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POSTGRADUATE STUDIES – SECOND CYCLE

THESIS:

The Design and Implementation of Collaborative Systems in Small and Medium Enterprises

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Abstract

The Project Management represents the key to success for every company currently active in our market. In order to facilitate the workflow and increase productivity of the employees the companies' management tends to implement different systems in order to allow task and document management.

This research was conducted in the Republic of North Macedonia, analyzing the data gathered from small and medium enterprises and aiming to develop a collaboration application that would solve the major issues that most of the companies face in our country.

Designing a simple application which enables the users to track and easily access their projects, their tasks and their documents, and share with one-another every detail through the project, we tend to upgrade the traditional working process to a more sophisticated and automatic process. Generating Task and Project Progress Reports the application ensures full visibility to both the management and employees of a company.

Key Words

Collaboration Systems, BPMN, Small Medium Enterprises, Project Management, Task Management, Document Management, Report Generator, Market Research, Comparative Analysis

Abbreviations

Listed in the table below are the abbreviation used through my thesis:

Table 1. Abbreviation Table

Abbreviation	Meaning
BP	Business Process
BPM	Business Process Management
BPMN	Business Process Model and Notation
ERP	Enterprise Resource Planning
PM	Project Management
SaaS	Software as a Service
SME	Small and Medium Enterprises
UI	User Interface
UX	User Experience
MEAN	Mongo DB, Express.js, Angular and NodeJs

1. Introduction

As the technology advances, a lot of small or medium sized enterprises find it hard to adapt to the new and most updated technologies and their everyday working tasks become very challenging to track.

Most of the collaboration systems that facilitate the job within a company are provided at a high price and usually target the big enterprises. Due to the lack of financial resources or the courage of trying new things, the managers of the SMEs in our region hesitate to change the traditional way of performing the daily tasks in their companies.

The aim of this master thesis is to conduct a research on how the SMEs in our region work, and based on the results of this research, to develop a new collaborative system which would facilitate their business process by using tasks and schedules, which would enable the employees to be more productive and to avoid doing repetitive things due to lack of technology.

1.1. Research field

This research blends in with the Collaborative Systems' field, having on focus small and medium enterprises. To further elaborate the problems that are encountered in the current "traditional" business processes of SMEs, the two below mentioned surveys are used:

- The first one targets the management of the enterprises
- The second one targets the workers

Ensuring that the gathered information comes from two different viewpoints, the results are used as basic requirements for developing the design on a new Collaborative System for Small and Medium Enterprises.

1.2. Importance of the research thesis

In the region of the Republic of North Macedonia, the small and medium businesses are more reserved when it comes to using new technologies or to change their traditional process of working, and we assume that this happens due to the reasons listed below:

- Lack of information about the new technologies
- High costs of existing systems
- Lack of experience in these systems

- Avoiding and Minimizing the risks of system's failure

The importance of this master thesis is that it intends to offer the business people a system which will constructively affect their working process. Offering them the chance to test the end-product, getting a free version, they will be able to see the difference before and after using the system. This thesis is expected to grow the awareness of the benefits of using collaborative systems to facilitate everyday tasks by avoiding repetitive and unnecessary work, when they can be done only with one click.

1.3. Aims and objectives of the research

The aim of this research, based on the research findings during our thesis writing process, is to offer a new web-based solution, which will allow the small and medium enterprises to better organize, coordinate and manage their projects.

To achieve the objectives of this research, below there are listed the major milestones that are to be taken in order for the end product to be completed:

- Conduct two different questionnaires and send them out to small and medium enterprises in the Republic of North Macedonia to fill in.
- Carefully extract the basic requirements of the software that is developed based on the results of the surveys
- Conduct a comparative analysis with the most used Collaborative Systems, analyzing their pros and cons to see the best way of implementing the requirements
- Start developing the web-based software based on the above-mentioned results

1.4. Research Methodology

With the purpose of gathering more accurate and relatable data, the most suitable methodology for this research was the triangulation methodology. By using both primary and secondary research methods this research intends to collect trustworthy data from two different viewpoints.

Triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Carter, et al. 2014)

Starting with the primary research, this thesis is mainly focused on the quantitative data where questionnaires are distributed to different companies encouraging the management and the

employees to fill in the needed data, and based on those results the foundation for the application is developed. Continuing with the comparative analysis which is done by checking, using and testing existing collaborative systems in order to see the gaps and the strengths of each one, leading to a better design and implementation of each function in the application.

In order to support my work, different papers from various scholars are used as a base for starting my master thesis literature review, including papers from the same field that have similar approach and that have the most basic concepts of developing a collaborative system.

Target Group and Sampling

The target group of this research is consisted of the small and medium enterprises in the Republic of North Macedonia. The questionnaires are to be sent out to two different categories:

- The questionnaire for the managers
- The questionnaire for the employees

The first questionnaire is mainly consisted of open – ended questions, where the managers were asked for the general workflow, and how it can be improved in the project management point of view. Whereas the second questionnaire has a balanced number of closed-ended and open-ended questions, enabling us to understand the previous experience of the workers with different collaborative systems, and their ideas on how their workflow can be improved and facilitated.

1.5. Hypothesis

The main hypothesis of this research will be as follows:

H0. "The working process for managing a project through both planning and execution stages, can be improved using collaborative systems"

The following questions need to be answered in support of the main hypothesis:

Q1. How much time does it take daily to work on a project?

Q2. How much of that time is spent repeating administrative tasks?

Q3. Does it help to manage a project, if one can track each task in detail?

Additional supporting hypothesis are listed below:

H1. "The traditional way of working takes time in administrative and repetitive tasks"

H1a. "Avoiding the repetitive tasks, using a collaborative system will significantly reduce the unnecessary workload of the employees and will increase their productivity during one working day"

H2. "Most companies hesitate to change their working process due to the lack of knowledge and experience with collaborative systems"

1.6. The Structure of the Thesis

This master thesis has a simple and clear outline starting from the abstract and introduction, which will provide a short description and summary of the overall content of the master thesis, including the purpose of this master thesis and the expected results.

The thesis is developed further through five chapters as listed below.

Chapter 1. Introduction

- Research field
- Importance of the research thesis
- Aims and objectives of the research
- Research Methodology
- Hypotheses
- Structure of the thesis
- Project Management Systems

Chapter 2. Literature Review

Chapter 3. Comparative Analysis of Collaborative Systems for Small and Medium Enterprises

- Google Drive
- Office 365
- Slack
- Trello
- GitLab

Chapter 4. Research findings

- Research methodology

- Questionnaire
- Results

Chapter 5. Design and Implementation of Collaborative System for SMEs

  - Design
  - Implementation
  - Testing

Chapter 6. Conclusions

  - Design
  - Implementation
  - Testing

Chapter 5. Conclusions

Each chapter presenting a separate phase of the thesis, containing the theoretical part which will represent the research that is done related to the subject and then the practical part or as it is called the: “Software Engineering Approach”, where the application will be developed and documented as needed.

1.7. Project Management Systems

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. (Institute 2013, 5-6)

Due to the pressure of implementing projects successfully within increasingly shorter periods and under continuously rising costs, project management methods and tools are becoming more important in the industry and in the public sector. (Franz 2015)

The implementation of a project management system differs based on the following key parameters:

- Size of the company
- Workload of the company
- Complexity of the projects and services of the company

Depending on these parameters the management of a company decides the type of a Project

Management System they need to implement in order to increase their productivity and facilitate their working process. Taking into consideration the services that need to be provided from a company the project management system consists but is not limited to:

- Scope
- Quality
- Schedule
- Budget
- Resources
- Risks. (Franz 2015)

For implementing a project management system a company might either get the license for a ready product (software) or may develop a custom software based on their needs.

Due to the lack of capabilities of the non-IT companies for developing their own software and the lack of financial resources for monthly subscription in larger software solutions this thesis focuses on assisting small and medium enterprises in our country to implement a simple web-based software which would allow them to:

- Manage their tasks,
- Manage their documents
- Provide visibility through reports.

2. Literature Review

This chapter encompasses the literature review related to the topic: “Collaborative Systems for small project management”. The papers that are collected and used as a base for starting this master thesis include all the viewpoints of a collaborative system for small project management. Starting from the collaborative systems as a general concept and going further to breaking down all the business processes in order to complete and produce a useful and more efficient web software at the end of the thesis. The table below represents a summary list of papers and authors that are analyzed for the purpose of defining the research gap for this thesis.

2.1. Literature Review Table

Table 2. Literature Review Table

Nr	**Authors**	Title	Place	Journal / Conference	Year
1	Petra Schubert; Johannes H. Glitsch	Adding Structure to Enterprise Collaboration Systems: Identification of Use Cases and Collaboration Scenarios		Procedia Computer Science	October 7-9 2015
2	Ravi Seethamraju	Adoption of Software as a Service (SaaS) Enterprise Resource Planning (ERP) Systems in Small and Medium Sized Enterprises (SMEs)	New York	Springer Science + Business Media	2014
3	Sandra Morley; Kathryn Cormican; Paul Folan3	An Analysis of Virtual Team Characteristics: A Model for Virtual Project Managers	Chile	Journal of Technology, Management & Innovation	23 March 2015
4	Gary R. Waissi; Mustafa Demir; Jane E. Humble; Benjamin Lev	Automation of strategy using IDEF0 A proof of concept	Netherlands	ELSEVIER – Operation Research Perspectives	2015
5	Stephan Bögel; Stefan Stieglitz; Christian Meske	Bringing together BPM and Social Software	Chicago, USA	19th Americas Conference on Information Systems	2013
6	Austin Dsouza; Hugo Velthuijsen; Hans Wortmann	A business model design framework for viability; a business ecosystem approach	US	Journal of Business Models, Vol. 3, No. 2 pp. 1-29	2015
7	Andreas Mladenow; Christine Strauss; Christine Bauer	Collaboration and Locality in Crowdsourcing		2015 International Conference on Intelligent Networking and Collaborative Systems	October 2015

Nr	Authors	Title	Place	Journal / Conference	Year
8	Raimund Vogl; Holger Angenent; Rainer Bockholt; Dominik Rudolph; Stefan Stieglitz; Christian Meske	Designing a Large Scale Cooperative Sync & Share Cloud Storage Platform for the Academic Community in Northrhine-Westfalia	Latvia	19th European University Information Systems Congress, At Riga, Latvia	2013
9	Ravi Seethamraju	Determinants of SaaS ERP Systems Adoption	Taiwan	Pacific Asia Conference on Information Systems (PACIS)	2013
10	Jacek Lewandowski; Adekemi O. Salako; Alexeis Garcia-Perez	SaaS Enterprise Resource Planning Systems: Challenges of their adoption in SMEs	US	e-Business Engineering (ICEBE), 2013 IEEE 10th International Conference	September 2013
11	Florian Schwade; Petra Schubert	Social Collaboration Analytics for Enterprise Collaboration Systems: Providing Business Intelligence on Collaboration Activities	Hawaii	Proceedings of the 50th Hawaii International Conference on System Sciences	2017
12	E. Tello-Leal; O. Chiotti; P.D. Villarreal	Software Agent Architecture for Managing Inter-Organizational Collaborations		Journal of Applied Research and Technology Volume 12, Issue 3,Pages 514-526	June 2014
13	Vincent Ribaud; Philippe Saliou; Rory O'Connor; Claude Laporte	Software Engineering Support Activities for Very Small Entities	France	Springer. EuroSPI 2010, Sep 2010, Grenoble, France. pp.165-176	September 2010
14	Rory V. O'Connor; Claude Y. Laporte	Software Project Management in Very Small Entities with ISO/IEC 29110	Berlin	European Conference on Software Process Improvement	2012
15	Asli Sari; Gülfem Işiklar Alptekin	An Overview of Crowdsourcing Concepts in Software Engineering		International Journal of Computers	2017

Nr	Authors	Title	Place	Journal / Conference	Year
16	Matthew Johnson; Tobias Viere; Stefan Schaltegger; Jantje Halberstadt	Application of Software and Web-Based Tools for Sustainability Management in Small and Medium Sized Enterprises	Germany	Proceedings of the 28th EnviroInfo 2014 Conference, Oldenburg, Germany	2014
17	Ahmad Sharbatoghlie; Mehran Sepehri	An Integrated Continuous Auditing Project Management Model (CAPM)		6th International Management Conference	2015
18	Achmad Nizar Hidayanto; Muhammad Azani Hasibuan; Putu Wuri Handayani; Yudho Giri Sucahyo	Framework for Measuring ERP Implementation Readiness in Small and Medium Enterprise (SME): A Case Study in Software Developer Company		Journal Of Computers, Vol. 8, No. 7	July, 2013
19	Frosina Tasevska; Talib Damij; Nadja Damij	Project planning practices based on enterprise resource planning systems in small and medium enterprises — A case study from the Republic of North Macedonia		International Journal of Project Management	2013
20	Ahm Shamsuzzoha; Mahmood Al Kindi	Open Innovation Through Virtual Business Network: Perspective from Small and Medium Enterprises		Journal of IT and Economic Development 7(1), 25-33	April 2016
21	Kadam, Aishwarya A.; Chaudhari, Harshada R.; Patil, Chandani M.; Chavhan, S. P.	Web Application Development by Using MEAN Stack		International Journal of Science Technology Management and Research, 15-18	2017

2.2. Literature Review Summary

In this section only the most significant papers that provide us additional information regarding the collaboration systems, their usage and implementation that can be used as secondary research for this thesis are summarized.

By explaining the content of the paper including the gaps that the authors found during their research the reader will understand the basic notions and features regarding collaboration systems that may later on be used while developing this thesis.

The below papers are organized into the following groups:

- Papers related to the comparison between ERP-s and ECS-s
- Papers regarding the relation between BPM and Collaboration Systems
- Papers related to Virtual Team implementation
- Papers related to incorporation of Social features into collaboration systems

Adding Structure to Enterprise Collaboration Systems: Identification of Use Cases and Collaboration Scenarios (Schubert and Glitsch 2015). – Based on analysis and research done upon 14 different case studies, authors have tackled their main research question:

"Is ERP and ECS the same?"

They have concluded that ERP and ECS are different, to the point that one system cannot inherit the other one, even though they are used and operate in similar ways. ECS stands for Enterprise Collaborative Systems, and in this paper its usage is mainly simulated through Social Media channels. The paper further provides a better understanding on the incorporation of the Social Media features within the ECS, different business scenarios where this application would be helpful, and on what view it would improve the business working processes. The value that this paper would add to this thesis is that the model which is proposed in this paper (IRESS Model: Identification of Requirements for Enterprise Social Software) clarifies the most basic steps that need to be considered when starting to develop the idea of the software.

Determinants of SaaS ERP Systems Adoption (Seethamraj 2013)– ERP is costly, not only for purchasing and implementation, but also for further development and adoption. Its cost is not only seen in the monetary side, but also on time. Larger companies face with the consistent urge to adapt their ERP system to their specific needs, which follows development, new add-ons, training for employees, usage, implementation, etc. Is it worth the wait? For large enterprises, yes. Medium and small ones do not have this luxury of money and time. What is found to work

is using ERP as a SaaS. This enables medium and small sized companies to use ERP with shorter deployment time, smaller cost of ownership, continuous improvement, and support by the vendor. This paper elaborates the idea of implementing the Enterprise Resource Planning System as Software as a Service for small and medium sized enterprises and illustrates the benefits that the enterprises can have from its usage.

SaaS Enterprise Resource Planning Systems: Challenges of their adoption in SMEs (Lewandowski, Salako and Perez 2013) – this paper elaborates further the idea of implementing the SaaS ERPs, showing how to adopt them to the small and medium sized enterprises. This paper clarifies the obstacles that can be encountered on the process of the implementation and it shows how to avoid those obstacles and how to adopt the SaaS ERP to the SMEs. Authors have outcome with the listed below major concerns in the phase of implementation:

- Risk of being locked in vendors platform
- Loss of control to the changes made in the system or interface
- Inability to customize the application to meet business needs
- Meeting government or industry compliance requirements
- Integration with other systems
- Data and application security

The research has emerged with the need of creation of a specific framework for implementation of SaaS ERP in medium and small enterprises, which will have in consideration not only the major concerns emerged, but also the needed development for a best fit. Future work of this research will be focused on drafting the mentioned above framework.

Adoption of Software as a Service (SaaS) Enterprise Resource Planning (ERP) Systems in Small and Medium Sized Enterprises (SMEs) (Seethamraju 2014) – even though ERP system usage provides a variety of advantages to their users, they have one main disadvantage: they have a high price. Small and medium sized businesses find them costly and, when analyzed, their cost does not meet their benefits for this type of businesses. Software as Service (SaaS) enables this type of businesses to use ERP in an affordable way. This paper briefly elaborates first the benefits and then the best ways on how you can adopt a SaaS ERP system in a small and medium sized

enterprise. Showing all the advantages and disadvantages of using this approach this paper provides the reader with the most basic requirements and points to think of when starting the development of the software. Even though this paper is focused on ERP, the structural similarity of ERP and ECS, enables for this thesis understanding of basic requirements and a first draft of our software solution.

Project planning practices based on enterprise resource planning systems in small and medium enterprises — A case study from the Republic of North Macedonia (Tasevska, Damij and Damij 2013)– this paper presents real data related to ERP systems that find practice in SMEs in the Republic of North Macedonia. This Case Study will be taken as a base for the theoretical information that will be updated after finishing the initial research with SMEs in Republic of North Macedonia.

Bringing together BPM and Social Software. (Bogel, Stieglitz and Meske 2013) – BPM lacks the ability to cope with collaborative tasks in team working companies. As a solution to it, is mainly used with social software. What social software lacks is role assignment. When used together, BPM provides role assignment and social software provides the collaboration. This way of usage of both systems enables monitoring and control of collaborative processes. Authors elaborate the benefits of emerging the BPM and Social Software together, it shows clearly the benefits of applying this approach and also it enables the user to have a clear view on the different types of collaboration patterns that can be implemented in the software that will be developed during this master thesis.

A business model design framework for viability; a business ecosystem approach (Dsouza, Velthuijsen and Wortmann 2015)– this paper provides a new approach on making the business processes more viable which affects the workflow in an enterprise and covers some gaps that facilitate the job significantly if applied in a right way. It tackles new approach which is based on ignorance of business rules. As a solution to this, it applies a design scientific approach known as BMDFV. It adopts a new BM and adds the missing elements which emerge from avoiding business rules. The gap provided from this research is in the testing and implementation phase of the outcome findings. Authors will further focus on rigorous testing and evaluation of BMDVF in practice.

An Analysis of Virtual Team Characteristics: A Model for Virtual Project Managers (Morley, Comican and Folan 2015)– this paper elaborates the core concept of the virtual team, the way it functions, the benefits of working on virtual teams, and the workflow compared to the traditional team. Taking into consideration that this thesis is based on a collaborative system and the aim is to virtualize the working system of the small and medium sized enterprises, this paper explains the most significant perspective related to the virtual teams and using a case study, it clearly shows the process and its best usage within an enterprise. Authors have customized the procedures to match the enterprise case used: medical device manufacturer, but they leave the possibility of further expanding their research and methods in various other enterprises.

Social Collaboration Analytics for Enterprise Collaboration Systems: Providing Business Intelligence on Collaboration Activities (Schwade and Schubert 2017) – this paper is focused on the ESS (Enterprise Social Software) which is a relatively new type of collaboration system, the main focus of this paper is to run a social collaboration analytics on the issues that are found in the implementation of the ESS. The authors have developed the paper through 3 main stages:

- The first one being the understanding of the integrated ECS – emerging from the background research conducted from authors. The authors have selected IBM Connections as a case study for conducting their research
- The second one includes business needs analysis - which was conducted within a focus group for data collation upon the research subject (Social Collaboration Analytics)
- The third one comprises of the prototypical reports and evaluation- development of the SCA framework and reports based on data collected.

Authors main challenge remains in for future research: finding the right question for SCA. Their research is applicable to their case study, but it will further be expanded and implemented in wider enterprise sets. What it points out is the role and importance of social collaboration in enterprises, which is day by day giving more value to efficient and effective functionality of enterprises.

Designing a Large Scale Cooperative Sync & Share Cloud Storage Platform for the Academic Community in Northrhine-Westfalia (Vogl, et al. 2013)– the synchronization and cloud storage

are two of the most important features that a collaborative system can provide. There are already existing software that enable the mentioned features above, such us Google Drive, DropBox, OneCloud, etc. But what happens if you need to share sensitive information with your coworkers? Who grants you the privacy needed on specific topics? Common issue with these platforms is security. To prevent leaks of sensitive data, large organizations/ enterprises/ communities tend to create and design software applications which enable synchronization and share cloud storage within them. This paper presents a new platform on how to design and implement a secure software solution enabling these two functions and for this reason it serves as a security approach background analysis to this thesis.

Software Agent Architecture for Managing Inter-Organizational Collaborations (Tello-Leal, Chiotti and P.D.Villarreal 2014) – with globalization has risen also the need for communication between organizations/ enterprises/ businesses. For enabling these types of communications, there have been developed several executing collaborative business processes. Authors of this paper have chosen agent-based software architecture for enabling and managing inter-organizational collaborations, working on with two types of agents:

- Collaboration Administrator Agent – setting up collaborations
- Process Administrator Agent – executing collaborative business models

This paper presents how this type of software architecture improves the collaboration between organizations. It is one of the most significant topics that will be considered when developing the software when it comes to the technicalities; it gives a clear view on the basic structure of a collaborative system and shows on what the main focus should be.

Application of Software and Web-Based Tools for Sustainability Management in Small and Medium Sized Enterprises (Johnson, et al. 2014) – this paper illustrates the advantages of implementing software and web based tools in small and medium sized enterprises. It provides new insights on influential factors for the adoption of sustainability management software. Based on the conclusions presented by the authors, it is shown that besides the strong influence of company size, the decision to adopt sustainability management software mainly depends on the observability or in other words awareness that sustainability management software exists. SME

managers have been able to try it out and that managers have an overall positive attitude towards the software. The results extracted from this paper give us information on how to better select the companies that are to participate this research.

Web Application Development by Using MEAN Stack (Kadam, et al. 2017) – this paper describes thoroughly the benefits of using MEAN stack in the modern web application development. By clearly stating the full package that comes bundled in the MEAN stack including: Mongo DB, Express.js, Angular and NodeJs it led to the decision of using the MEAN platform for the development of our collaboration system.

2.3. Conclusion

The findings from the above-mentioned papers have been helpful and significant to the further development of this thesis.

Starting with the clear definition of a Collaboration System, which is often confused with Enterprise Resource Planning systems. Whereas the ERP is more process-oriented application, the collaboration systems usually focus on the cooperation between team members (Schubert and Glitsch 2015). This leads us to focus on a simple solution, which would prioritize the teamwork during one project, and attempting to implement the social features to the application, enabling the users to access easy and fast communication features.

Following with the definition of the target group, defining which companies would be fitting to participate in this research, estimating based on the industry, number of workers and other parameters, which are the companies that would find a collaboration system helpful.

Another important input received by the literature research is the understanding of Business Process Modeling and its implication in Collaboration Systems. The fact that each company has its own business processes directly affects the company's needs when it comes to a system. Depending on the work that a company does, and what type of approach it follows to manage the projects, the requirements that it might have for a collaboration system might differ. Therefore, it is crucial when starting to develop a collaboration system to clearly define the business processes that the system will be able to cover, and to select the companies that would find that system helpful and adopted to their requirements.

3. Comparative Analysis of existing Collaborative Systems

The key to successfully lead a business, nowadays lies on providing a strong business process in an environment where the employees will easily access all the information and will have a clear view on the tasks that they need to follow so that the company achieves its goals.

Since we are living in the era of technology, each company uses computers and other related technological tools depending on their area of business to complete their everyday tasks. In order to facilitate the work, companies tend to use different systems which provide the users with features such as: document and task management, synchronization, file sharing and so on. All these features are provided on basis of guaranteed security and privacy enabling the companies to feel comfortable while using these collaborative systems.

Each system has the strengths and weaknesses that will be further explained in this chapter, using as samples the greatest and most used existing collaborative systems: Google Drive, Office 365, Slack, and Trello. The table on the page overleaf illustrates the summary of strengths and weaknesses for each system

Table 3. Comparative Analysis

Systems	Document Management		Task Management		Communication	
	Strengths	**Weaknesses**	**Strengths**	**Weaknesses**	**Strengths**	**Weaknesses**
Google Drive	Supports different formats; Provides large memory; Online Editing Versioning; Sharing Documents; Synchronization	/	Can be integrated with other apps	Does not provide task management features	Online file editing at the same time	No chat provision
Office 365	Supports different formats; Versioning; Sharing Documents; Synchronization	Higher Prices; Lower Memory	Integration with One Drive and SharePoint Synchronization to outlook calendar	/	Chat; Video Calls; Meeting Organizations	Not available to all plans
Slack	Allows you to add files to channels; Integration with other apps	Does not allow online editing	Allows integration to other apps	Does not provide on its own	Easy Chat Features; Video Calls; Audio Calls; Screen Sharing	/
Trello	Allows to attach files; Integration with other apps	Does not allow online editing	Scheduling; Organization; Notifications	/	Integration with other apps	Does not provide chat

3.1. Google Drive (G. Team 2019)

Google Drive is one of the most used systems in collaboration and file sharing. Allowing its users to create new files whether it is a text document, a spreadsheet or a presentation this system offers the opportunity for its users to collaborate and work with each other. Some of the features that this system provides are listed below:

- Create documents of different formats, best supported are: Word, Excel and PowerPoint files.
- Edit existing documents at real time
- Enable multiple persons to edit at the same time distinguishing them by colors
- Auto save continuously every change as the user is editing the document
- Integration with other applications
- Enables the user to see an old version of a file
- Easily share documents with each other

3.1.1. Document Management

Storage

Once one becomes a google user by creating an account, google provides 15GB of free cloud storage in Google Drive. Being one of the most open handed systems when it comes to storage, google offers many options allowing the user to choose in case they need more than 15GB storage. Listed below are the storage limits and prices that are offered by Google:

- 100 GB 1.99$ per month
- 1TB 9.99$ per month
- 2 TB 19.99$ per month
- 10 TB 99.99$ per month
- 20 TB 199.99$ per month
- 30 TB 299.99$ per month

Synchronization

The synchronization feature is provided to the users by downloading and setting up the Back Up and Sync from Google. A folder named My Drive is added to your computer allowing you to synchronize everything amongst your computer and the cloud. Listed below are the advantages of using this feature:

- Selecting Folders that need to synchronize at all times from your PC to your cloud

- Fast Synchronization
- Being able to edit your files while offline and then synchronizing to the cloud
- Carry your files everywhere
- Change your download / upload preferences in Settings
- Back up your files

As a disadvantage of this feature is that it is only supported in Windows and Mac but not in Linux Systems.

File Sharing

The file sharing feature enhances the collaboration attributes when it comes to document management. Google Drive enables the user to share files with anyone who has a google account, and allows them to work together in one shared document and edit it in real time.

The drawback of this feature is that it does not allow the user to protect the links by a password and neither does it allow setting a time frame through which the link may be available to the people, making the users doubt the system when it comes to working with sensitive data.

Application Integration

Application Integration is one of the utmost features of Google Drive. It enables the user to incorporate different features and application into Google Drive. Starting from Calendars, Media Players, Other format Readers, and Drawing tools and so on. Google ensures that the features that are not directly offered to the users by Google Drive can still be used by integrating them in your drive with just a few clicks.

Data Security (Google Cloud 2016).

In order to provide high quality services to its customers, Google Cloud prioritizes their security and privacy of the data. With the intention of avoiding any possible malicious attack on their customers' sensitive data, google cloud uses multiple layer encryption.

Starting at the storage system layer where the data is broken down into small pieces for storage, each piece being encrypted with an individual encryption key using AES (Advanced Encryption Standard) algorithm. Going further to storage device layer where the data is encrypted with at least AES128 hard disks (HDD) and AES256 for new solid state drives (SSD) using a separate device-level key (different to the previous mentioned key). The last but not least is the layer of back-ups encryption ensuring that the data remains encrypted through the back up process by

encrypting each backup file independently with its own data encryption key (DEK), derived from a key stored in Google's Key Management Service (KMS) plus a randomly generated per-file seed at backup time (Google Cloud 2016).

3.1.2. Task Management

Google Drive does not have a task management feature incorporated inside of it, but it does allow the users to integrate the Google Calendar ensuring that they can create tasks and link them to different drive documents that will later appear on the Google Calendar.

This feature is highly limited on its functions, and not preferable to use while working on project management.

3.1.3. Communication

While using google drive for managing your work, the communication will be one of the robust advantages. The platform enables the users to directly communicate while editing a document, and it also offers the below listed options:

- Integrate different discussion apps within the google drive
- Integrate different chat apps within the google drive

Giving the user the opportunity to select which ever option that they find the most useful to them, Google Drive remains one of the strongest Collaboration Systems in the market nowadays.

3.1.4. User Interface

Google Drive has a straight forward, easy-to-use interface, allowing the users to access the functions only by few clicks. Listed below are the five key parameters used for describing the user interface:

- Simplicity – a simple design avoiding overload of information enabling the user to enjoy the work.
- Clarity – provides the user with a clear view on its functions making google drive platform user-friendly.
- Visual Order – providing a clear order of the functionalities of the platform, ensuring that the user will easily navigate through the website.
- Efficiency – google drive is highly efficient when it comes to their user interface, being consistent on what it offers, ensuring that the user will get its services at a high speed and just in a few clicks.

- Responsiveness - offering the user the opportunity to use the website / application in different devices and screens, and avoiding the frustrating layout malfunctions.

3.2. Office 365 (Microsoft 2019)

Office 365 is a cloud – based system powered by Microsoft, providing the user with some of the strongest and finest applications that assist companies to carry out their daily business activities including: document management, task management and communication.

Listed below are the main features offered by Office 365:

- Use Microsoft Office Platform including: Word, Excel, Power Point, etc.
- Using One Drive for Business for document management and synchronization
- Using Outlook for e-mail communication
- Using Skype for Business for real time communication
- Managing Tasks through outlook and one drive for business

3.2.1. Document Management

Storage

The module provided by Office 365 for document management is the One Drive / One Drive for Business Module. Compared to Google Drive, the One Drive is not as open handed. Once you buy the Office 365 you get only 5GB free storage space. Additional offers are listed below:

- 50 GB for 1.99$ per month (One Drive)
- 1TB for 6.99$ per month (One Drive)
- 5TB for 9.99$ per month (One Drive)
- 1TB for 60$ per year per user (One Drive for Business)
- Unlimited storage for 120$ per year per user (One Drive for Business)

Synchronization

If you are a Windows 10 user (or after installing the Office 365 for the users of older Windows versions) the One Drive folder is automatically created in you windows explorer. Allowing the users to upload, edit, download and delete files based on their subscription plan. The advantages of using One Drive / One Drive for Business are listed below:

- Easy Upload of files
- Enables the user to work offline and later synchronize to the cloud
- Offers Selective synchronization

- Have your files in all the connected devices
- Able to synchronize SharePoint Libraries

The downwards of using One Drive are that it does not support Linux Systems and the synchronization is not as fast as with Google Drive.

File Sharing

One of the strongest features of One Drive is File Sharing, allowing the user to easily copy the link of the file and share it through Outlook.

The foremost advantage of using One Drive when it comes to file sharing is the opportunity that is provided to the user to add a password to the link, increasing the security of the data being shared, and also the opportunity of setting a time frame when the link will be available to the other users.

These features are provided to the user depending on their subscription, preventing some of the subscribers of using these advantages.

Application Integration

In view of the fact that One Drive comes as part of Office 365, its integration with other office applications is excessive. Apart from being advantageous when it comes to uploading MS Office documents (Word, Excel, PowerPoint, etc.) the One Drive module also pools resources with SharePoint which is a highly qualitative Document Management system powered by Microsoft, and also with Outlook which enables the task management and file sharing features.

Data Security (Microsoft Office Support 2016)

For a long time Office 365 has been an industry leader in Data Security. Focusing on the well-being of its clients, the office 365 considers security and privacy to be vital to their services.

Consequently, they ensure that the data is secured at all times using the strongest encryption algorithms.

While transmitting data the One Drive uses SSL/TLS connections, which are established using 2048 – bit keys (Microsoft Office Support 2016). There are two types of encryption used:

- BitLocker disk level encryption, which is deployed for One Drive across the service.
- Per – file encryption including a unique key for each file. This encryption uses Advanced Encryption Standard with 256-bit keys and is Federal Information Processing Standard (FIPS) 140-2 compliant. The encrypted content is distributed across a number of

containers throughout the datacenter, and each container has unique credentials. These credentials are stored in a separate physical location from either the content or the content keys. (Microsoft Office Support 2016)

3.2.2. Task Management

The Office 365 Work subscription comes bundled with a task management tool named: Microsoft Planner. Providing the users with a user friendly interface this tool offers the below listed functions:

- Create Projects
- Assign Team Members
- Add tasks to projects
- Group Tasks in Buckets
- Assign Tasks to team members
- Add additional comments, files or links to each task
- Send notifications for task assignments
- Generate a visual report on the tasks progress using charts.

This tool is also integrated with One Drive, which is used to add files to the tasks. As mentioned above, this tool is only available for Office 365 Work or School subscriptions.

3.2.1. Communication

The full package that comes with Office 365 ensures that the communication is also provided to the user, in order to increase the collaboration between the team members. Offering the Microsoft Teams Tool, Office 365 enables the users to collaborate, discuss and organize the work within the team at its best way.

Listed below are the functions that come within the Microsoft Team Tool:

- Chat
- Video Calls
- Meeting Organizations

This tool is integrated as a service in the Office 365 Business Premium and Business Essential subscription plan.

3.2.3. User Interface

Office 365 is an enormous package, providing the users the opportunity to collaborate with each

other and run their businesses.

It has a simple and straightforward design, and comprises of different tools and applications. Each function that is offered by Office 365 is built as a separate application and it is integrated within the full package. All these applications follow a similar user interface, described by the attributes in the below list:

- A very simple design and easy on the eye
- A consistent navigation menu, keeping the users interested in the work
- User-friendly design
- Each of these applications are responsive, making them available in different devices with an adaptive layout to each one of the devices.

3.3. Slack (S. Team 2019)

Slack is a collaboration system, which is built on basis of communication and chatting features. By creating channels and adding team members the user will be able to communicate, share ideas, files and collaborate with each other through the entire project life cycle.

Listed below are the functions provided by slack:

- Creating projects / channels
- Adding team members
- Integrating with other applications to manage documents and tasks

3.3.1. Document Management

Using Slack enables the user to attach files to the channels, and in order to manage the documents, it allows the users to integrate additional apps such as: Google Drive. Once the application is integrated the user will be able to use the features of the selected application.

3.4.1. Task Management

The Slack solution does not come bundled in with task management features, but it enables the users to integrate task management applications such as Asana, Trello etc.

By selecting the most suitable task management application each user can benefit and proceed their working process within the slack application.

3.3.2. Communication

Slack focuses its functionality on communicating and sharing data between the team members. Being the industry-leader on the chat based collaboration systems; Slack is also integrated by other applications that use its utmost chatting features.

Application Plans

Listed below are the different plans that Slack offers to the users and the pricelists:

- Slack Free – available to the users with no extra payment, but limited to 10 application integrations, 10, 000 message searches and only 1 to 1 video calls.
- Standard Slack – available to the users for 6.67$ per user per month, providing unlimited searches, application integration. Also allows group calls and guest team members.
- Plus Slack – available to the users for 12.50$ per user, per month. Provides unlimited services and 24/7 support.

Data Security (Security at Slack n.d.)

Slack focuses on bringing the best solution to the users, and one of the major concerns that slack covers is keeping the data secure. Slack uses both in transit and at rest encryption.

Slack supports the latest recommended secure cipher suites to encrypt all data in transit, using TLS 1.2 protocols, AES256 encryption, and SHA2 signatures, as supported by the clients. Slack monitors the changing cryptographic landscape and upgrades the cipher suite choices as the landscape changes, while also balancing the need for compatibility with older clients. Whereas data at rest in Slack's production network is encrypted using FIPS 140-2 compliant encryption standards. This applies to all types of data at rest within Slack's systems—relational databases, database backups, etc. Slack stores encryption keys in a secure server on a segregated network with very limited access. (Security at Slack n.d.)

3.3.3. User Interface

Slack has a simple user interface. It allows the users to navigate easily through the application, and it provides support at all times.

By using its "Slackbot" function, the users may ask questions and will be provided with an answer by the Slackbot instantly.

Additional applications that are integrated within Slack may also integrate an AppBot that will be there to provide any answers regarding the application usage, for example: TrelloBot.

3.4. Trello (T. Team 2019)

Trello is a web-based project management application that enables its users to better organize and keep track of the work.

This application is based on board which represent a project and within each board the users can create cards, tasks and tasks lists, assign team members to each tasks, set deadlines and discussions between the team.

3.4.1. Document Management

Trello enables unlimited attachments to be added in the cards. It also allows files to be shared through Google Drive, DropBox or One Drive. This feature makes trello a very flexible application, allowing its users to have the opportunity to keep their documents by integrating different applications.

The application integration depends on the type of subscription that a user has. Listed below are the plans and price lists offered by trello:

- Free Subscription includes unlimited cards, tasks, task lists, attachments, one power up per board and allows to attach files up to 10 MB
- Business Class Subscription costs 9.99$ per user per month, includes unlimited power ups, attaches files up to 250MB, better options for organizing the team, provides better security.
- Enterprise Subscription costs 20.83$ per user per month, includes higher quality and security of files.

Security (Security and Privacy of Trello n.d.)

Trello production services are hosted on Amazon Web Services' ("AWS") EC2 platform. Akamai is used for DDoS protection and Web Application Firewall Services. For data in transit, Trello uses industry standard Transport Layer Security ("TLS") to create a secure connection using 128-bit Advanced Encryption Standard ("AES") encryption. Whereas for data at rest it is used full disk, industry-standard AES encryption with a unique encryption key for each server. (Security and Privacy of Trello n.d.)

3.4.2. Task Management

The tasks are managed through the cards. In each card the user can add as many tasks and task lists as they need. Once a deadline is set to the task the user will get notification regarding the

task and also the system will automatically distinct the tasks through different colors: green representing the completed tasks, white being the tasks that still have time to be completed and red being the late tasks.

Each task can be labelled or dragged through different cards. Also documents may be attached in every task.

3.4.3. Communication

Within each card the users can leave comments when using Trello, but besides this the system also allows the users to integrate different applications, including chat applications which will facilitate the communication between the team members.

3.4.4. User Interface

Trello is a very easy to use application. Allowing the users to create boards, within each board the cards are created. Enabling the users to move cards by drag and drop through each stage of the project for example: To do List, In Process, Completed. And so on.

Trello also enables the users to use a background by their choice which makes it more attractive to the users' eyes. The navigation through the application is simple, it is consistent and the users enjoy using it.

3.5. Conclusion

In this section are presented the conclusions that were made regarding the current standards in the market, do these standards meet the companies' requirements, what can be improved and what the small and medium companies in our country can implement.

The comparative analysis was conducted by gathering information through the web and also registering to each one of the applications and using our own experience in order to have more in-depth research. The four different functions listed below were considered to provide more visibility:

- Document Management;
- Task Management;
- Communication;
- User Interface

3.5.1. Document Management

Nowadays, the internet provides countless data for the people to use. Small, medium or even big companies tend to collect a lot of data in order to be up to date with the most recent trends, and to develop their business up to the top. Although the users can access all the information, the same can become a huge obstacle when it is not organized appropriately.

This leads to one of the major concerns for all the companies: “How do we organize the data?” In order to have a better use of the information, it needs to be organized in some way depending on the company’s policies, and since most of the data at this time is digital the market tends to provide different software solutions to assist with data storage.

Despite the size or the industry of the companies, they all collect a lot of information throughout the years and in order for them to have a strong archive of their files and data, they require solutions that include the below mentioned features:

- High Limit Storage
- Low Price Solution
- High Security

In order to comply with the market requirements the world’s leading software companies provide solutions regarding the Document Management systems such as: Google Drive or One Drive for Business. Each of these systems offers different packages on different prices which are explained in more details in the previous section of this chapter.

These systems have set a very high standard when it comes to document management providing a lot of storage space, and high security which prevents the leakage of the data. However, not all the companies can afford the prices that are set by these companies and because of this, most of the small and medium enterprises in our country do not use such a system for their documents. They either have a hard copy archive, or store their documents locally in their computers, which leads to multiple versioning of the documents, and different mistakes that can be improved by implementing a custom made solution that would enable these small companies to improve and facilitate their document management process.

3.5.2. Task Management

In order to better-organize their work, another requirement of the companies is the task management feature. What enterprises appreciate the most in the tasks management systems are the following benefits:

- Tasks connected to projects
- Deadlines
- Visible Reports

Working on different projects simultaneously can be confusing to many people, and having a digital automatic schedule that would remind each one the tasks that need to be completed every day is very helpful.

By organizing and connecting each task to a specific project, assigning a specific person to it and setting a deadline is a very efficient way to motivate people to do their everyday tasks.

The utmost benefit of using this is the provision of visible reports, generated automatically for each task showing if it has been completed on time allowing the team members to define if there is any issue and to easily find the solution together.

Based on the above research the simplest and the most used system for managing the tasks is Trello. Intending to reach a simplicity similar to Trello, in this thesis we will propose a task management system that will be focused on the most important points without extending too much the details.

3.5.3. Communication

The crucial key to complete a collaboration system is the communication between the team members. If the employees find difficulties to work with each other that would lead to a very poor work performance.

The way most of the current systems approach the communication is through chat or discussion boards, allowing users to instantly communicate for different projects. Depending on the nature of the projects or the policies of the companies both of the options might be suitable. If the company prefers more visibility and transparency between the team members they would go with the discussion boards (similar to Trello), whereas if the company would prefer a more private approach they would find chat as a more suitable option (similar to Slack).

Based on the comparative research the strongest system communication – wise is Slack, which

provides chat, video calls, and group conference calls.

Since this thesis is focused on small and medium enterprises, the discussion boards are found to be more suitable in order to provide the transparency needed.

3.5.4. User Interface

When it comes to the user interface and user experience the companies prefer the software solutions that are easy to use, do not require special training and are easy to navigate.

The main points to consider while designing an application are:

- User Friendly
- Attractive
- Not a lot of unnecessary functions

The small and medium enterprises do not need many functions in order to manage their working process. They need simple designs and the job to be done just in a few clicks. This is the main approach that is followed while developing the application in this thesis.

4. Research findings

In this chapter, the research findings are elaborated. Starting with the first part of the chapter where the research methodologies are stated, including the method types and the reasons that affected the decision for selecting this methodology. Following is the detailed explanation of each question including: the aim of the question, the result and the implementation of the same in this thesis.

4.1. Research Methodologies

As stated in the first chapter of this thesis the methodology that was selected for gathering the information needed in this research is the triangulation methodology.

There are two types of triangulation methodology: Across Method and Within Method, where the first one refers to combination of both qualitative and quantitative data and the within method refers to focusing on only one type of data either qualitative or quantitative but not both. (Bekhet and Zauszniewski 2012)

In this research it is used the Within Method where the questionnaires are prepared to collect quantitative data in order to receive the results regarding the collaboration systems that are used by the companies in the Republic of North Macedonia.

The reason for selecting the triangulation methodology for this research is to cover two different groups of people that participated in the surveys: Management and Employees.

These two groups provide us the information that we need from two different approaches: on one hand the people who manage the complete company and on the other hand the people who do the everyday work continuously.

In order to answer the main questions that this research addresses (stated in the first chapter) and to be able to compare the results in order to design and implement a new collaboration system we have chosen the Within Method as the most suitable for this thesis. By designing our questionnaires in such a way that we mostly address quantitative data, we have received the results that lead us to the answers that we seek.

4.2. Questionnaire

Two questionnaires were used in order to gather information regarding the workflow processes

in the regional small and medium enterprises and define the below key parameters that directly affect the development of the system represented in this thesis:

- How much the collaboration systems are currently used in Republic of North Macedonia
- How much the entrepreneur are willing to implement such a system in their companies
- What are the most difficult areas of business in our country?
- How it can be improved using collaboration systems?

One of the questionnaires is directed to the Management of the companies whereas the second one is directed to the employees. In Annex A are listed both questionnaires.

4.3. Results

Questionnaire 1 (Management)

This questionnaire is filled in by 17 participants from different companies. The questionnaire was delivered to the participants by mail.

Question 1: The number of employees in your company

This question determines the number of employees in the company, which further reflects the type of the business, depending on the answer. The Figure1 shows that most of the companies participating in this research have 11-50 workers (43.8 %), which is most of the participants. The second option is 1-10 workers (37.5 %). More than 150 workers is chosen by several participants (12.5 %), and the last option of 101-150 is the least chosen (6.3 %). The results of this question give us the coverage of the companies based on the number of employees and it shows that it is a relevant distribution of the sample.

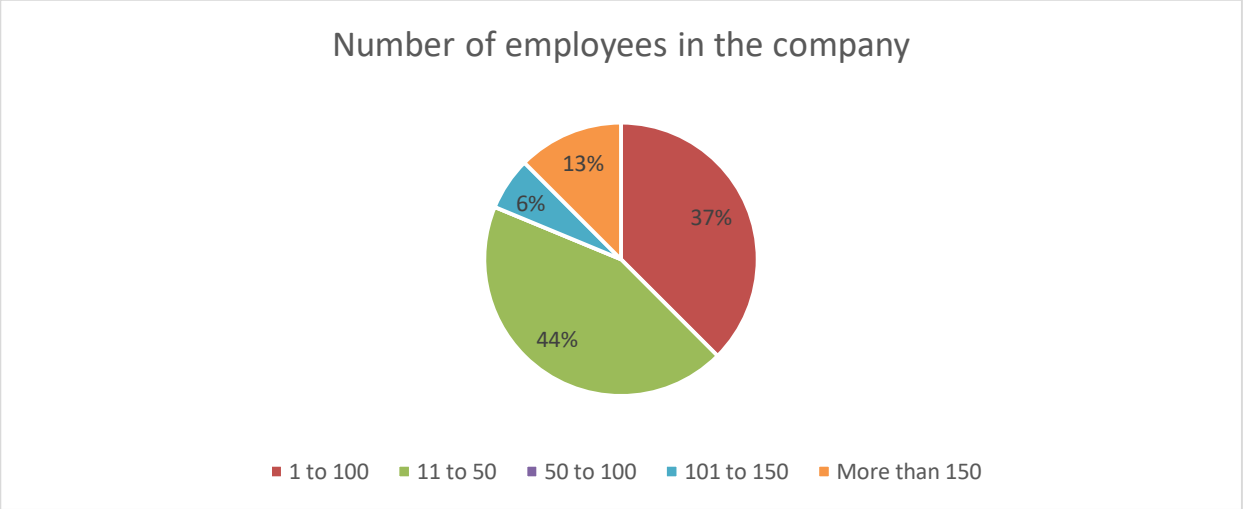

Figure 1. Questionnaire 1 Question 1

Question 2. Operating company

From this question we have the outcome of the services in which the participating companies operate. There are several options given to participants, which are chosen based on the services the company provides to their clients. Most companies are operating in Technology/E-Commerce (25 %), Government, and Distribution Services, and Manufacturing are following (18.8 %), Marketing (12.5 %), and Construction/Architecture (6.3 %). Figure2 visually represents the results. The results that were retrieved from this question show that we have covered a wide range of industries such as technology, production and manufacturing, tourism, market, retail, etc.

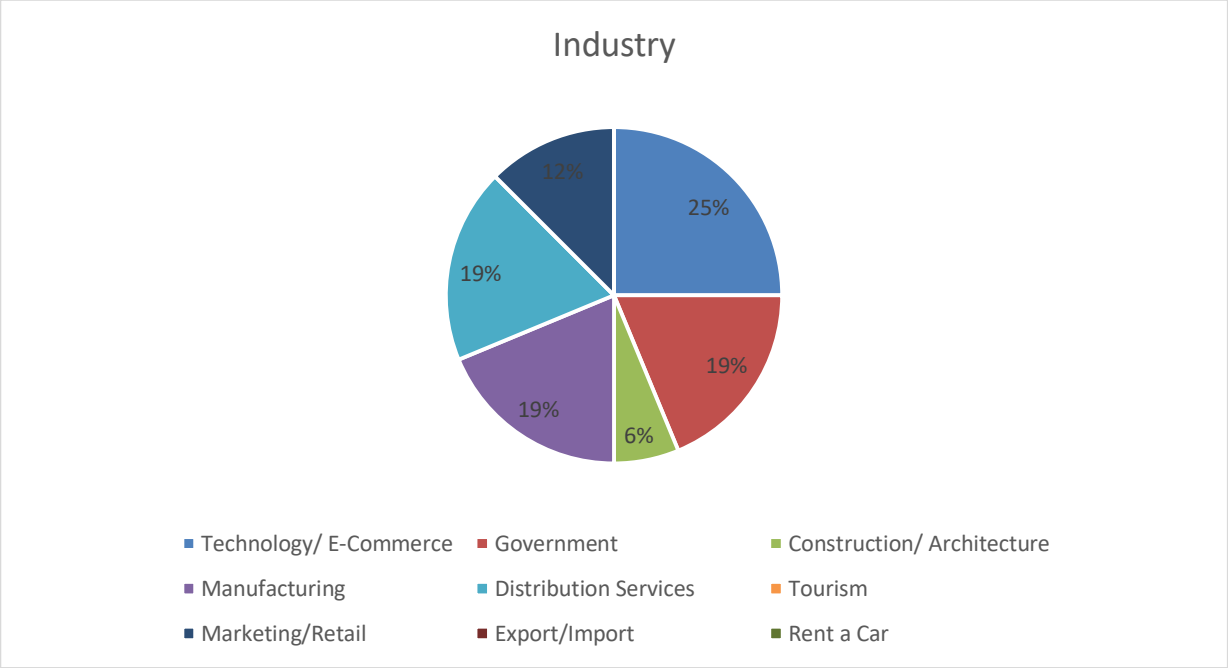

Figure 2. Questionnaire 1 Question 2

Question 3. Usage of Software tool for managing projects

The purpose of this question is to find out if any of the companies involved in the research are already using any kind of software which enables them project management. In this way they are more in control of their progress, and they also can see all the priority points which may affect the overall outcome of the project. From the results we can conclude the bigger the company, the higher the chance of usage of software for project management. In Figure3 we can see that majority of the involved companies use software for managing projects. They are using software as: Jira, Git, Bitrix2, Trello, Excel, Ultima, and a personally developed one.

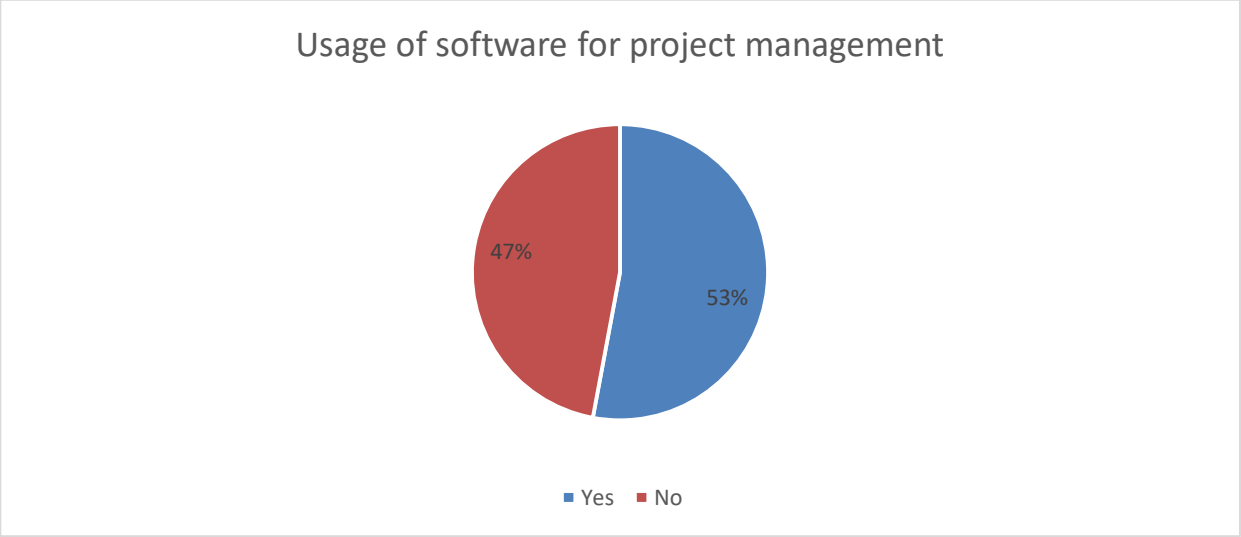

Figure 3. Questionnaire 1 Question 3

Question 4. Visibility of project progress

All companies want to be able to see the progress of their project, but not all of them have the tools to do so. This question firstly asks of the opinion if the visibility of project progress can improve work. Most of the companies agree with this opinion (82%). Figure4 illustrates these results.

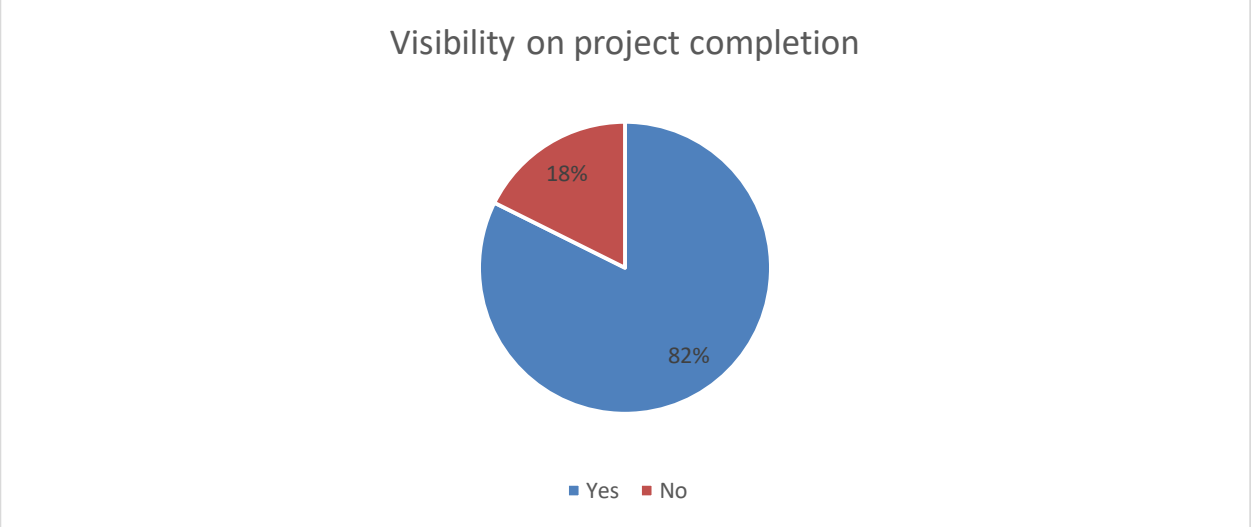

Figure 4. Questionnaire 1 Question 4a

The following Figure(Figure5), gives us the insight on how do participating companies think would improve the visibility of the project progress. Majority of the companies are identifying the information through project cycle and project progress as a crucial part for improvement. The following activities are database usage and monitoring of the project progress.

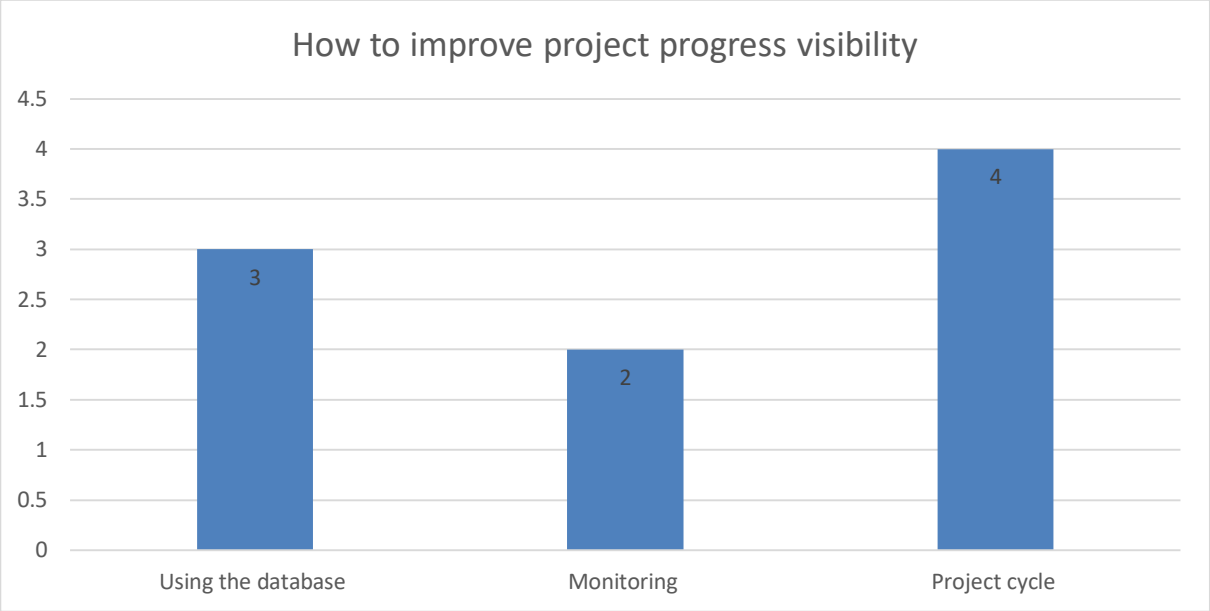

Figure 5. Questionnaire 1 Question 4b

Question 5. Tracking employees' availability

All companies participating in the research have employees. But how do they track how much work they have done and when are they available for new tasks assignment? This question asks the same. Most companies participating in this research do not use software which enables them this tracking, work/task/project assignment, progress on employee work, and availability for new task assignment. In Figure6, 35% of companies agreed on tracking employees' availability with help of a software.

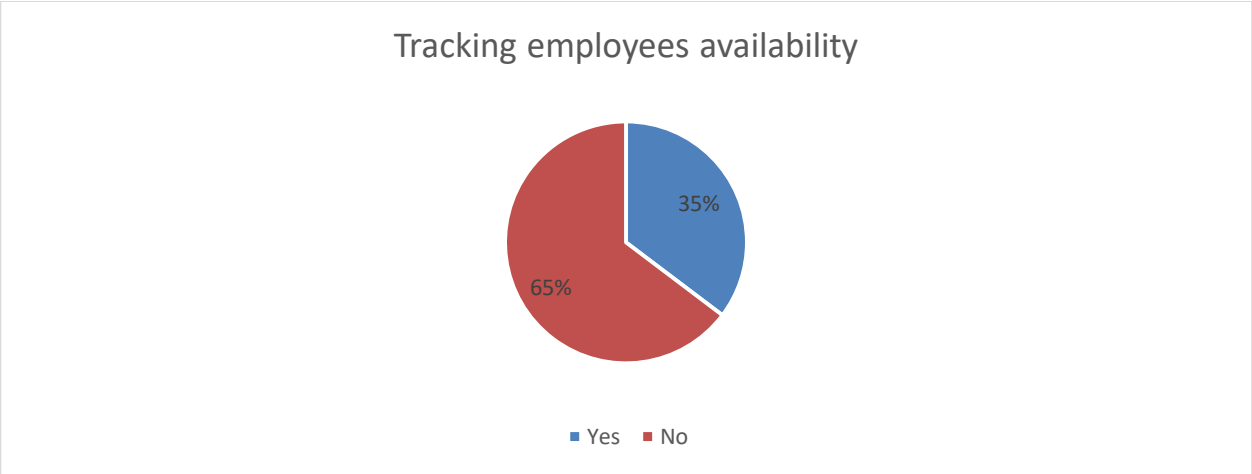

Figure 6. Questionnaire 1 Question 5

Question 6. Documentation Storage

Where do you store your document? In your drive? Your computer? Your database? Or maybe hard copy? This question reveals how the documentation is stored in different companies. In Figure7, you can see that most of the documents are stored locally on the employees computers (41 %), database (18%), hard copy archive (18%), shared drive (17%)

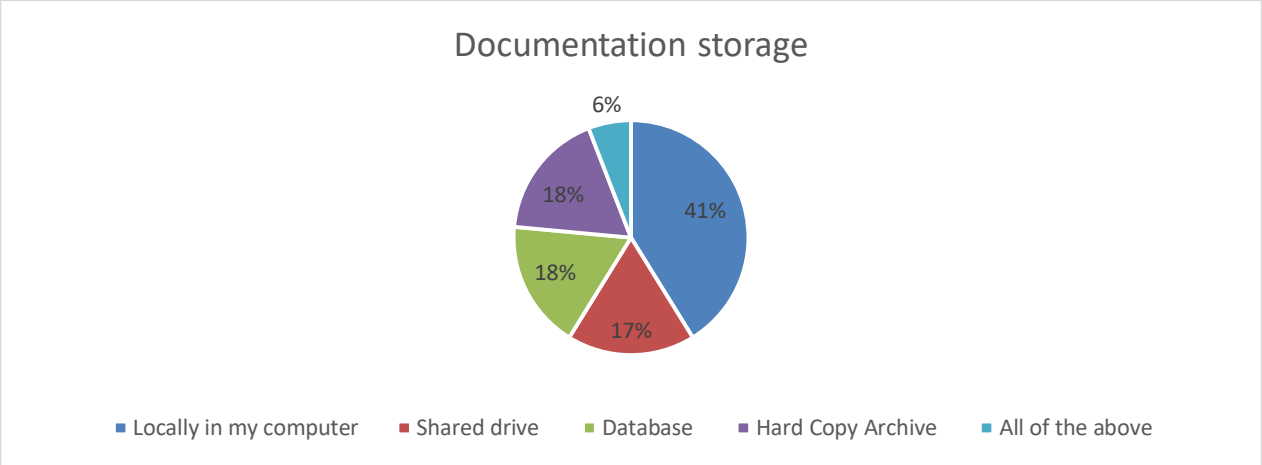

Figure 7. Questionnaire 1 Question 6

Question 7. Software for tracking and managing customers

Customers are the main point of profit to companies. Companies need to adapt their products and services as per customer needs. But how will a company get the needed information for product/ service development if they are not in contact with their clients? There are existing software solutions, which enable tracking and management of customers. Through the following results, we can see how many of participating companies use this software. In Figure8, most of the companies use software for tracking and managing customers (59%). The results of this question show that having an interface providing customer visibility is preferred by most of the companies, and having this opportunity in one software altogether with the rest of the functions and not purchasing an extra software for this is affordable for everybody.

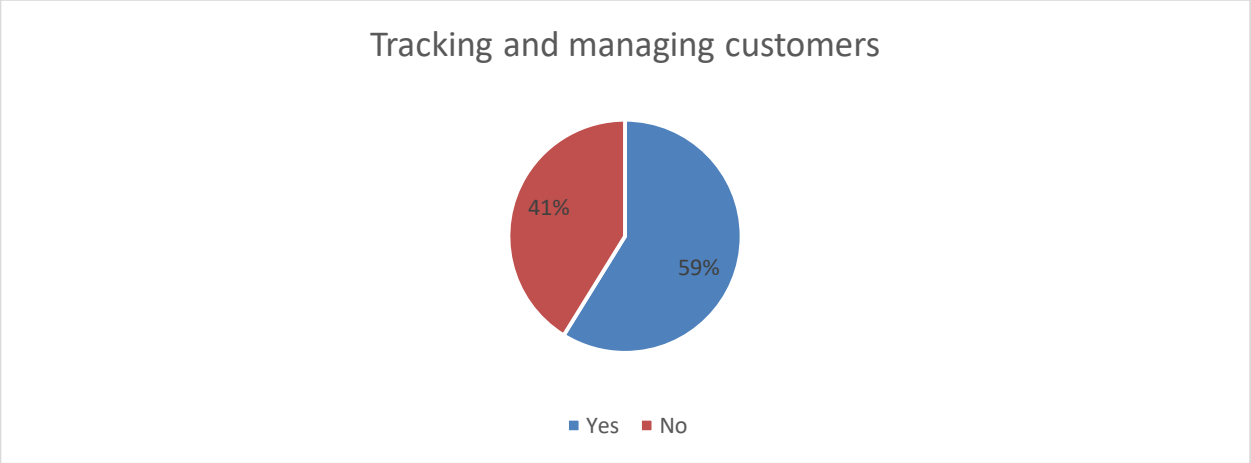

Figure 8. Questionnaire 1 Question 7a

Figure9 shows the types of the software companies are using for tracking and managing customers. As the results show the most used software currently is Jira, which is better suited for software companies. Comparing the results between this question and the company industry, we come to conclusion that the companies that are currently using a software are mostly from the technology industry, whereas the other industries tend to require a custom-made software since they do not find Jira very suitable to their business.

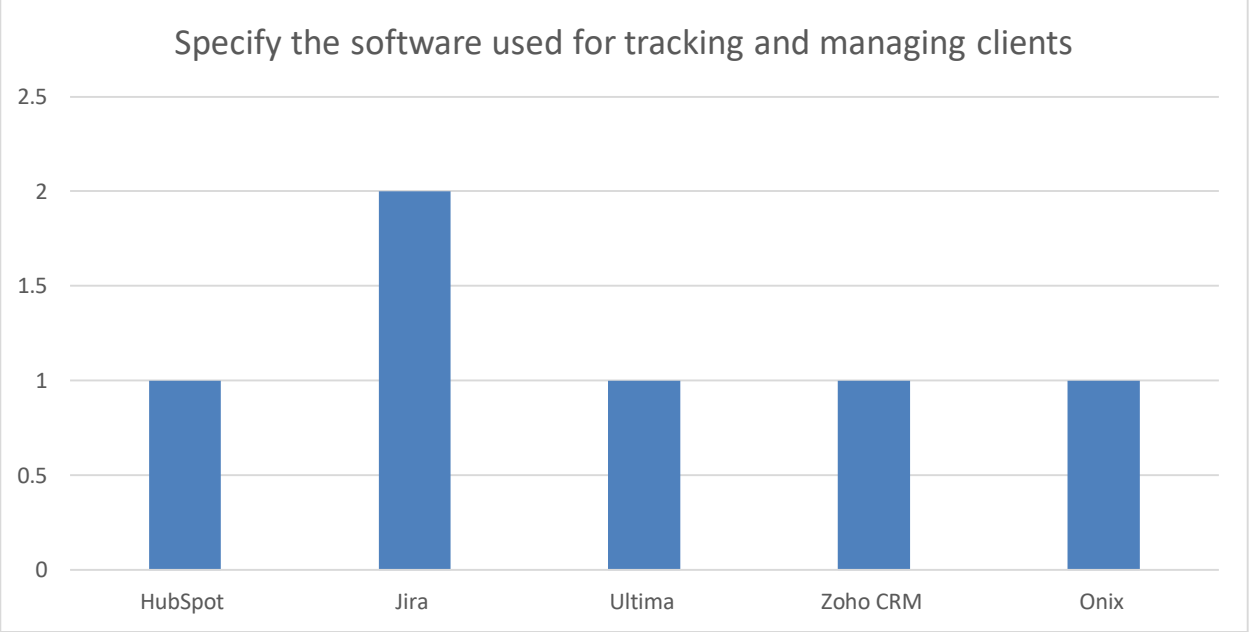

Figure 9. Questionnaire 1 Question 7b

Question 8. Difficulties in the company

In the following question, “What are the difficulties in the companies participating in the research?” the aim is to reveal the processes that can be improved within the company. From Figure10, you can see that most of the companies face difficulties in resource management, overlap of repetitive and manual tasks, lack of communication between employees, and organization of documents.

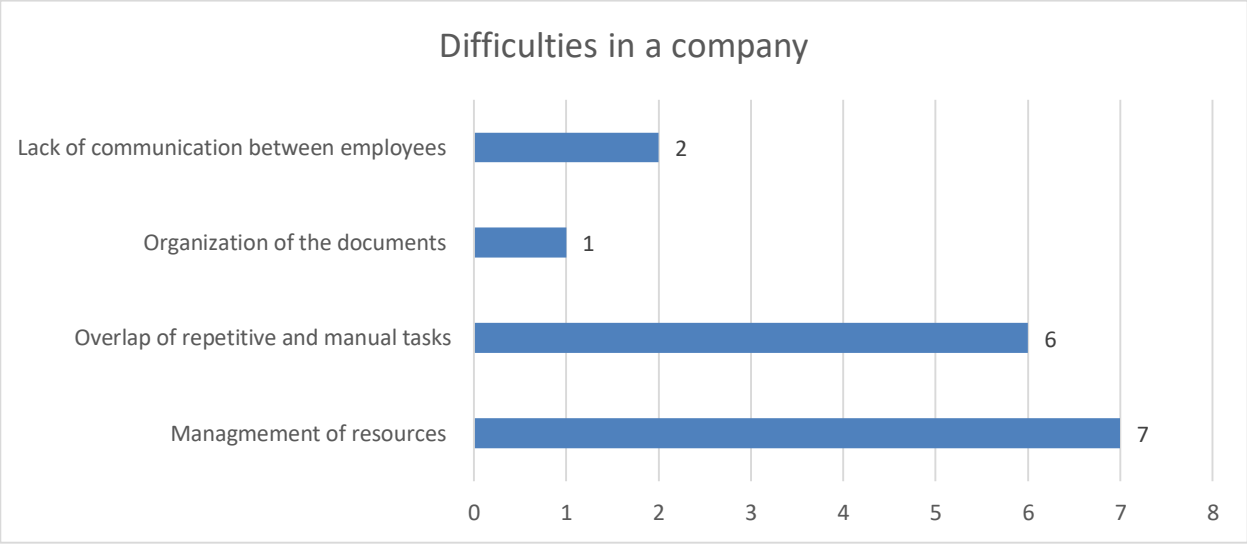

Figure 10. Questionnaire 1 Question 8

Question 9. Implementation of a new collaborative system to improve the productivity

This question reveals the preparedness of companies to try new software solutions for productivity increasement. Figure11 reflects that most of the companies would agree (53 %) to implement a new collaborative system, which would improve their work productivity. This is important since it gives us information on the relevancy of our thesis.

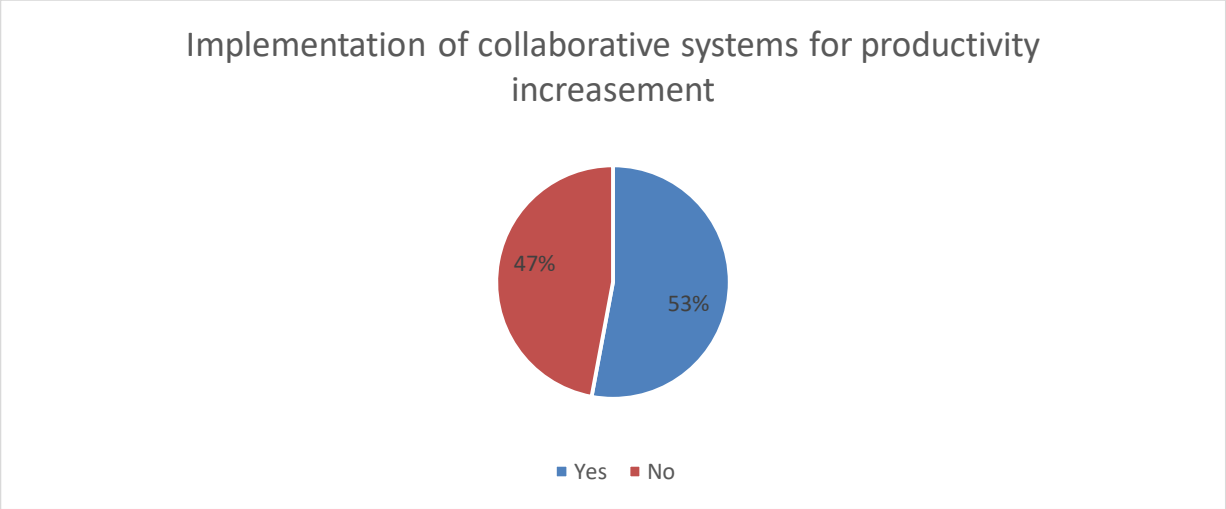

Figure 11. Questionnaire 1 Question 9

Question 10. Function implemented in a system for work process improvement

There is always space for improvement. Companies tend to develop and improve daily with the purpose to attract more customers and gain a higher market share. With this question we can see the functions which companies would want to implement for a work process improvement. In Figure12, the first is listed internal communication improvement, followed by customer management, departments' collaboration, and system collaboration. There are also mentioned planning of the activities, notifications for work activities, and trainings.

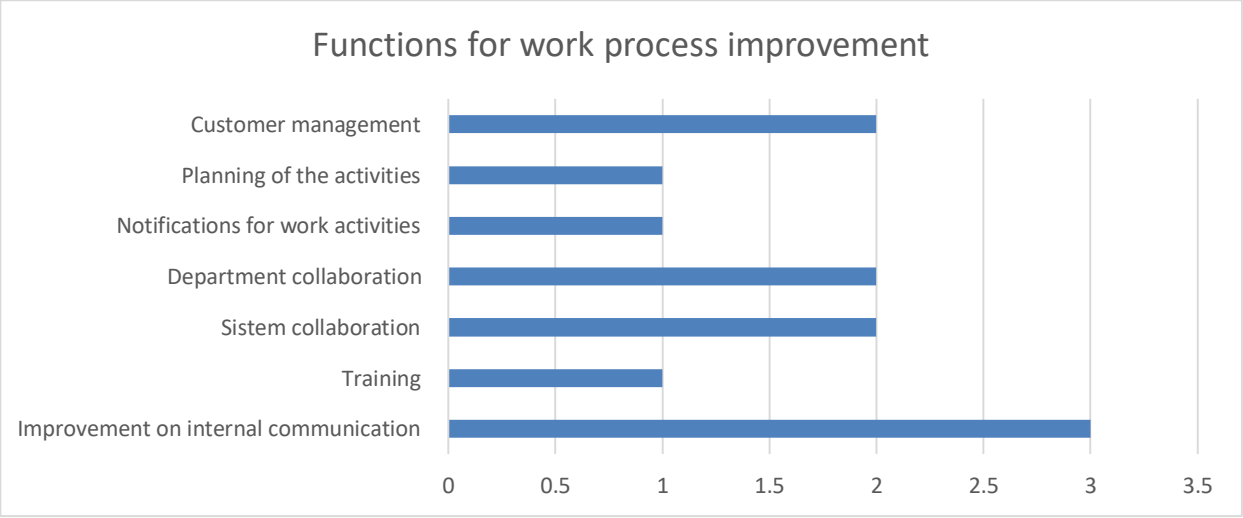

Figure 12. Questionnaire 1 Question 10

Questionnaire 2

The feedback of employees is also important since it gives in-depth information on the usability of these systems within the company from their perspective. This questionnaire was distributed to employees via email. 45 employees participated in this research. Below you will find results of this questionnaire.

Question 1. Working industry

This question determines the industry in which the employees are currently working. This also affects their further questions, because depending on the working industry they have different working procedures. In Figure13 are represented the results, with majority of the participants working in the Marketing/ Retail industry, Government, and Manufacturing (18%), following Construction/Architecture (13%), Technology/E-Commerce (11%), and others. Having a wide range of industries is important and also it allows us to compare the results to the management questionnaire giving us a higher lever overview of the results.

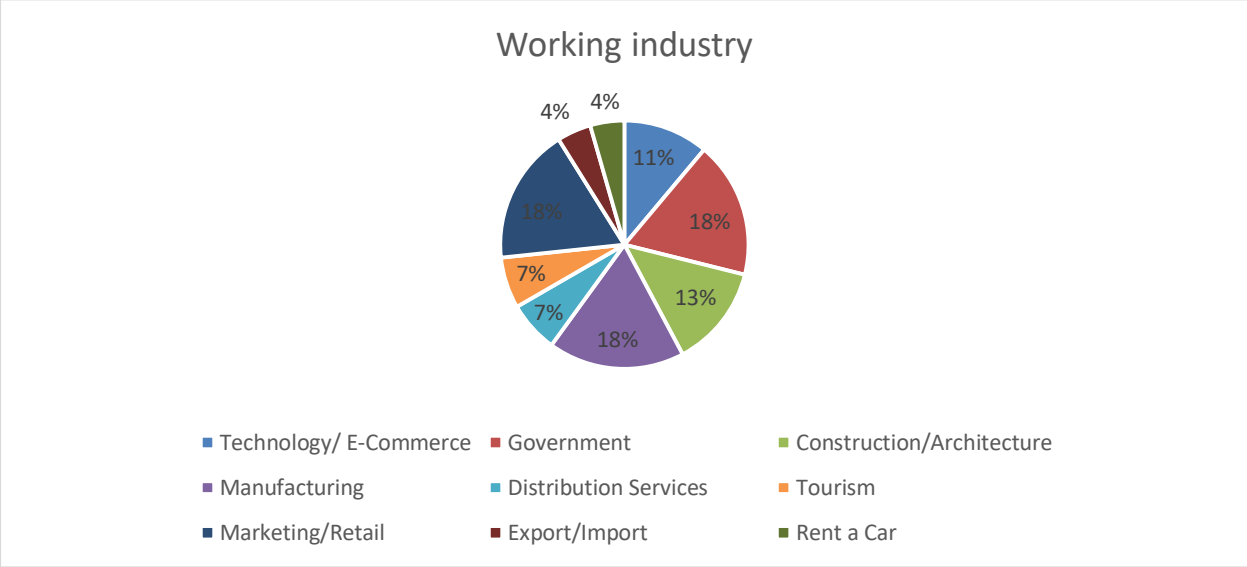

Figure 13. Questionnaire 2 Question 1

Question 2. Working hours per day

Because this questionnaire is filled in by employees, there is a need to determine the average working hours per day of the participants. This indicates the time spent on completing tasks. In Figure14, we can see that most of the participants are working eight hours per day (66%), there are some of them working 10 hours per day (22%), and only few are working six hours per day (12%). A minority (2%) of the participants are working 12 hours per day.

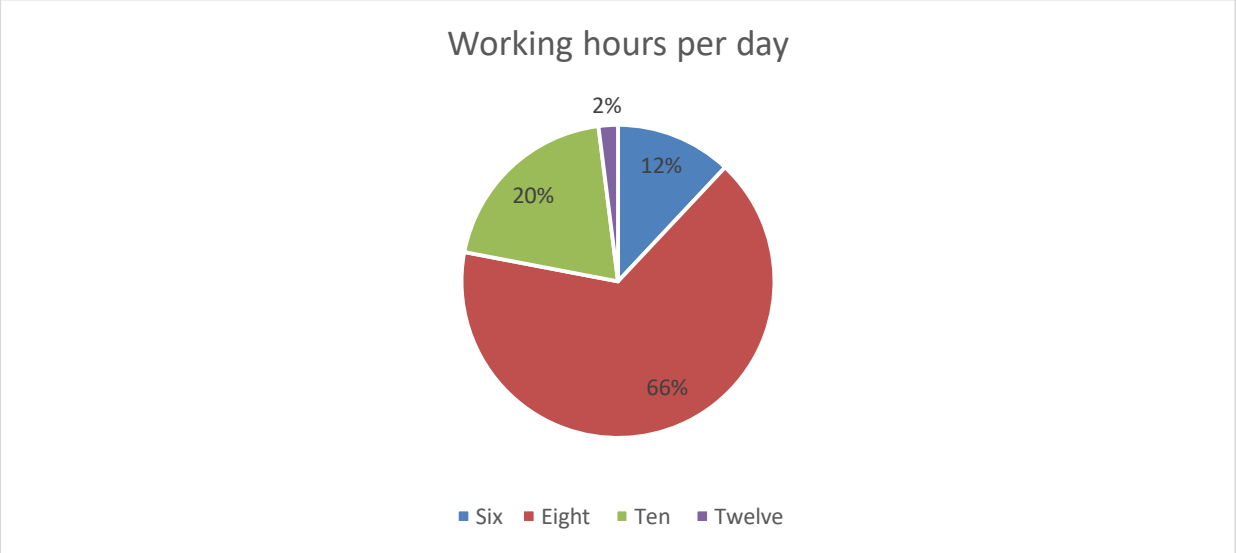

Figure 14. Questionnaire 2 Question 2

Question 3. Approximate number of finished tasks per day

Workload depends on several factors: industry operating, number of workers, promotional periods, and others. This may affect the number of tasks an employee performs per day. Some days one can perform 2 tasks, and other days one can perform 10 tasks. But, at the end of a certain working period, there is an average of tasks performed by day. From Figure15 we can conclude that majority of the participants finish 5-10 task per day (38%), followed by more than 10 tasks per day (35%).

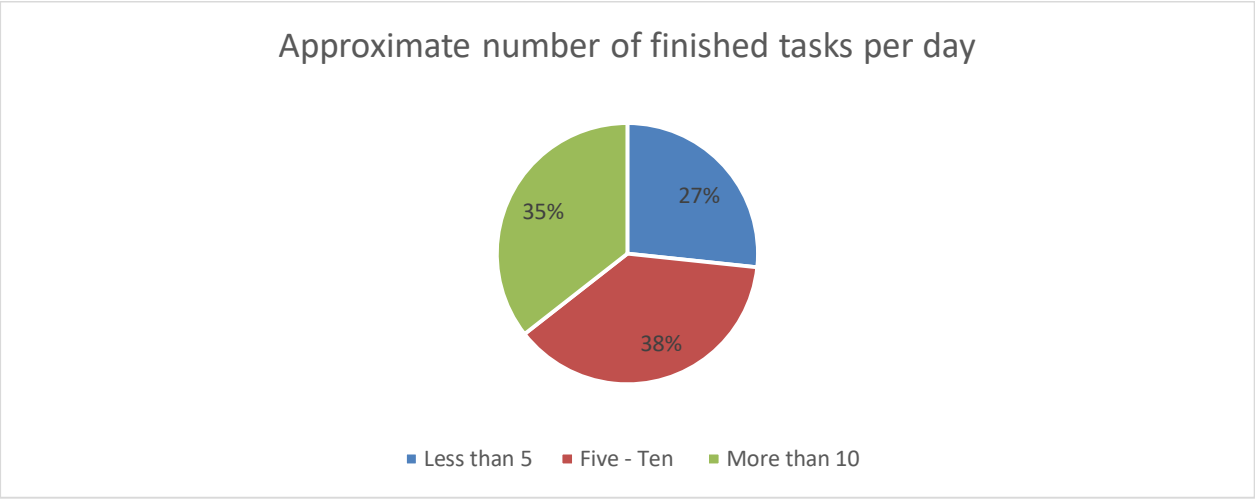

Figure 15. Questionnaire 2 Question 3

Question 4. Time consumed on repetitive tasks

Each one of us has a task that is performed daily in the same way. Based on the results of the questionnaires we have come to the conclusion that the companies that are currently using collaboration system are from the technology industry (11%) meaning that 89% of the participants are working on the traditional way. Considering this, having only 27% of our participants that spend less than 1 hour in repetitive tasks and the

rest spending 2 hours or more, we can conclude that our sub hypothesis stating that “the traditional way takes more time in repetitive tasks” is true. Figure16 shows the results mentioned above.

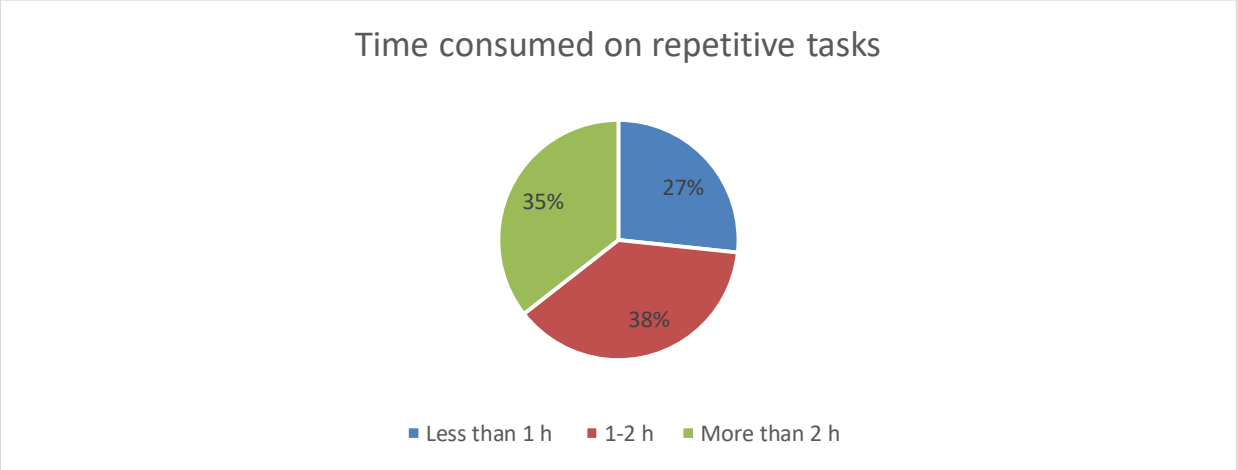

Figure 16. Questionnaire 2 Question 4

Question 5. Avoidance of repetitive tasks by process automatization

There are several repetitive tasks which cannot be automatized. But, for those that can be automatized, would it contribute in work productivity. Majority of our participants agree that yes, it would contribute if they would avoid doing repetitive tasks, as it is time consuming and a routine process. There are several of them which selected maybe, and a few of them chose no, mainly because their tasks cannot be automatized. Figure17 visualizes answers for this question.

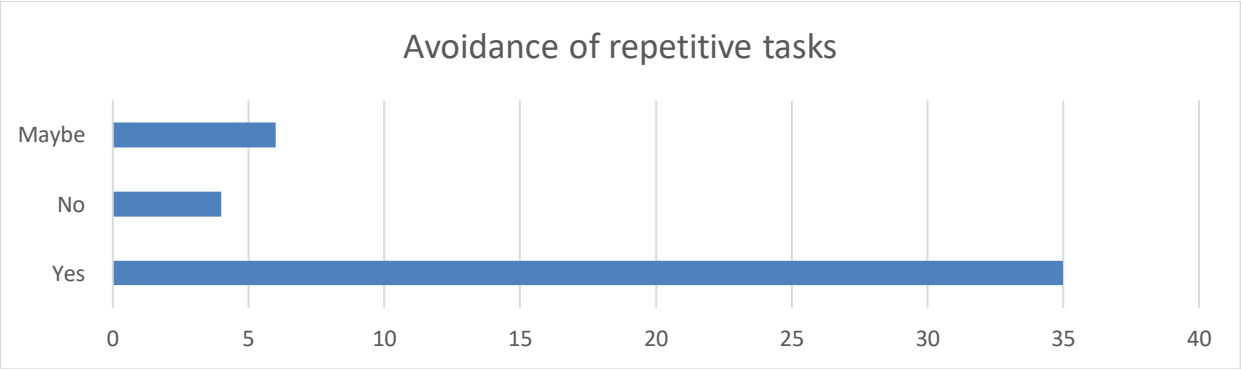

Figure 17. Questionnaire 2 Question 5

Question 6. Usage of task management systems and schedule for work improvements

Although all the companies have a certain schedule being it a flexible or a fixed one, not all of them use task management systems to see which tasks an employee has performed during the day, which task took him/her longer, tasks that were postponed, etc. When asked for the relevancy of task management functions in improvement of the overall work process, 98 % of the participants agree that such a function would significantly improve their work (as seen in Figure18). The importance of these results is that they directly affect the relevancy of this thesis, showing us how imperative is to implement a task management

function in the application.

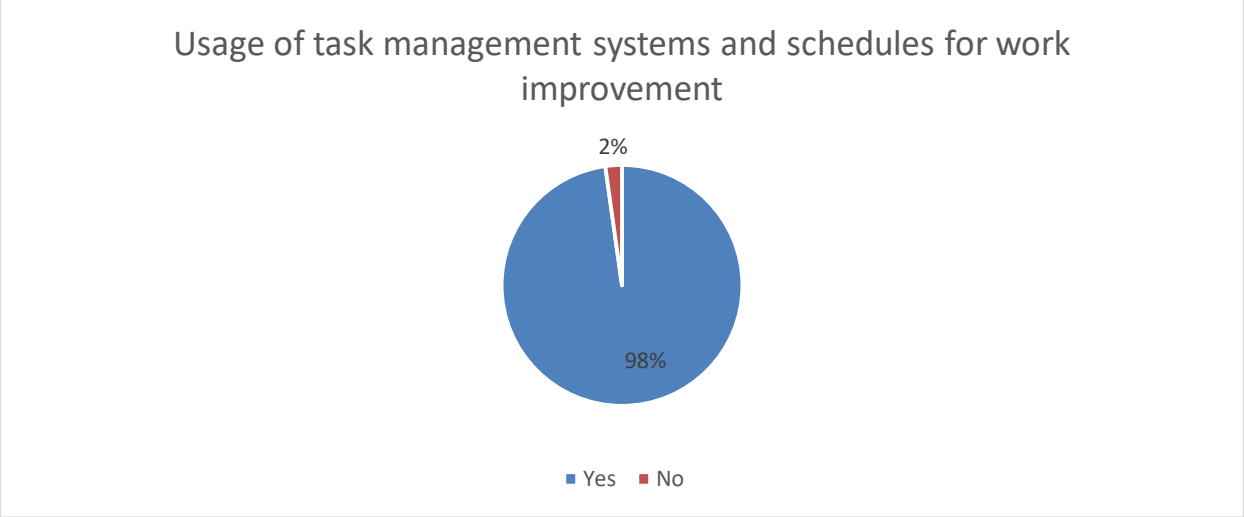

Figure 18. Questionnaire 2 Question 6

Question 7. Document storage

This question determines where participants in this research store their documents most often. While storing documents locally, people might end up with multiple versions of the same document, leading to confusion and mistakes and companies cannot afford such mistakes being made as it costs them time and money. The results of this question show us that 46% of the employees save their documents locally, 12% have a hard copy archive and only a small percentage has a database or a shared drive where everyone can access the same files (as shown in Figure19).

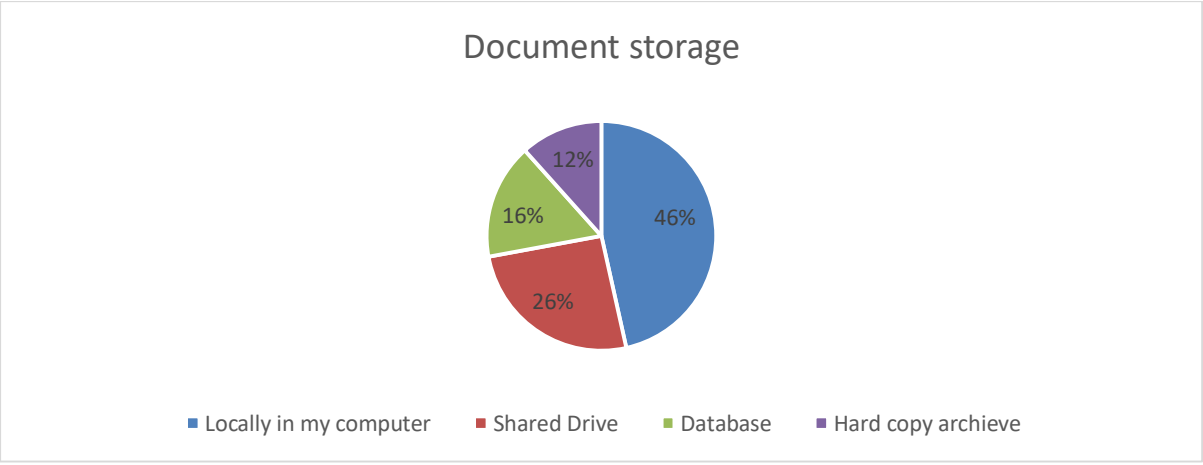

Figure 19. Questionnaire 2 Question 7

Question 8. Sharing documentation

Several employees may need to work on the same document, or one document needs to be filled in by several departments. For doing this, documents need to be distributed to several employees. How do employees share the documentation between each other is graphically represented in Figure20. 71% of

participants share documentation by e-mail, and the rest use online storage systems and Shared Drive.

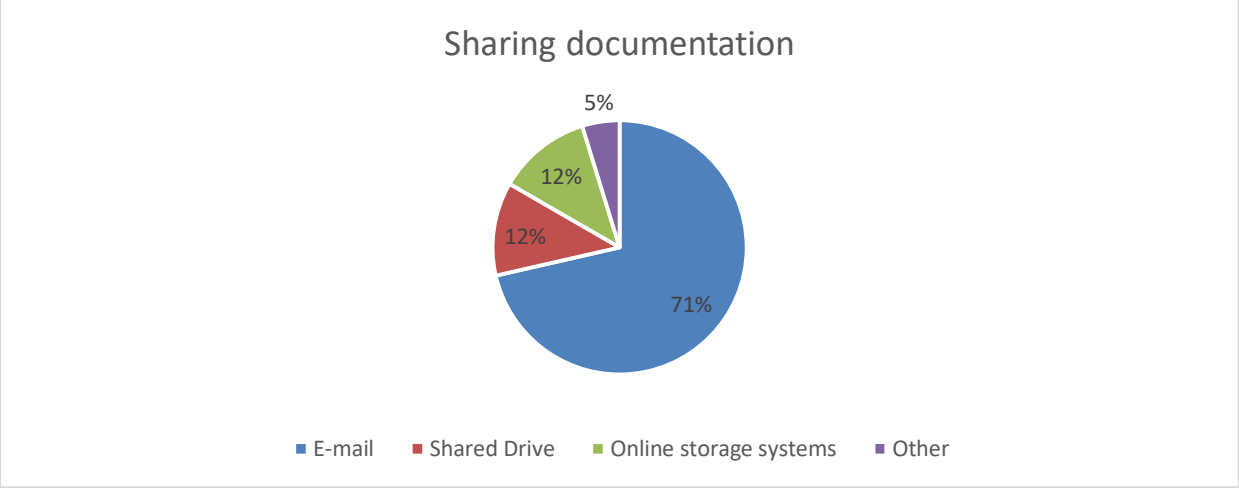

Figure 20. Questionnaire 2 Question 8

Question 9. Document management and avoidance of multiplication

From the above question (Question 8), we concluded that majority of participants use e-mail for sharing documents. But can we avoid multiplication of a document when several people are working on it? If we send one document by e-mail to five other employees to work on their parts, we will receive 5 updated copies after they have completed their part. The participants in this research can easily manage documents and avoid their multiplication (54%), and some of them find difficulties in doing the same (46%). Figure21 illustrated question results.

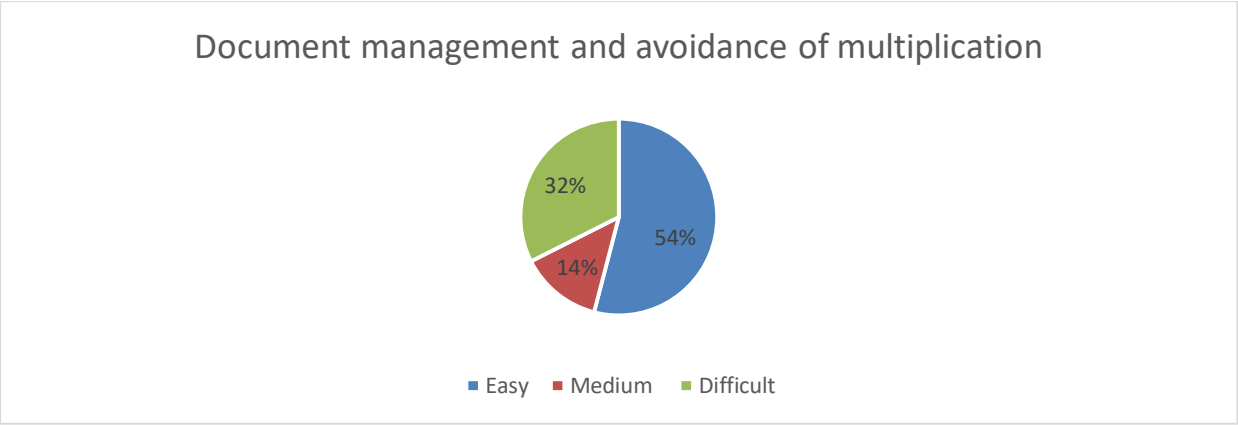

Figure 21. Questionnaire 2 Question 9

Question 10. Improvements in document management

Figure22 presents the opinion of our participants on how to improve document management. 13% don't think they need any improvement now for now; 5% would incorporate databases for document management; 16% are of the opinion of organizing and structuring documents in folders; 19% would make the documents available online to all employees; 21% would recommend connected systems; 26% usage of

new software for document management.

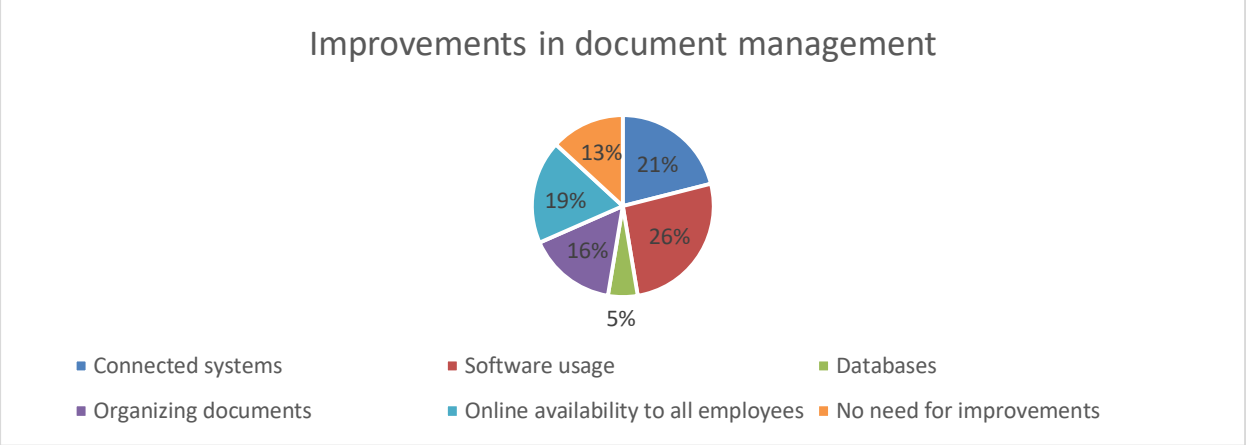

Figure 22. Questionnaire 2 Question 10

Question 11. Suggestion for improvement on automatization of work process

This question collects suggestions which the participants in this research have for improvement on automatization of work process. The Figure23, reflect that most of our participants would suggest online availability of documents. Next suggestions are software usage, database usage, task management programs. However, there are several participants without any suggestion on this question.

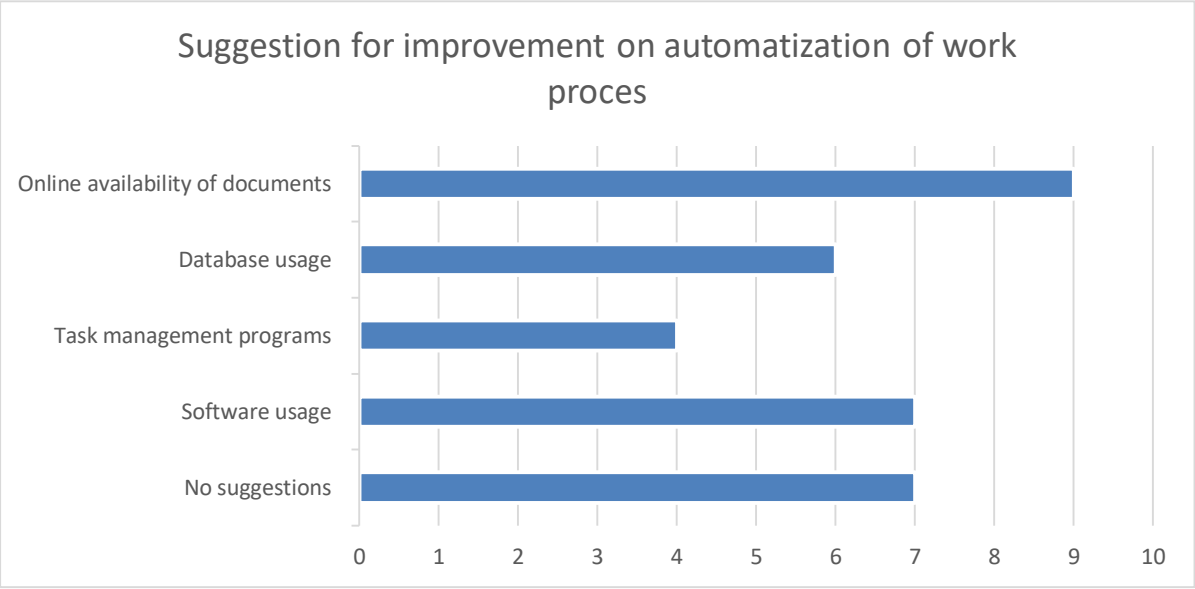

Figure 23. Questionnaire 2 Question 11

4.4. Conclusion

The results of the distributed questionnaires give us full visibility on the current status of the small and medium companies in our country regarding the collaboration system usage. They show that in both questionnaires we have covered a wide range of industries and different sizes of companies.

The analysis of these results shows us that the companies that belong to technology industries tend to use

different software applications to manage their work, whereas the other industries such as retail, construction, manufacturing, marketing and government enterprises although are willing to try new customized applications, they currently do not use such an application.

Based on the results from our questionnaires we come to a conclusion that the biggest issues are regarding the task management, project progress tracking, document management and communication between team members.

The participants of our questionnaires have given us different suggestions for the improvement of their working process most of them focus on a customized software that would include: a common database system, online templates that can be filled in faster, task tracking system, project progress reports, etc.

5. Design and Implementation of Collaborative System for SMEs

Based on the literature review findings regarding the implications that business processes have when designing a collaboration system, and having the main goal to facilitate the working process of the company allows us to define what are the business processes that we need to cover in this system and how to approach the solution.

The comparative analysis that was done in the third chapter has provided more thorough information on what are the current standards in the market, what are the prices offered and what approaches are followed when it comes to collaboration systems.

By taking the best solutions from these findings and combining them together with the information that was gathered from the companies in Macedonia in this chapter we will present the design for a new collaboration system.

5.1. Design

Initial Concept Design

The starting point for the development of this software is the development of an initial concept. Taking input from the below listed points, the initial concept design leads to a more stable and qualitative solution:

- The current need - establishing an as – is analysis of the status of the companies in our country and gathering information on what are the major issues and the requirements that our entrepreneurs have.
- The desired outcome of the solution – defining the goals that this software solution needs to achieve.
- The implementation timescale
- The type of equipment, or technique
- The sector or geographic area which is to be developed

As – Is Analysis

The As-Is Analysis was done through the questionnaires that are described in the previous chapter. One questionnaire gathers the information regarding the business process issues from the management point of view whereas the other questionnaire provides us with the information regarding the everyday issues that negatively affect the daily work of the employees. The results of these questionnaires led to the main parameters that drive the design of the proposed collaboration system in this thesis. This is why we will focus on these core functionalities as a basis for our new Collaborative System:

- Tasks Management
- Human Resource Management
- Document Management

- Discussion Boards

Desired Outcome of the solution

The purpose of developing this software is to allow its users to easily manage and schedule their projects. Adding assignments to the tasks, providing a common workspace for storing the documents being able to track the most recent versions of each document, and based on the requirements of the company developing custom-made administration templates that would allow the employees to easily add the data in the system.

The implementation time-scale

As a web based software, it is very easy to access once a company is registered. But, the implementation time-scale of the system may differ between companies, depending on the below parameters:

- Company size
- Number of Projects
- Number of Employees
- Amount of documents stored

After the registration of the company, all the employees, projects and documents need to be added in the system in order to get the best from the software usage.

The type of equipment, or technique

There is no special necessities in order to use the software. All the users need in order to use it are listed below:

- Desktop Computer or Laptop
- Internet access
- Be registered as employee in a company

The sector or geographic area which is to be developed

This software is developed based on the information that is gathered in the Republic of North Macedonia and it meets the requirements that were made by the small and medium enterprises of this country.

BPMN Design

Business Process Management (BPM) is the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantages of improvement opportunities (Dumas 2018).

In order to provide a better view on how the software will assist in the business processes of small and medium enterprises, the most important processes are illustrated using BPMN 2.0 modeling standard, which are then mapped to UML Diagrams.

The main business processes that were defined while designing the requirements of this software are listed

below:

- Company Registration
- Employee Registration
- Customer Registration
- Project Creation
- Task Management
- Document Management

Each of the processes illustrates the interactions between the users and the system in order to complete the full cycle of the activities. Using activities, dependent instances and other loops and iterations, the simple design of the business processes is easy to read and follow. The schema of the BPMN presented in the page overleaf shows the complete workflow that will be processed through the system. The workflow is divided in two major groups:

- The set of functions that are done by the company manager / owner or other assigned person for the project management, starting with the company registration and followed by the employee registration, customer registration and project creation.
- On the other hand, it also illustrates the Task Management and Document Management processes that are included done through the employee interface.

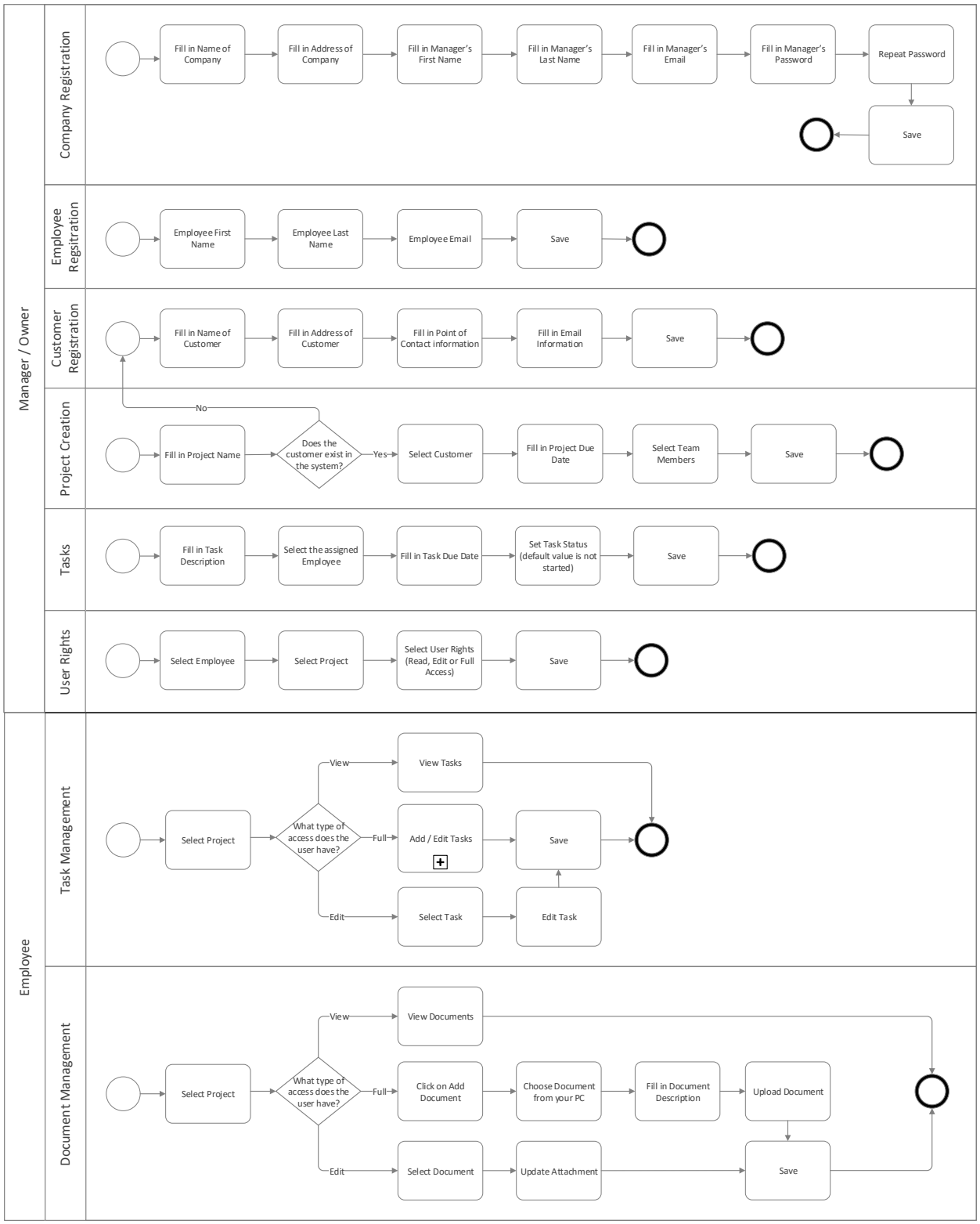

Figure 24. Business process workflow using BPMN 2.0 notation

UML Diagrams

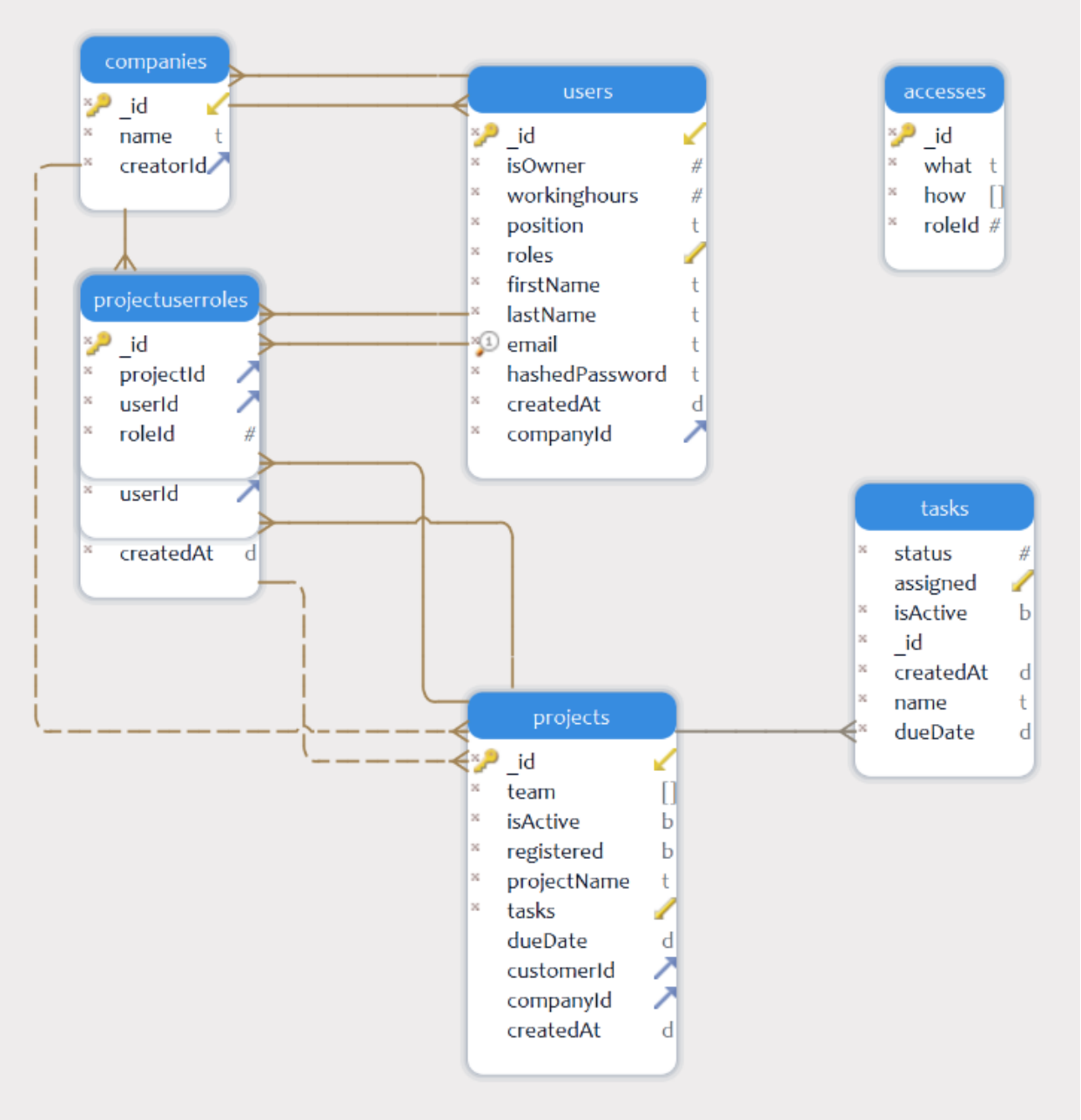

Figure 25. UML Diagrams

The above figure shows the UML Class diagrams which are created based on the database design of the application. The software used for automatically extracting these diagrams is DB Schema software. As it is shown above the application consists of the following classes:

- Companies – contains Id, Name and CreatorID
- Projects – includes id, team, isActive, registered, projectName, tasks, dueDate, customerID (referring to the customers), companyID (references the compnies)
- Project User Roles – contains ID, project ID (which references to the Project class), user ID (referring to the Users class) and role ID.

- Users – includes id, isOwner, workinghours, roles, firstName, lastName,email, hashedPassword, companyID (references companies).
- Tasks – consists of status, assigned, id, name, dueDate
- Access – consists of id, what,how, roleID.

Database Design

For the development of our collaboration system, we have decided to use the MEAN stack. According to the research done on the literature review, for designing modern applications MEAN is the most used platform.

MEAN is a full stack JavaScript platform and a non-relational or document based Database technology. Java script is the most popular client-side programming language on the Web today and the second fastest growing server-side programming language. MEAN is an acronym for MongoDB, ExpressJS, AngularJS and Node.js (Kadam, et al. 2017).

The Mongo DB database is non-relational and it is based on collections and documents. Each collection is consisted of fields that are used together and each data stored in the fields represents a document.

The Collections defined for this database are:

- Companies – is used to store the information when registering the company.
- Users - it is used to store the information regarding the employees registered in the system. The user is directly connected to the company, therefore the users collection contains the company ID information. As a unique information we store the users' emails.
- Customers – is used to store information regarding the list of the customers, which are later connected to the project.
- Projects – is used to store information of the project including the customer and the team of the project. The project is later connected to the tasks which are added on Project level.
- Documents – stores the uploaded documents, which are added on Project level.
- Project User Roles – is used to store the user rights that are assigned to the employees including the employee, the type of access, and the project
- Accesses –is used to store the three types of access that can be assigned to the user.

User Interface Design

The user interface design of this project is based on Bootstrap 4. In order to create a responsive and simple design the libraries of bootstrap were used. The idea behind using bootstrap is to provide the user with a simple design to not overload it, and to be easy on the eye and to provide a high quality UX.

The interface of the application consists of three main pages:

- Starting Page
- Owner Page
- Employee Page

The starting page or the home page introduces the application to the potential user by providing a short description of the services provided in the rights column of the page and it provides the options to register or to Log In if you already are a user. Below is provided a screen shot illustrating the design of the starting page:

Figure 26. Starting Page Design

The Owner page, will be used by the person who will register the company being the owner of the company, the manager or an assigned administrator responsible for maintaining the information.

This page consists of the header which is similar to the starting page, the left column providing us the navigation menu where the user will be able to access the services and on the right column the services will appear based on the selection that the user makes. Illustrated below is the first view when landing in the Owners Page:

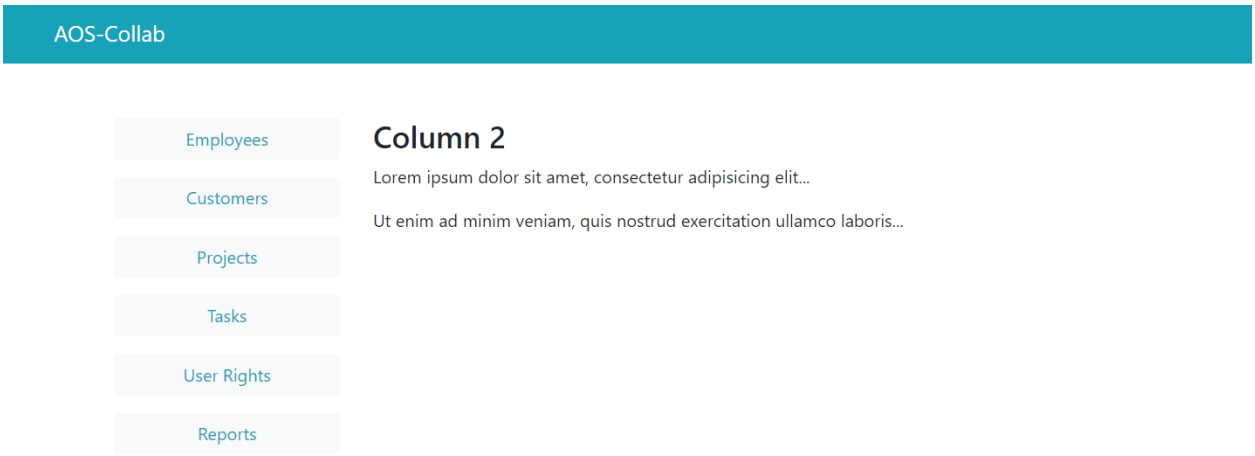

Figure 27. Owner's Page starting view

Employees' Page consists of the header, the left navigation menu and right column containing the list of project where the user needs to first select a project in order to continue further with the services. Illustrated below is the view of the employee's page:

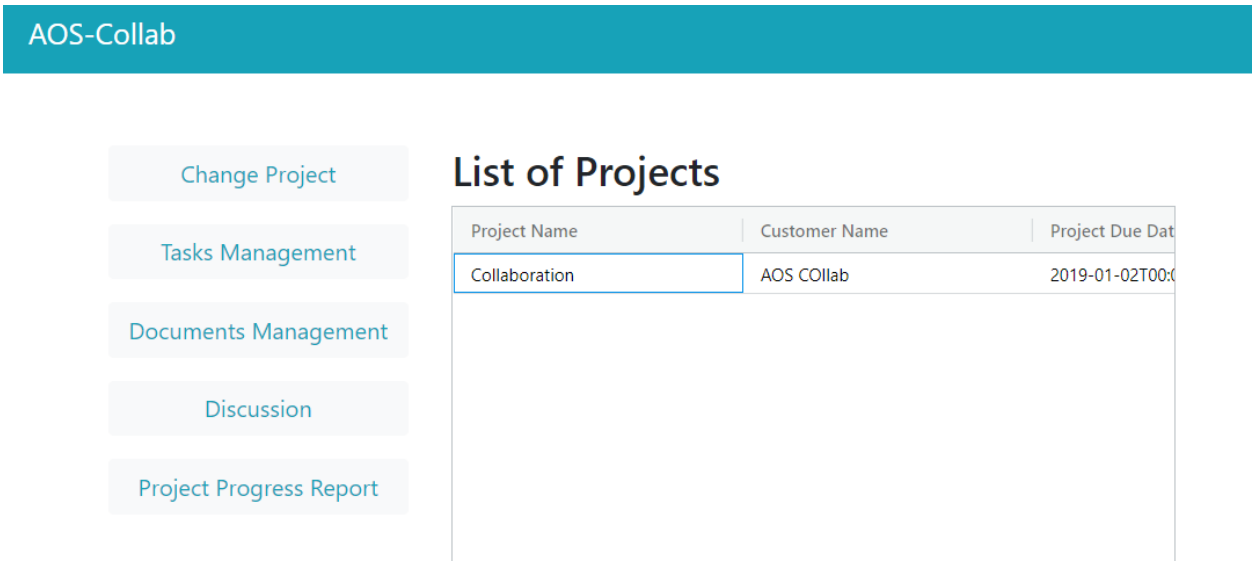

Figure 28. Employee's Starting Page

5.2. Implementation

The programming language that was used to develop this application is Angular, which is a framework based on JavaScript. The reason behind the decision of using this framework is that it provides a variety of libraries, it is easy to use, and it includes:

- Data binding features meaning that automatic updates of the view whenever the data changes and vice versa
- Dependency Injection, which allows application components to be wired together in a way that facilitates reusable and testable code (Bodrov-Krukowski 2018)

The application developed during this master thesis is considered to fit small and medium enterprises of the Republic of North Macedonia, therefore it is a simple web based software providing the below functions:

- Task Management
- Document Management
- Discussion Boards
- Report Generator

In order to use the application the first step to take is to register the company in the application and setup the needed information. The owner of the company, a manager of the company or an assigned administrator, does this.

Company Setup

The company registration is simple; it required basic information regarding the company and also the key user in this case being the person creating the company profile. With a very simple registration form, the user can start with the setup shortly after. Depending on different parameters, the time for setting up the complete company may vary based on:

- Number of the Employees
- Number of Projects
- The Life of the company – how long has it been operating
- Number of Customers

The steps that need to be followed in order to complete the setup of the company are listed below:

- Register Employees – an email will be sent automatically notifying them regarding the registration and providing the credential information.
- Register Customers – the customers are only registered with the aim of linking projects to the customers and also keeping track of the basic information such as: who are the customers, the contact information and identifying the key customers
- Create Projects – adding the basic information such as the name of the project, the customer and the team members
- Grant the Access to the employees – based on the projects that the employees work and on the position that they have they might have: read, edit or full access.

Task Management Module

Based on the findings from the companies in our country one of the most required module was the task management. By implementing this module in both sites: administrators and employees will be able to add, edit or delete tasks.

Our main goal when designing the application was to facilitate the working process for the people and to provide a solution that will organize the daily work for them. The best way to keep track on your work and to organize your daily activities is following a schedule.

The task management module enables the users to have access to a simple schedule which is based on the projects. Each project will have a different schedule consisted of numerous tasks that will all be assigned to the responsible team members. For each project, the tasks will be organized into three types as listed below:

- Late Tasks – every task that hasn't been completed and the deadline has passed
- In Progress – every task that is due today
- Not Started – every task that is scheduled for the upcoming days
- Completed – every task that was completed within the deadline

The organization of the tasks as described above is done based on the employees' input. They need to continuously update the status of the task into: Not Started (the default status), In Progress or Completed. The late tasks are taken automatically when the "Not Started" tasks have passed their deadlines.

Documents Management

The next step to be taken in order to facilitate the work is to have a clean and well-organized document storage module. The most important elements considered while designing this module are listed below:

- Having all the project documents into one place
- Team Members sharing the access to the same documents
- Possibility to Download / Upload Documents
- Restricted access

While working in one project it is preferable to have all the related documents in one place. This is why we made the decision to develop the Document Management feature in project level, allowing the users to upload / download documents within one project if they have the required access.

The employees will be able to upload documents using two different approaches:

- The main documents of the project
- The documents uploaded to a specific discussion board

By following the two approaches the system enables its users to share different documents with each other when having a discussion but at the end there will still be the latest version of document uploaded in the project.

Discussion Boards

The team work is based on the strong communication between its members, otherwise it would fail. The aim of team work is sharing ideas, combining different skillsets in order to get a final product that complies with the requirements. Most of the companies invest a lot of resources in order to provide the opportunity and the necessary prerequisites to their employees so they can work together and deliver their best.

Our approach towards the communication module is to provide the users with the Discussion Boards feature. The initial idea of the discussion boards emerged as a simpler version of Trello Boards.

For each project the users can create new discussion boards, where their team members can comment, post and also upload additional documents.

Reports

Aiming to provide full visibility the automatic report generator is developed for both sites: Administrator and Employees. The approach that was followed for the reports in the administrator site is to show the overall status of the project the tasks.

There are two types of reports provided to the administrator: Tasks Report and Project Report. The first one shows the list of all the tasks, showing the status marked in different colors:

- Green indicating that the task is completed
- Blue indicating the tasks that are in progress
- White indicating that the tasks are not started
- Red indicating the tasks are late

This report is illustrated in the figure below:

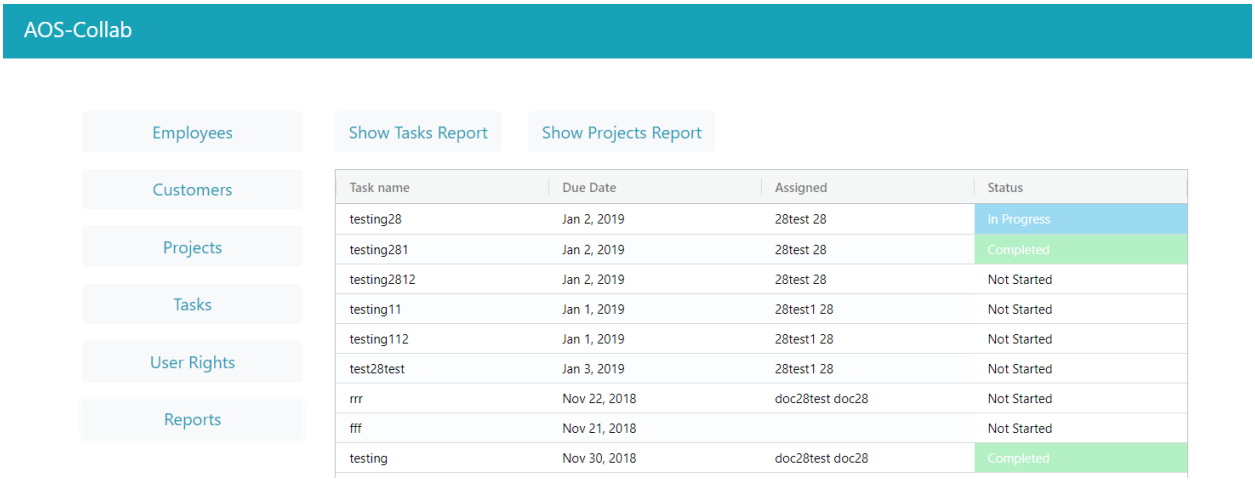

Figure 29. Show Tasks Report

The second type of report provided in the administrator's site is the Project Report which is generated based on the calculation of how many tasks are completed the administrator / owner will be able to see how many percent is the project completed and when the deadline of that project is.

The below picture shows the Project Report:

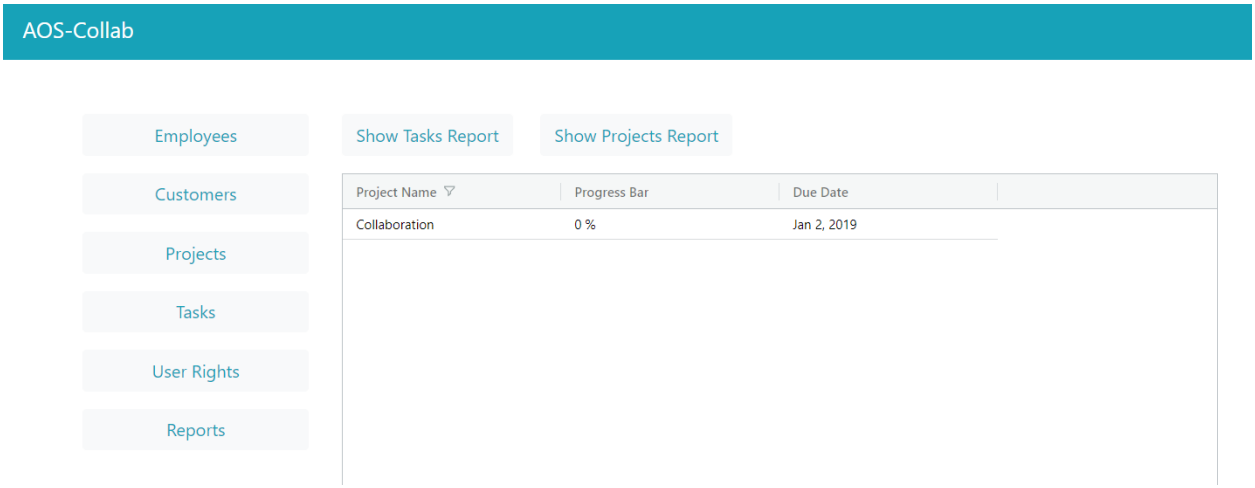

Figure 30. Show Project Report

The figure below shows the code that was used to calculate the percentage of the project completion:

```
beatifyProgess(object){
  let tasks:Tasks[]=object.data.tasks;
  let taskDones=tasks.filter(task=>task.status==2).length;
  let progress=((taskDones/tasks.length)*100).toFixed();

  return progress + " %";
}
```

Figure 31. Showing Completion % in Administrator / Owner Projects Report

On the employees' site the report is visualized different. The report is generated on project basis and the team members are able to see where they stand, what can be improved and how much time can they save. This report consists of all the tasks related to the project, on the right side of the grid the colors are shown indicating the different statuses of the tasks (same indications as specified in the administrator's report), and on the top of the page there is a progress bar showing the completion of the project.

The below figure shows the report in the employee site:

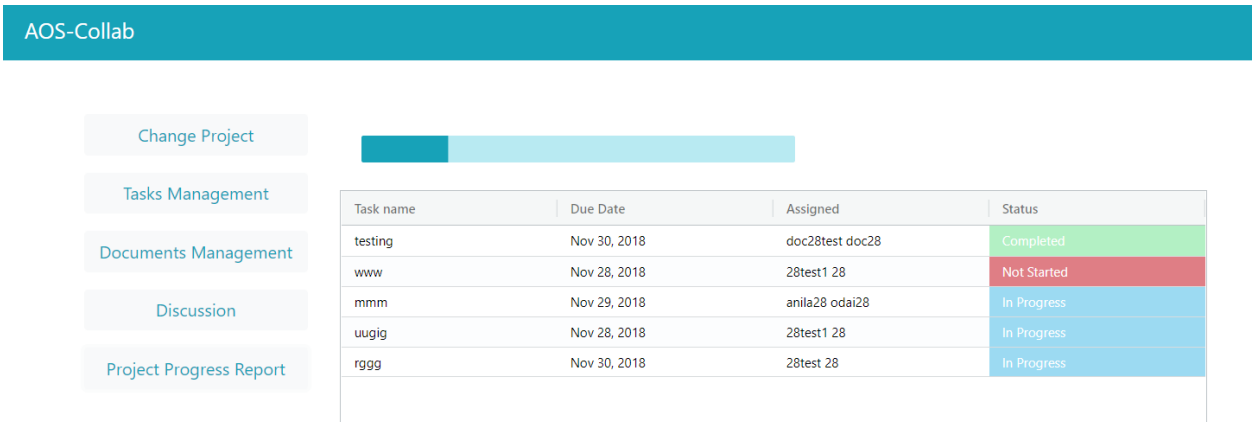

Figure 32. Reports in Employees' site

5.3. Testing

For testing the software, we have followed the below types of testing:

- Performance System Testing
- User / Customer Testing

Performance System Testing

Once the application was completed, a performance system testing was established. Testing the response of each function how much time it takes and what types of warnings or errors we get from it were the key parameters used for this testing. The main functions tested were:

- Company Registration
- Employee Registration
- Customer Creation
- Project Creation
- Task Management
- Report Generation
- Documents Managements
- User Rights

Each of these functions successfully passed the performance tests. The application was tested in different environments:

- Using Wired Connections:
    - Download speed of: 61.78 Mbps
    - Upload speed of: 87.47 Mbps.
- Using Wireless Connection with speed:
    - Download Speed of: 6.39 Mbps
    - Upload Speed of: 0.49 Mbps

None of the functions had any delay while performing the above mentioned tests.

User Testing

For the user testing a sample of 8 people tested the application. By providing them a testing matrix, they were able to test each function and to provide their input. The User testing was organized as below:

- User Interface Testing
- Functionality Testing
- User Rights Testing

For each one a matrix was created and was filled in by the test users. They tested the complete application separately and on different times. In the appendix B the list of the filled in matrixes is provided.

5.4. Conclusion

As a result of our research from previous chapters, we designed a simple web based application that provides the below listed functions:

- Task Management
- Document Management
- Discussion boards
- Report Generation

Our aim was to facilitate the work of the users and we based our design on the input that we received from the questionnaires, where the participants included suggestions on how their work can be improved when using a collaboration system.

As the results of our application testing show, we accomplished to provide a qualitative system, where our users have full visibility on their work, and can be more productive during their working hours.

6. Conclusion

The need for automatizing the work and increasing the productivity of the employees is growing fast in the recent years. The biggest companies all over the world tend to use different project management systems, information systems and collaboration systems in order to increase their profitability and be one step ahead at all times. Conversely, smaller companies in less economically developed countries such as our own, hesitate to change their traditional way of working when it comes to using large and complicated systems, since they do not need the entire package of a project management software.

The focus of this thesis is to research and analyze the current usage of collaboration systems in the small and medium enterprises in the Republic of North Macedonia. By gathering information from different sources we aim to elaborate our main hypothesis that states: “The working process for managing a project through both planning and execution stages, can be improved using collaboration systems”.

This research was initiated by conducting a secondary research, searching for different papers and articles that have previously studied the collaboration systems. During this literature review, many papers were found, some of them comparing the collaboration systems with similar tools such as ERP systems, virtual teams studies, social media features incorporated within collaboration systems, etc.

Also papers regarding the most recent trends on web development were found that have assisted on the further design and implementation of our collaboration system.

Based on the findings from our literature review we accomplished to define the below points:

- We need to focus on simple collaboration systems, without adding unnecessary features
- The business processes that our system aims to cover
- Which companies we will target and will include into our survey
- The social features that we need to implement into our system
- Choose the MEAN stack platform to be the most suitable for developing our system

Although our literature review provided us with the basic information regarding the collaboration systems topic, we continued further with the research by doing a comparative analysis of the most used systems such as: Google Drive, Office 365, Trello and Slack.

The information was collected following two approaches:

- Collect information regarding the prices, security policies and trends using the official websites of these systems
- Registering and subscribing to each one of the systems in order to get more in depth information on the user experience, what are the gaps or the benefits of using them

Our focus while collecting this information was to define the current market trends, what the people expect

from a collaboration system, what are the standards that are provided from the big companies, which are the functions that would not be useful to a small company and what can be implemented into our collaboration system in order to allow every small and medium company in our country to use and to benefit from our system.

The systems that were compared in this thesis have set high standards, by providing different features for document management, task management and communication. Because of these various features, these systems become complicated to the users, and require additional trainings in order to comprehend the complete package. Nonetheless, small and medium enterprises seek for simple solutions, that cover only the most basic features that can be easily learned without additional trainings and that are offered at reasonable prices that can be affordable to them.

The information that was gathered until this point was very helpful for the further development of this thesis and the next step to follow was to adopt our solution based on the requirements of the SMEs in our country. In order to provide the best solution for these companies, we distributed two types of questionnaires to them: one was directed to the managers and the other one to the employees.

The findings from the questionnaires show us how much the collaboration systems are currently used in RM, how much the entrepreneurs are willing to implement such a system in their companies, what are the most challenging areas of their working process, how can these challenges be improved by using collaboration systems.

The main input that was received based on the questionnaires' results is as listed below:

- We had different coverage of the companies based on the number of their employees
- A wide range of industries was covered such as: technology, production, manufacturing, tourism, retail, architecture, etc.
- The bigger the company the higher the chance of usage of software for project management
- Most of the companies are storing the documents locally in their computers, leading to multiple versioning of the documents
- Challenges in their companies include: management of resources, overlap of repetitive and manual tasks, organization of the documents, and lack of communication between employees.
- 53% of the participants are willing to implement a new collaboration system
- The companies that are currently using collaboration system are from the technology industry (11%) meaning that 89% of the participants are working on the traditional way. Considering this, having only 27% of our participants that spend less than 1 hour in repetitive tasks and the rest spending 2 hours or more, we can conclude that our sub hypothesis stating that "the traditional way takes more time in repetitive tasks" is true.
- The participants of our questionnaires have given us different suggestions for the improvement of their working process most of them focus on a customized software that would include: a common

database system, online templates that can be filled in faster, task tracking system, project progress reports, etc.

Based on all the findings mentioned above we decided to develop a simple web based application that would match the requirements of the small and medium enterprises in our country. This application addresses both Document and Task Management by providing a common workspace for the companies, where they can store, organize, sort and filter documents as they need and also download them in their local computers. In addition to that the task management is provided allowing each user to see what the status of a project is, how long it can take to be completed and it facilitates the process of finding the issues within a project giving them the opportunity to improve in the next projects.

Our collaboration system is designed in such way that it covers the below listed business processes:

- Company Registration
- Employee Registration
- Customer Registration
- Task Management
- Document Management

At the end we tested this application with some users from the companies that were part of the survey, and the results show that it significantly facilitates the working process of these companies. Most of the feedback was positive, there were some comments on the design which was based on the personal taste of the users, but the functionality testing passed all the tests and the feedback from the users was highly encouraging.

6.1. Limitations

During my research there were companies that were not willing to fill in the questionnaires. The number of companies that participated is 17, and it would give a more productive result if more companies participated. The initial idea consisted of giving the customer the right to adapt the system to their own needs, which in this research reflected into creation of custom made templates for each involved company in the research, from the administrative templates distributed. Even though this would ensure them to have a system tailored specifically for their needs, majority of the companies involved did not want to participate in this part, mainly because they were considering it as providing sensitive information.

6.2. Future Works

Based on the input collected during the research, it came to our attention that an additional feature that the SMEs in our country would prefer to implement is the management of online administrative forms in order to save time in their working space. This might be a productive future research which can lead to high

quality results.

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Annex A

Questionnaire 1 (Management).

1. The number of employees in your company:
    a. 1-10
    b. 11-50
    c. 50-100
    d. 101-150
2. In what industry does your company operate?
    a. Technology / E-Commerce
    b. Government
    c. Construction / Architecture
    d. Manufacturing
    e. Distribution Services
    f. Tourism
    g. Marketing / Retail
    h. Export/Import
    i. Rent a Car
3. Do you use any software tool for managing your projects / products development (if yes please specify what tool):
    a. YES
    b. NO

    _____

    _____

    _____

4. Do you think that by having full visibility on a project's progress can help the working process of your company (if yes please specify how)?
    a. YES
    b. NO

    _____

    _____

    _____

5. Do you use any tool for tracking your employees' availability (if yes please specify which tool)?
    a. YES
    b. NO

    _____

6. Where do you store your documentation?

a. Locally in my Computer
b. Shared Drive
c. Database
d. Hard Copy Archive
e. Other (please specify)_____

7. Do you have an interface where you can track and manage your customers?
    a. YES (if yes please describe your current system/interface)
    b. NO (if no, do you think that such an interface may be helpful to your company)

    _____

    _____

    _____

8. In which section do you think your company has the most difficulties?
    a. Management of resources
    b. Overload of repetitive and manual tasks
    c. Organization of the documents
    d. Lack of communication between employees
    e. Other (please specify) _____
9. Are you willing to implement a new collaboration system if it helps you increase your productivity as a company?
    a. YES
    b. NO (please specify your reasons)_____

    _____

    _____

10. Based on your opinion, what are some functions that can improve the working process in your company?

    _____

    _____

    _____

    _____

Questionnaire 2 (Employees).

1. In what industry do you work?

a. Technology / E-Commerce
b. Government
c. Construction / Architecture
d. Manufacturing
e. Distribution Services
f. Tourism
g. Marketing / Retail
h. Export/Import
i. Rent a Car

2. How many hours do you work per day?
    a. 6
    b. 8
    c. 10
    d. 12
3. How many tasks do you finish per day approximately?
    a. Less than 5
    b. 5-10 tasks
    c. More than 10
4. How much time do you spend doing repetitive daily tasks (filling in the same forms, generating the same reports, etc.?
    a. Less than 1 hour
    b. 1-2 hours
    c. More than 2 hours
5. Do you think that the repetitive tasks can be avoided by automatizing your working process if yes please explain how?
    a. YES
    b. NO

    _____

    _____

    _____

6. Do you think that having a task management system and schedule can help you improve your productivity in work?
    a. YES
    b. NO
7. How do you store your documents?
    a. Locally in my Computer
    b. Shared Drive
    c. Database
    d. Hard Copy Archive
8. How do you share the documents with your colleagues?
    a. E-Mail

b. Shared Drive
c. Online Storage System (such as: Dropbox, Google Drive, One Drive for Business etc)
d. Other (please specify)_____

9. How hard do you find it to manage your documents and to avoid their unnecessary multiplication (different versions of the same document)?

_____
_____
_____

10. How do you think the document management can be improved in your workplace?

_____
_____
_____

11. Do you have any idea on how to improve and automatize the business process in your workplace?

_____
_____
_____

Annex B

Table 4. User Interface Testing

User Interface Testing	**User 1**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	Enough Information
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	Clear Navigation
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	Yes
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	Clear Navigation
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	Yes
User Interface Testing	**User 2**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	Good Information
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	Yes
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	Yes
User Interface Testing	**User 3**			
	Passed	**Failed**	**Level of Usage**	**Remarks**

Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	
User Interface Testing	**User 4**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	
User Interface Testing	**User 5**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	Enough Information
Owner Page - Accessibility	X		Easy	

Owner Page - Navigation	X		Easy	Clear Navigation
Owner Page - Colors		X		Prefer darker colors
Owner Page - User Friendly	X		Easy	Yes
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	Clear Navigation
Employee Page - Colors		X		Prefer darker colors
Employee Page - User Friendly	X		Easy	Yes
User Interface Testing	**User 6**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	Enough Information
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	Clear Navigation
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	Yes
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	Clear Navigation
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	Yes
User Interface Testing	**User 7**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided		X		More Information Needed
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	Clear Navigation
Owner Page - Colors	X			
Owner Page - User Friendly	X		Easy	Yes

Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	Clear Navigation
Employee Page - Colors	X			
Employee Page - User Friendly	X		Easy	Yes
User Interface Testing	**User 8**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Starting Page - Navigation	X		Easy	
Starting Page - Information Provided	X		Easy	Enough Information
Owner Page - Accessibility	X		Easy	
Owner Page - Navigation	X		Easy	Clear Navigation
Owner Page - Colors		X		Prefer darker colors
Owner Page - User Friendly	X		Easy	Yes
Employee Page - Accessibility	X		Easy	
Employee Page - Navigation	X		Easy	Clear Navigation
Employee Page - Colors	X	X		Prefer darker colors
Employee Page - User Friendly	X		Easy	Yes

Table 5. Functionality Testing

Functionality Testing	**User 1**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	

Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 2**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 3**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	

Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 4**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 5**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	

Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 6**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 7**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	

Generate Reports Employee	X		Easy	
Change Project	X		Easy	
Functionality Testing	**User 8**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Company Registration	X		Easy	
Employee Registration	X		Easy	
Customer Registration	X		Easy	
Project Registration	X		Easy	
Add Tasks	X		Easy	
Edit Tasks	X		Easy	
Delete Tasks	X		Easy	
Add User Rights	X		Easy	
Edit User Rights	X		Easy	
Delete User Rights	X		Easy	
Employee Add Tasks	X		Easy	
Employee Edit Tasks	X		Easy	
Employee Delete Tasks	X		Easy	
Add Documents	X		Easy	
Edit Documents	X		Easy	
Delete Documents	X		Easy	
Generate Reports Owner	X		Easy	
Generate Reports Employee	X		Easy	
Change Project	X		Easy	

Table 6. Access Testing

Access Testing	**User 1**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 2**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 3**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 4**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	

Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 5**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 6**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 7**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	
Access Testing	**User 8**			
	Passed	**Failed**	**Level of Usage**	**Remarks**
Edit rights	X		Easy	
Full Access Rights	X		Easy	
Read Rights	X		Easy	

Tetovo, March 2019