhat likely
 - Neutral
 - Not very likely
 - Not likely at all

- 11. What do you hope to achieve with Monday.com?**

Figure 7: Interview questionnaire template

Appendix C: Interview Questionnaire Results

The following figures represent the results, acquired during the individual interviews.

- 1. How do you feel about the implementation of Monday.com in the company?**
 - Very positive
 - Somewhat positive
 - Neutral
 - Somewhat negative
 - Very negative

- 2. How do you think Monday.com performs, compared to the previous project management method?**

Currently, everything is kept in different folders, documents, platforms, which makes it difficult to search for information. For me, Monday.com centralizes everything in one place. With Monday.com you can write comments, you can make updates for yourself and for other team members, you can import documents, etc.

- 3. Has Monday.com helped you in your daily activities so far and if yes, how?**

Yes, definitely. Monday.com is basically one place that shows everything you need to do, all projects, all documents, etc. Now I can just open Monday.com and I see everything that I need to do, when it needs to be done etc.

- 4. What concerns related to the use of Monday.com do you have?**

We want to use Monday.com in the whole company, and for that to happen, we need to convince management that Monday.com is the way to go and that it will save time and effort for employees. This will be difficult, since employees are very busy and are struggling to make time to dive deeper into Monday.com.

- 5. How would you rate the interface of Monday.com?**
 - Very intuitive
 - Somewhat intuitive
 - Neutral
 - Not very intuitive
 - Not intuitive at all

- 6. How would you rate the difficulty level of the use of Monday.com?**
 - Very difficult to use
 - Somewhat difficult to use
 - Neutral
 - Somewhat easy to use
 - Very easy to use

- 7. How motivated are you to use Monday.com in your daily activities?**
 - Very motivated
 - Somewhat motivated
 - Neutral
 - Not very motivated
 - Not motivated at all

- 8. How helpful do you think Monday.com will be in your daily activities?**
 - Very helpful
 - Somewhat helpful
 - Neutral
 - Not very helpful
 - Not helpful at all

- 9. How would you rate your overall experience with using Monday.com?**
 - Very satisfied
 - Somewhat satisfied
 - Neutral
 - Somewhat dissatisfied
 - Very dissatisfied

- 10. How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?**
 - Very likely
 - Somewhat likely
 - Neutral
 - Not very likely
 - Not likely at all

- 11. What do you hope to achieve with Monday.com?**

Monday.com, according to its website, is mainly a tool for collaboration, for working in teams. So, the hope is that we, at the company, can see if we can really work as a team, using Monday.com in the sense that right now people can just stand up and go to their colleague's desk and talk, and Monday.com has to be an easier option than that. Another hope is to have an overview of all projects and who is responsible for a task. We hope that Monday.com will help improve the general workflow. Personally, I hope to get more grip on my work, that is my entire goal.

Figure 8: Energy Manager feedback (used Monday.com for about a month)

1. **How do you feel about the implementation of Monday.com in the company?**
 - Very positive
 - Somewhat positive
 - Neutral
 - Somewhat negative
 - Very negative

2. **How do you think Monday.com performs, compared to the previous project management method?**

It is amazing compared to the current way, because with Monday.com I can work in the cloud, which is better than what we do now – work on the local disk, which is also very old-fashioned. And working with processes in the past will not help the company develop in the present and the future.

3. **Has Monday.com helped you in your daily activities so far and if yes, how?**

It's helping me to do my job on time. Instead of putting everything in my agenda as a to-do, I can put it in Monday. It makes my life easier. Especially when I learn more about its functionalities and possibilities, I think it will be even more helpful for me!

4. **What concerns related to the use of Monday.com do you have?**

If Monday is hacked, what happens with our administration and documents? Should we fear a potential cyber security threat?

5. **How would you rate the interface of Monday.com?**
 - Very intuitive
 - Somewhat intuitive
 - Neutral
 - Not very intuitive
 - Not intuitive at all

6. **How would you rate the difficulty level of the use of Monday.com?**
 - Very difficult to use
 - Somewhat difficult to use
 - Neutral
 - Somewhat easy to use
 - Very easy to use

7. **How motivated are you to use Monday.com in your daily activities?**
 - Very motivated
 - Somewhat motivated
 - Neutral
 - Not very motivated
 - Not motivated at all

8. **How helpful do you think Monday.com will be in your daily activities?**
 - Very helpful
 - Somewhat helpful
 - Neutral
 - Not very helpful
 - Not helpful at all

9. **How would you rate your overall experience with using Monday.com?**
 - Very satisfied
 - Somewhat satisfied
 - Neutral
 - Somewhat dissatisfied
 - Very dissatisfied

10. **How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?**
 - Very likely
 - Somewhat likely
 - Neutral
 - Not very likely
 - Not likely at all

11. **What do you hope to achieve with Monday.com?**

More overview of what has to be done and when, so we can save more time to do other things. Then it will cost the company less money. Also Monday.com, even if it might be a bit difficult to learn, will hopefully be less work than the way we work now.

Figure 9: Project Coordinator feedback (used Monday.com for about two weeks)

1. How do you feel about the implementation of Monday.com in the company?

- Very positive
- Somewhat positive
- Neutral
- Somewhat negative
- Very negative

2. How do you think Monday.com performs, compared to the previous project management method?

It's nice, because it's a living online platform, Microsoft Excel does not let you see live what other people are doing. With Monday.com you can easily change stuff, you can create templates or use a variety of ready templates, that have preset functions, etc.

3. Has Monday.com helped you in your daily activities so far and if yes, how?

Yes, it has structured my tasks, because I work with a lot of different projects and topics, and in Monday I can see what I have to do daily, I have an overview. Everything is in one place, instead of to-dos in my booklets, or things written down somewhere. It just combines all of my information in the same place.

4. What concerns related to the use of Monday.com do you have?

My concern is that within the company, not everyone will start using it. Or if they do, I am concerned that they will not use it in the same way, because it is very customizable and allows for a really wide range of possibilities. I think this will be a problem, since, if projects do not follow the same logic, upon they are incorporated into Monday.com, it will create a lot of confusion and will just not be optimal. We would definitely need a general template or guideline on how to do things for Monday.com to actually work well.

5. How would you rate the interface of Monday.com?

- Very intuitive
- Somewhat intuitive
- Neutral
- Not very intuitive
- Not intuitive at all

6. How would you rate the difficulty level of the use of Monday.com?

- Very difficult to use
- Somewhat difficult to use
- Neutral
- Somewhat easy to use
- Very easy to use

7. How motivated are you to use Monday.com in your daily activities?

- Very motivated
- Somewhat motivated
- Neutral
- Not very motivated
- Not motivated at all

8. How helpful do you think Monday.com will be in your daily activities?

- Very helpful
- Somewhat helpful
- Neutral
- Not very helpful
- Not helpful at all

9. How would you rate your overall experience with using Monday.com?

- Very satisfied
- Somewhat satisfied
- Neutral
- Somewhat dissatisfied
- Very dissatisfied

10. How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?

- Very likely
- Somewhat likely
- Neutral
- Not very likely
- Not likely at all

11. What do you hope to achieve with Monday.com?

For the company, I hope Monday.com can make our work more productive and efficient and will allow us to have quicker feedback loops, instead of walking to people's desks. I hope Monday.com will give us more clarity of what people need to do. For me personally, I hope it helps me to not feel so overwhelmed with tasks I need to do. It's nice if I can prioritize my tasks, or assign tasks to other people or have my boss assign priorities for me.

Figure 10: Brand Designer feedback (used Monday.com for about three weeks)

1. How do you feel about the implementation of Monday.com in the company?

- Very positive
- Somewhat positive
- Neutral
- Somewhat negative
- Very negative

2. How do you think Monday.com performs, compared to the previous project management method?

Currently, I work with Microsoft Excel. Monday.com, in comparison with Microsoft Excel, can automate tasks and activities, it can put deadlines and Microsoft Excel can't. You can see what tasks need to be finished, based on status, priorities, etc. Monday is thus greater to work than Microsoft Excel.

3. Has Monday.com helped you in your daily activities so far and if yes, how?

Not yet, since I haven't worked too much time with it. But I can tell that it has the potential to help me in setting my to-do list in priorities, so I can see each day, what my priorities are, when the deadlines of tasks are, etc., which will help me stay more focused on the tasks at hand.

4. What concerns related to the use of Monday.com do you have?

Right now, my only concern is that Monday.com might be difficult in the beginning. But after I use it for some time, I think it will become more easy. It is a matter of time.

5. How would you rate the interface of Monday.com?

- Very intuitive
- Somewhat intuitive
- Neutral
- Not very intuitive
- Not intuitive at all

6. How would you rate the difficulty level of the use of Monday.com?

- Very difficult to use
- Somewhat difficult to use
- Neutral
- Somewhat easy to use
- Very easy to use

7. How motivated are you to use Monday.com in your daily activities?

- Very motivated
- Somewhat motivated
- Neutral
- Not very motivated
- Not motivated at all

8. How helpful do you think Monday.com will be in your daily activities?

- Very helpful
- Somewhat helpful
- Neutral
- Not very helpful
- Not helpful at all

9. How would you rate your overall experience with using Monday.com?

- Very satisfied
- Somewhat satisfied
- Neutral
- Somewhat dissatisfied
- Very dissatisfied

10. How likely is it that you would keep using Monday.com for the next couple of months, after the end of this research?

- Very likely
- Somewhat likely
- Neutral
- Not very likely
- Not likely at all

11. What do you hope to achieve with Monday.com?

My goal is to see the planning and how much time is left for some tasks and subtasks. See what I have to do and when, to have an overview. Also, I hope Monday.com's automations will help me have less on my mind – for example Monday.com can send automated notifications or emails to the responsible people, when a task's deadline approaches. Thus, I don't have to think about reminding people, and then to think who to remind, when to remind and what to remind them about.

Figure 11: Head of Billing Department feedback (used Monday.com for about a week)

Appendix D: Additional Information

	<i>OpenProject</i>	<i>ProjectLibre</i>	<i>Redmine</i>	<i>LibrePlan</i>
<i>Language</i>	Ruby	Java	Ruby	Java
<i>Multiplatform</i>	Linux Only	Yes	Yes	Yes
<i>Web-based</i>	Yes	No	Yes	Yes
<i>Issue tracking</i>	Yes	No	Yes	Yes
<i>Scheduling</i>	Yes	No	Yes	Yes
<i>Resource management</i>	No	Yes	No	Yes
<i>Document management</i>	Yes	No	Yes	Yes
<i>Reporting</i>	No	No	No	Yes
<i>Portfolio Management</i>	Yes	No	Yes	No
<i>Forum</i>	Yes	No	Yes	No
<i>Email Support / Integration</i>	Yes	No	Yes	No
<i>Resource management</i>	No	Yes	No	Yes
<i>Repository integration</i>	Yes	No	Yes	No
<i>Task management</i>	Yes	Yes	Yes	Yes
<i>Budget management</i>	Yes	Yes	Yes ¹	Yes
<i>Time tracking</i>	Yes	Yes	Yes	Yes
<i>CRM</i>	No	No	Yes ¹	
<i>Charts</i>	Yes	Yes	Yes	Yes
<i>Simulation Scenarios</i>	No	Yes	Yes ¹	Yes
<i>Import/Export data</i>	Yes	Yes	Yes	Yes

Table 13: Comparison Open Source software systems (Abramova et al., 2016)

	<i>Bitrix24</i>	<i>JIRA</i>	<i>MS Project</i>	<i>Asana</i>
<i>Development Language</i>	PhP	Java	.NET	Luna
<i>Multiplatform</i>	Yes	Yes	No	Yes
<i>Web-based</i>	Yes	Yes	No	Yes
<i>Issue tracking</i>	No	Yes	No	
<i>Scheduling</i>	Yes	No	Yes	Yes
<i>Document management</i>	Yes	No	No	Yes
<i>Reporting</i>	Yes	Yes	Yes	Yes
<i>Portfolio Management</i>	No	No	No	No
<i>Monitoring</i>	Yes	Yes ¹	Yes	Yes
<i>Forum / Wiki</i>	Yes	Yes ¹	No	No
<i>Email Support / Integration</i>	Yes	Yes ¹	Yes	No
<i>Resource management</i>	Yes	Yes ¹	Yes	Yes
<i>Repository integration</i>	Yes	Yes ¹	Yes	Yes
<i>Task management</i>	Yes	Yes	Yes	Yes
<i>Budget management</i>	No	Yes ¹	Yes	No
<i>Time tracking</i>	Yes	Yes	Yes	Yes
<i>CRM</i>	Yes	Yes ¹	Yes ¹	Yes
<i>Simulation Scenarios</i>	No	Yes	Yes	No
<i>Import/Export data</i>	Yes	Yes	Yes	Yes
<i>Custom Integrations</i>	No	Yes	Yes	Yes
<i>API</i>	Yes	Yes	Yes	Yes
<i>SSL Security</i>	Yes	Yes	Yes	
<i>Mobile Version</i>	Yes	Yes	Yes	Yes

Table 14: Comparison Close Source software systems (Abramova et al., 2016)

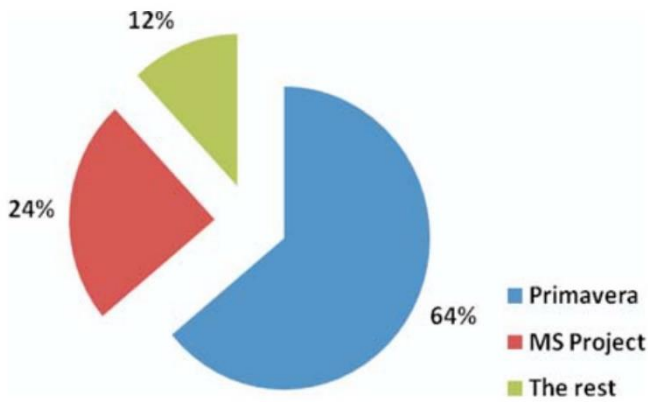


Figure 12: The usage of PMSSs in the US (Vukomanović et al., 2012)

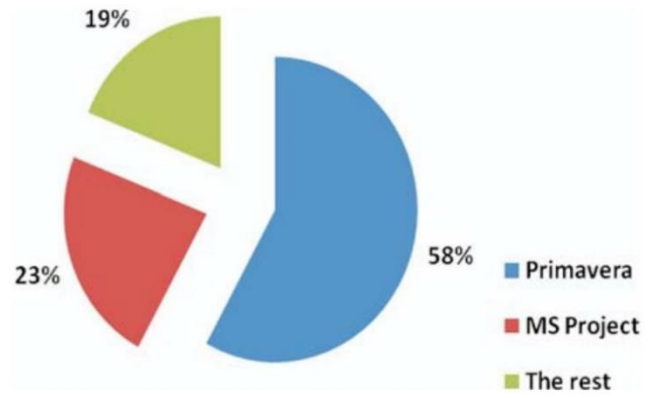


Figure 13: The usage of PMSSs in the Middle East (Vukomanović et al., 2012)

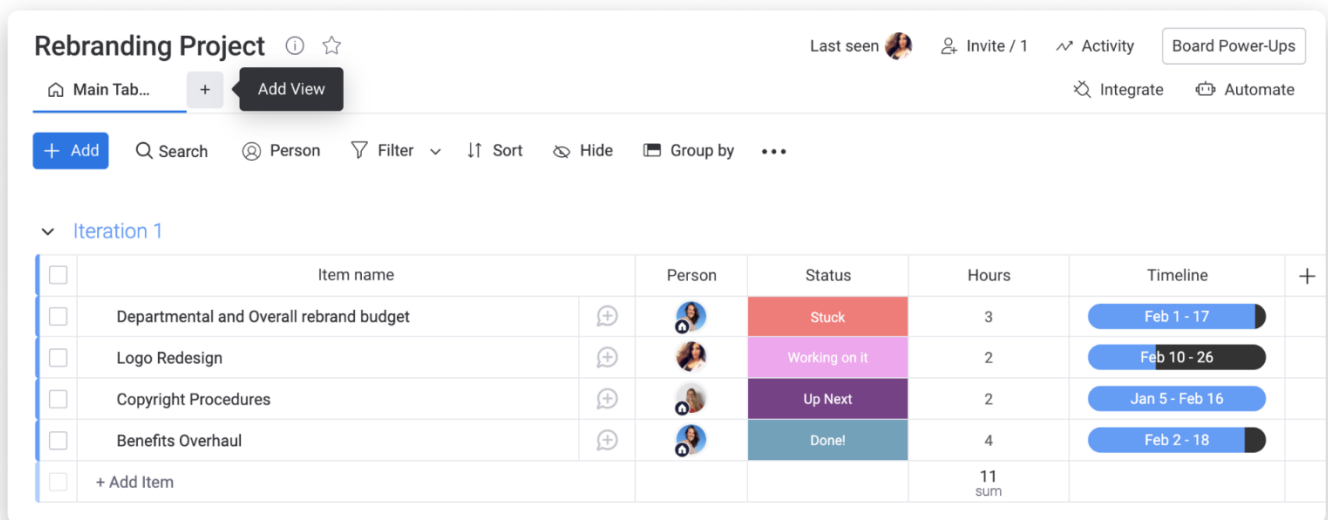


Figure 14: The task overview section of Monday.com (Security Check, n.d.-e)

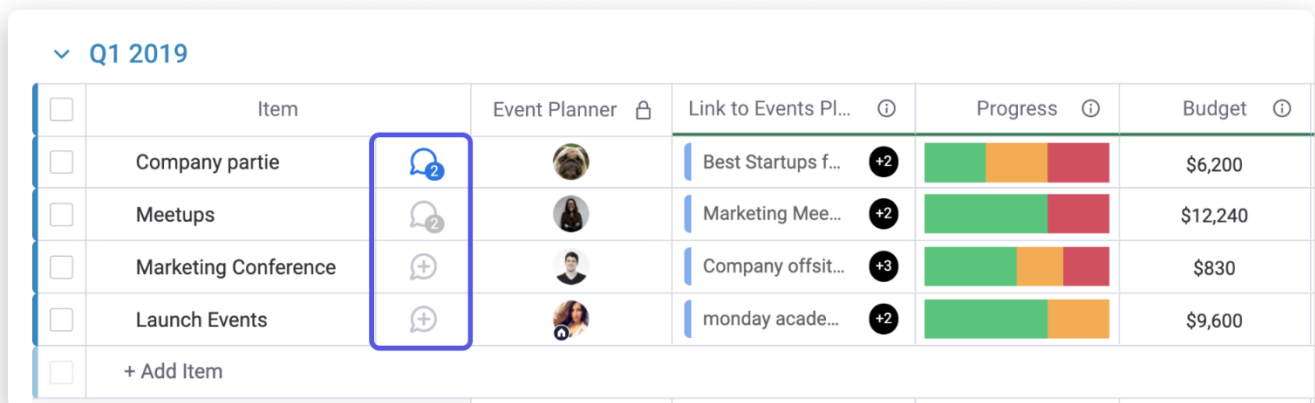


Figure 15: The updates section of a task within Monday.com (Security Check, n.d.)

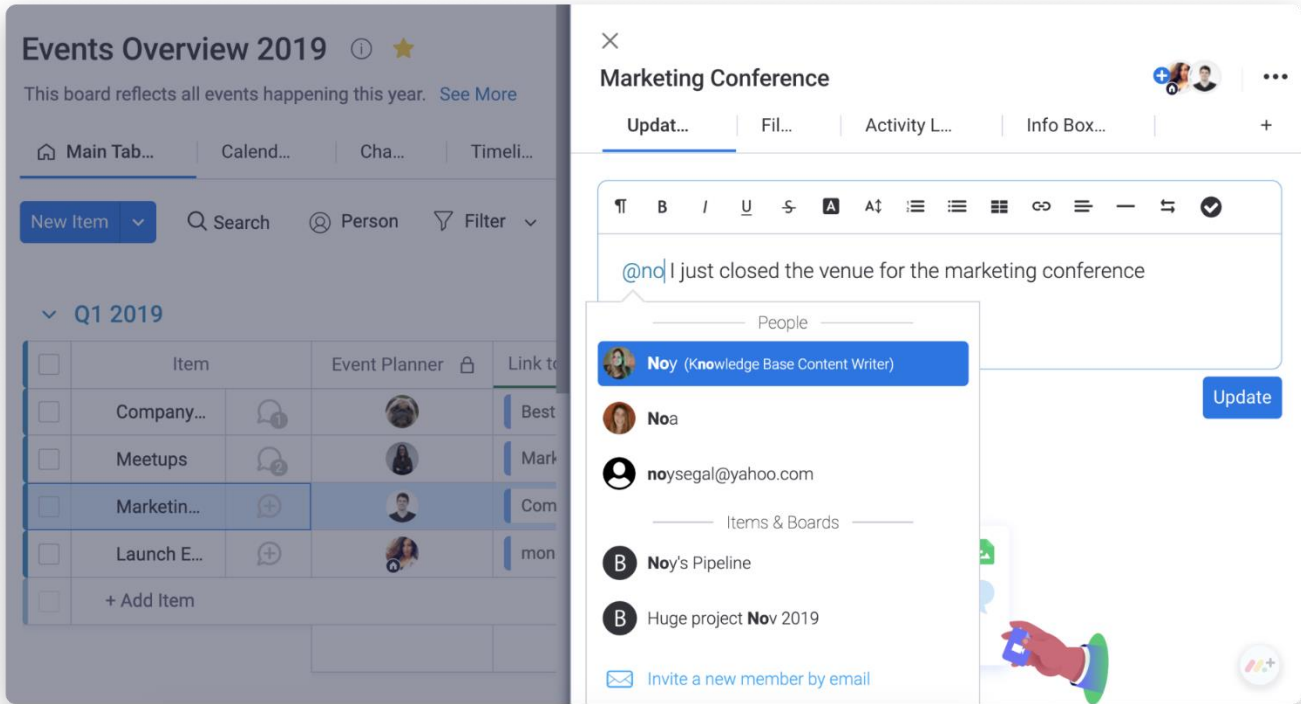


Figure 16: Creating an update in Monday.com (Security Check, n.d.)

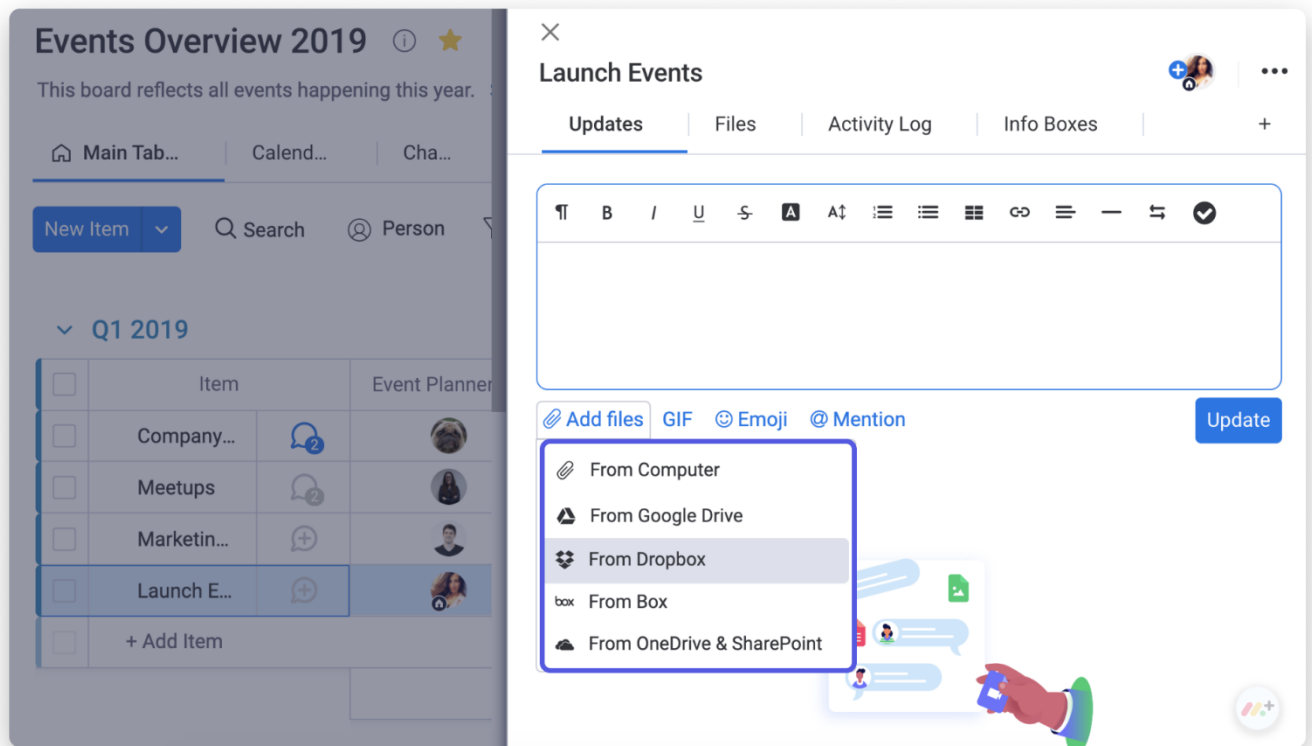


Figure 17: The file upload section of Monday.com (Security Check, n.d.)

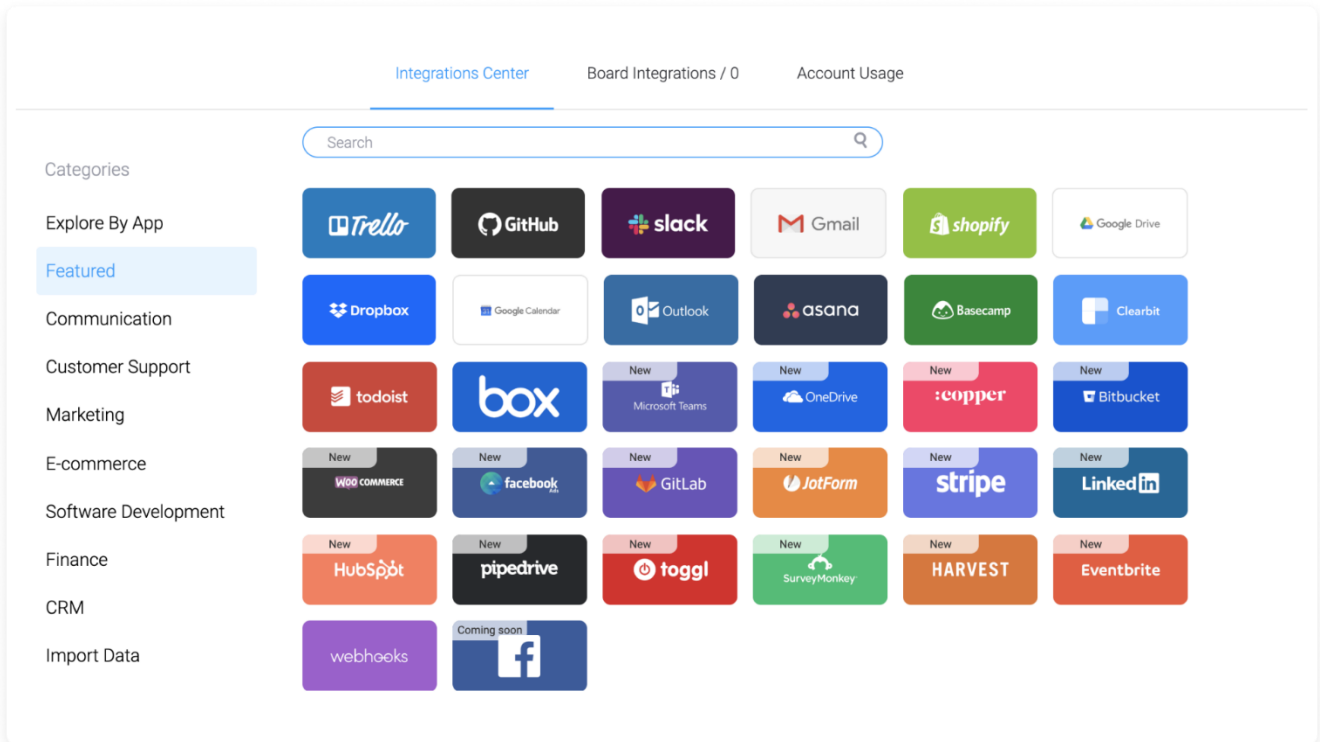


Figure 18: Possible integration between Monday.com and other platforms (Security Check, n.d.-b)

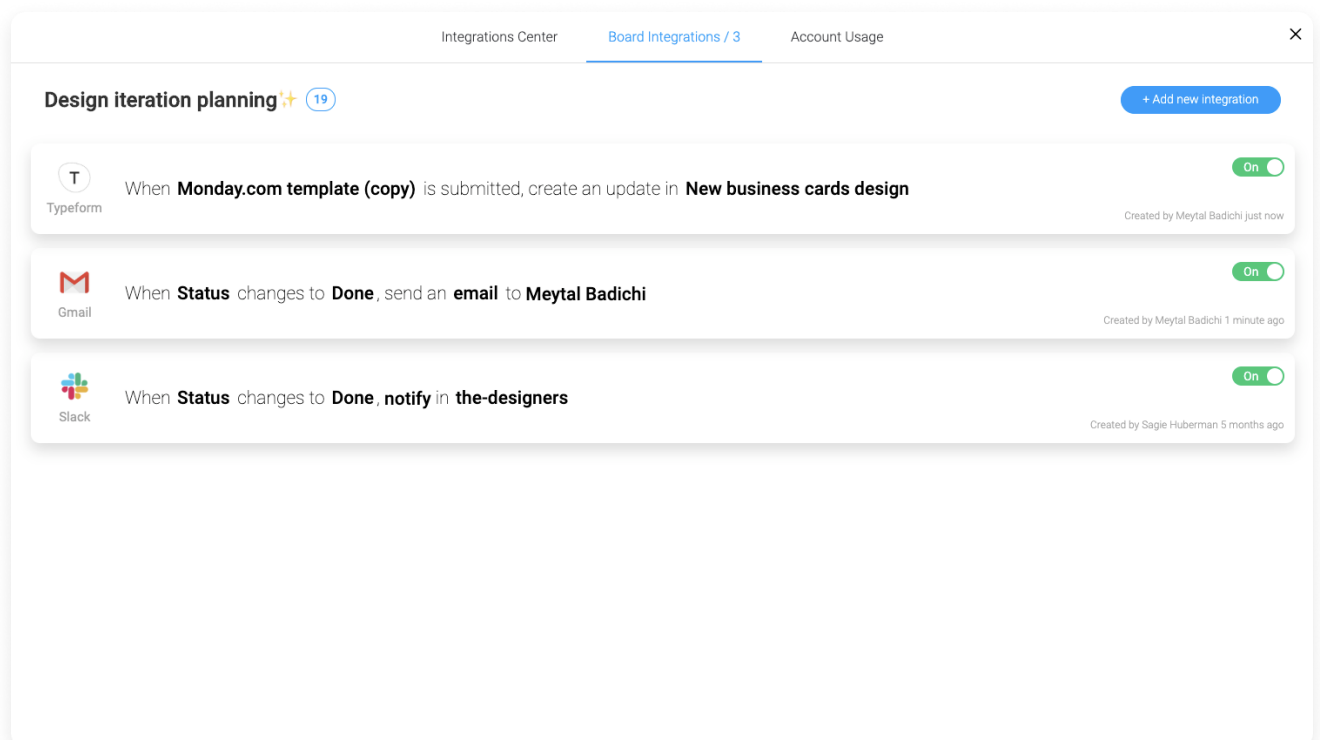


Figure 19: Possible automations between Monday.com and other platforms (Security Check, n.d.-b)

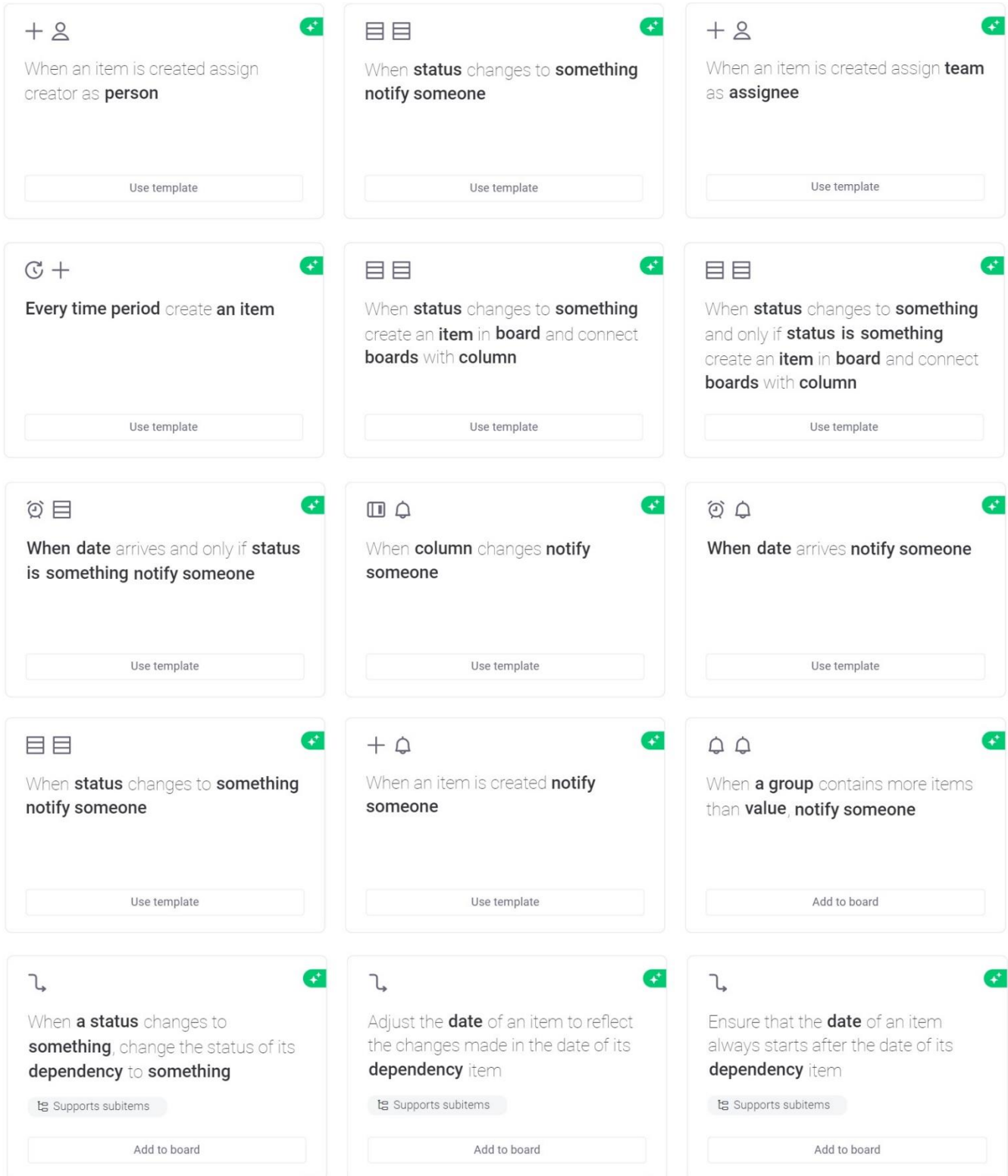


Figure 20: Possible automations in Monday.com