IMPROVING THE MANAGEMENT OF AN IT DEPARTMENT BY USING A NEW DEVELOPED COMPUTER APPLICATION

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ISEP Instituto Superior de
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Nuno Miguel de Sousa Correia

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ISEP – School of Engineering, Polytechnic of Porto
Department of Mechanical Engineering

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A dissertation presented to ISEP – School of Engineering, Polytechnic of Porto to fulfill the requirements necessary to obtain a master's degree in Mechanical Engineering, carried out under the guidance of Doctor Francisco José Gomes da Silva and co-supervision of Professor Alcinda Maria Sousa Barreiras.

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To God, for the blessing to be alive, and for the chance to be born and raised in a peaceful home and country.

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KEYWORDS

Activity Allocation; Resources Management; Project Management.

ABSTRACT

This work has been developed outside of office hours, in combination with the work of IT Analyst and Project Manager in Philip Morris SA (Switzerland).

The dissertation seeks solutions to real-life problems, specifically associated with the daily challenges faced by the managers and team members of the Information Technology department. It was acknowledged the need to enhance the management and assignment of tasks and projects to the team members, where the major issue resided on the understanding of the constraints affecting the work allocation and workload management. To solve the mentioned hurdles, it was needed to develop an appropriate tool, matching the specific needs while being economically efficient and easy to operate. The management was involved in various sharing sessions, allowing the work to be developed in line with the genuine pain-points and to be built accordingly to the needs and expectations of the end-users. The *SWOT analysis* and the *Ishikawa diagram* played an important role in the delimitation of the challenges and on documenting the improvement possibilities.

Firstly, the problem assessment was done, then it was time to review the literature, searching for the core values and best practices in Project Management. Later, there was an extensive review of the Resources Allocation subject, by concept and objectives, and as a tool to efficiently merging the specificities of the resources and activities while considering an extensive group of constraints. Then, it was done a broad attempt to combine the concepts of the Manager as a human and a servant leader with a focus on team success, with the usage of Resources Allocation tools as indispensable instruments for the success of any Project.

Later, the work arrives at its core, with the development of the *Allocation Algorithm* and the *MS Excel*® program that allows the Managers to properly register and assign the Projects and Tasks, considering the specificities and constraints in place. The developed tools have been validated and utilized by Managers while performing their daily management routines. The most relevant improvements indicated by the end-users have been, the centralization and availability of the information, the rapidity of new activities' assignment, and the benefit of having a unified status tool that takes into consideration the team specificities.

In the literature, there are different approaches related to the resources' allocation and project management issues and challenges. However, many of the Researchers never left the concept development stage and several of them have only proposed theoretical approaches. In this work, more than build an algorithm and a program with a straightforward approach to the management challenges, it was prioritized the practicality of the model and the development of a purposeful tool – allowing the ideas to get off paper, implementing the tool and as result, effectively improving the management of activities and the human resources allocation.

RESUMO

Este trabalho foi desenvolvido fora do horário de trabalho, em harmonia com o trabalho de Analista IT e Gestor de Projeto na Philip Morris SA (Suíça).

Esta dissertação procura encontrar soluções para problemas de gestão, especificamente para os desafios relativos ao trabalho diário dos gestores e membros de equipa do Departamento de Tecnologias da Informação. Assim, foi considerada a necessidade de melhorar o sistema de gestão de tarefas e projetos. Um dos desafios foi compreender as restrições que afetam uma boa gestão e alocação de tarefas, sendo necessário desenvolver uma ferramenta que seja economicamente eficiente e fácil de utilizar. Os gestores foram envolvidos em várias sessões de partilha, permitindo que o trabalho fosse desenvolvido em linha com as necessidades reais e tendo em conta as expetativas dos utilizadores finais da ferramenta. A utilização da análise SWOT e do diagrama de Ishikawa foram muito importantes para delimitar o problema e para definir as oportunidades de melhoria.

Primeiramente foi definido o problema, depois foi feita uma revisão da literatura, investigando os valores e os bons princípios da Gestão de Projetos. Seguidamente, foi feita uma revisão sobre a Alocação de Recursos, considerando a base teórica e a aplicabilidade na gestão e alocação de tarefas e de recursos humanos. Paralelamente foi feita uma análise sobre como conjugar o conceito do gestor como humano e líder, e o seu papel no sucesso dos projetos. Foi também analisada a importância das ferramentas na gestão de qualquer projeto.

Mais tarde, o trabalho chega ao seu âmago, com o desenvolvimento do Algoritmo de Alocação e do programa MS Excel®, ambos permitindo uma fácil e eficiente alocação de projetos e tarefas por parte dos responsáveis, considerando as restrições e as necessidades da empresa. O desenvolvimento do algoritmo e do programa foi feito em concordância com a gestão, garantindo dessa forma o alinhamento ideal entre o desenvolvimento e as necessidades reais. Os gestores indicaram como benefícios, a forma correta e fácil de associar atividades aos colaboradores, a centralização e qualidade da informação disponibilizada, e ainda a garantia de usar uma ferramenta que considera as especificidades da equipa e os projetos do departamento.

Na literatura existem várias abordagens relativas aos desafios da alocação de recursos e da gestão de projetos. Contudo, muitos dos investigadores ficam apenas pela fase do conceito, e muitos apresentam apenas hipóteses e soluções teóricas. Neste trabalho, procurou-se desenvolver um algoritmo e um programa de utilização simples, colocando o funcionalismo e aplicabilidade como prioridades – permitindo que as ideias saíssem do papel, garantindo a implementação da solução e criando melhorias reais em termos de gestão de atividades e gestão de recursos humanos.

LIST OF SYMBOLS AND ABBREVIATIONS

List of abbreviations

Term	Designation
AR	Action Research
AI	Artificial Inteligence
B2B	Business to Business
B2C	Business to Consumer
CCO	Chief Consumer Officer
CDO	Chief Diversity Officer
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CLSO	Chief Life Sciences Officer
CNVO	Chief New Ventures Officer
COO	Chief Operations Officer
CPO	Chief Product Officer
CSO	Chief Strategy Officer
CTO	Chief Technical Officer
DM	Decision Makers
DEA	Data envelopment analysis
DMU	Decision-making units
EU	European Union
FMCG	Fast Moving Consumer Goods
IS	Information Systems
IT	Information Technology
KPI	Key Performance Indicators
MT	Management Team
PMI	Philip Morris International
PM	Project Management
PMO	Project Management Office
PMBOK	Project Management Body of Knowledge by Project Management Institute
RRP	Reduced-Risk Products
USD	United States Dollar
USA	United States of America
VP	Vice-President
VBA	Visual Basic for Applications®
WIP	Work in Progress

List of symbols

Term	Designation
$	American Dollars (currency)
%	Percentage
=	Equal to
≤	Less or equal
≥	Greater or equal
+	Addition
-	Subtraction
×	Multiplication
/	Division
∈	Belongs to
∀	For all
∨	Or
∑	Sum

GLOSSARY OF TERMS

Term	Designation
3rd parties	External companies or individuals that provide goods and services to the organization, there is a business relationship founded in a contract between the companies.
Action Research	Scientific research methodology, a method of systematic inquiry and critical reflection upon the literature and results.
Agile Methodology	It is an approach to software development and project management that considers collaborative, self-organizing, and cross-functional – the team can do it. Focused on the client's needs, working products, and continuous review and improvement.
Algorithm	A mathematical process to solve a problem using a predefined number of steps.
Artificial Inteligence	Intelligence demonstrated by machines, where non-natural creation is capable of learning new concepts and techniques based on previous experiences and that can imitate the cognitive functions of humans beings.
Benchmarking	To evaluate a product or service against a standard or competitor, to understand what the market is offering and the improvement possibilities.
Cloud	The cloud computing, often known by "Cloud", is an on-demand computer system resources, mostly data storage. Often this is related to data centers making data available all over the world, to any device, through the internet.
Covid-19	An infectious respiratory disease induced by a specific type of virus, coronavirus, that may lead to severe illness.
Data envelopment analysis	A method associated with operations research and economics that is mainly used for the estimation of production frontiers, it is used to measure the efficiency of Decision-making units.
Decision-making units	Group of individuals, humans, or not humans, that participate in the decision-making process related to any type of process.
Equal Salary	In some countries there still exists a difference in salary between people of different genders. The concept of Equal Salary is applied when the same compensation is delivered to all employees within a company – the only condition is the position and responsibilities and never the gender.
Ishikawa	Kaoru Ishikawa is a well known Japanese organizational theorist and professor of Engineering. He is well known for the innovations and tools brought to the domain of quality management, one of those is the Ishikawa Diagram (Fishbone diagram).
Project	In an organization's level, it is a group of steps and actions taken by individuals or organizations to achieve a specific goal(s).
Project Management	A group of processes and methodologies that allow an individual or team to achieve success while considering the specific needs and constraints.
Waterfall	A well-known model that consists of breaking down project activities into small and sequential steps, in which the current or next steps have a dependency on the previous step or phase.

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INTRODUCTION

1   INTRODUCTION

The objectives of this section are the following: provide a real-life context, a theoretical introduction, context, and purposes of the thesis, the introduction of the company, and the investigation methodology.

1.1   Contextualization

The allocation of resources is one of the biggest challenges presented to the managers. In the specific case of human resources allocation, the task can be even more complex, considering the number of variables, the constraints, and the specificity of each professional.

It is recognized that people are the lifeblood of the organizations, despite the fact we are living in an era of great technological developments, most of the tasks are still done, handled, or supervised by humans. In an organization the size and complexity of many achievements still demand the involvement of many different people, sometimes from different organizations, that should act and work together to achieve common objectives. No matter if the goal of the organization is to provide products or services, there are always deliverables that can be used. However, people who participate are subject to constraints, for example, people have different competencies in different domains and have a limited working time per day (Ballesteros-Pérez *et al.*, 2019), this makes even more important the correct allocation of resources, right time and right place to achieve the biggest possible efficiency.

Nowadays, many companies across the world face numerous challenges in terms of business and digital transformation. The ferocious competition between companies acting in the modern globalized economy, the legal constraints, the fast-paced technological development, and the constant change of consumers' behaviors, make the world an extraordinarily complex and unpredictable place.

One of the biggest challenges, for the companies that want to succeed in this overwhelming economy, is to be able to quickly adapt to the new conditions – as we have seen quite recently with the Global Pandemic caused by the Covid-19. Thus, anyone attentive enough is looking for effectiveness and efficiency improvements, as these seem to be a key factor, allowing the organizations to keep up with the fast-paced change environment, staying ahead of the competition, and saving money without compromising the quality and attractiveness of their products or services. Consequently, the organizations are now more complex, and the management teams are more demanding than ever before. As today's example is the challenge that several people are facing, working from home for long periods while having to complete their daily tasks and manage other people remotely.

These incredibly special times we are living in are obliging the structure of the organizations to be more flexible, yet, fully professional, and efficient. With so many challenges being presented to the organizations, an optimal allocation of tasks and an efficient capability of reporting and resources management - knowing who does what and when - is critical for the completion of any project and at the end of the day, for the success metrics of the team.

Work, Work, Work
China's virus lockdown triggered a spike in demand for remote work apps
/ WeChat Work iOS downloads in China / Tencent Conference / DingTalk
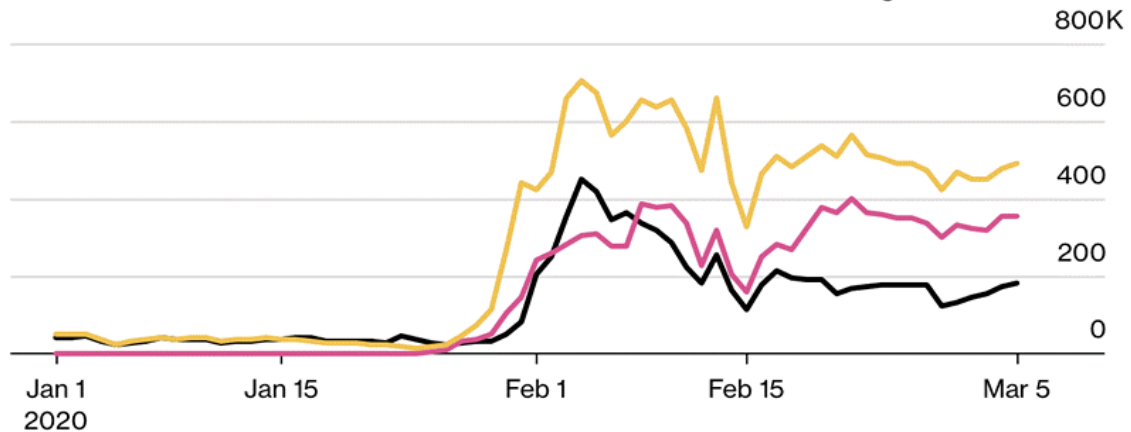
In Figure 1 it is shown the huge demand for remote work apps in China since the start of the lockdown. Nevertheless, and contrary to many common assumptions, it has been observed that the remote work can be highly collaborative, and the employees can even improve their performance while working outside of the office (Bloom *et al.*, 2015). If the organizations have specific success metrics in place (some of them are commonly known by KPI – Key Performance Indicators), it is easy for the management to quickly evaluate the work and achievement of goals of their internal and external employees.

In this specific work, we are faced to a company that is in the middle of a profound and extensive transformation, in terms of products, work methodology and digital innovation, the people are even more crucial to the success of the organization's strategy.

The turn-over of employees, the hybrid work methodology in place – using Waterfall and Agile in parallel - and the constant requests for a quick and efficient adaptation, due to strategy changes and the back and forth of the business sector, produce numerous challenges when it comes to the competent management of teams and projects. To efficiently tackle those complexities, the manager, and the team itself needs to be equipped with a sharp methodology and a pragmatic system of tasks and project's assignment. More than everything, it needs to be useful, simple, and straight to the point – covering the needs and specificities. The manager needs to apply just enough time to interact with the management system, as the workload is constantly high, and the deadlines are always tight.

Careful management of the employees, tasks, and projects can enhance the performance of the whole team and create opportunities for improvements, such as more efficient status meetings (internally known as an individual or team catch-ups), better alignment with the 3rd parties (Consultants) or with the PMO (Project Management Office). At the same time, it can permit a better measure of the required resources and an effective presentation of results to the MT (Management Team).

1.2 Impacted Company

This work was developed between March and July of 2020, inside the awe-inspiring environment of the Department of Information Technology (Switzerland), part of the Philip Morris International (PMI) European cluster.

The department currently works within a hybrid model (Agile-Waterfall), and the company is genuinely focused on the implementation of Agile methodologies, which is shown by the tools and training provided to the employees. The buzz words are "change" and "adaptability".

The managers of the department have been involved in the evaluation of the pain-points and the assessment of the improvement possibilities. Worth to mention the full support and availability of Yann Dreano, Manager of B2C Solutions

1.3 Objectives

This work aims to provide a functional solution for the challenge of human resources allocation to distinct tasks and projects, taking into consideration the specificities of the workforce and the management requirements. This took place within the Information Technology department of Philip Morris International, a multinational company in the Fast-Moving Consumer Goods (FMCG) sector.

The following objectives have been defined:
o   Acquire knowledge from reviewing the literature and examining the base concepts of project management, allocation methodologies, and analysis tools.
o   Then, analyze the hurdles that the manager and the team are facing, in terms of allocation and management of the tasks and projects.
o   Later, performing an analysis of the tools and methods that can lead to a suitable proposition, improving workload management and the employee's efficiency and efficacity.
o   Subsequently, investigate the available technologies that can be used while being focus on developing a tailored-fit tool that grants appropriate management of the activity's allocation, taking into consideration all the constraints and specificities of the projects and team.
o   As a result, supply a suitable tool that can be used in the activities' allocation and management of human resources.

1.4 Investigation Methodology

When looking for solutions for a new proposed challenge, it is critical to start by properly identifying all the specificities of the problem. Farther than finding an answer for the problematic, it should be ensured the implementation of a continuous improvement cycle – mainly these days, in a globalized world where companies are working in a fast-changing environment. To achieve this continuous improvement process, it is required to ensure the implementation of cycles of observation, research, planning, implementation, function analysis, and review of new improvement possibilities based on the results.

In this study, it was applied a tailored-fit methodology based on the Action Research (AR). Over the last few decades, it was possible to observe the evolution of different forms of action research (Benson, 1989), yet, the common technique is to apply a methodical, iterative approach, focused in the problem identification, in the action planning, solution implementation, evaluation, and review.

Each cycle is explored and analyzed using the data and the learnings of the previous cycle, and it should be included all the relevant information before the start of the new cycle (Eden et Ackermann, 2018). This allows continuous feeding of the news cycle with the learnings and experiences of the past, allow us to always explore the most recent version of the data set. Zuber-Skerrit (1991) extensively describes the four steps through which the Researcher should navigate in each cycle – Planning, Acting, Observing, Reflecting.

In this work, the steps and components are re-aligned to better fit the needs and the specifications of the investigation and problem under evaluation. It will be then considered the first cycle with six stages and the subsequent cycles of five stages.

First stage: diagnosis, identify the problem and the requirements. At this stage, it is important to evaluate the challenge and the needs of the organization. The researcher will identify the problems affecting the team in terms of work assignment and the current method in place, evaluating the nature of the problem, the causes, and the impacts on the daily routines. The information gathered will permit a correct assessment of the needs and will guide the plan that should be put in place ensuring the fulfillment of the requirements.

Second stage: solution research. It is necessary to search for tools and methodologies that will permit the implementation of a solution to the presented challenge. This research is based on brainstorming activities, assessment of the current technologies available, and finding the balance between complexity, cost, maintenance, and the necessary features.

Third stage: action planning. The needed improvements and the tools that will support them need to be selected. It is mandatory to structure the focus of the intervention and to plan the development of a new allocation system that will be offered. Clear steps should be defined.

Fourth stage: implementation. The proposed solution and the guidelines are made available to the team. The actions are implemented founded by the previous stage of action planning.

Fifth stage: testing. It is mandatory to ensure that the key stakeholders are involved in this step, ensuring that the feedback on the implementation is gathered, feeding the next cycle with the relevant information collected from the previous one. This stage is of extreme importance as it will guarantee the learning and the continuous cycle improvement.

Sixth stage: monitoring and review. At this stage, the learnings from the previous stages, implementation, and testing should be examined and properly handled to be incorporated into the news cycle. This is a recurrent bureaucratic stage that should occur before the start of a new cycle.

The order of the steps is flexible, and some of them may occur at the same time intervals across the process – typically as the cycle progresses into new repetitions.

It is expected that through the new cycles new learnings will be introduced, some may open new areas of analysis leading to changes in the selected solution. It is worth to mention that changes are expected across time, as we are dealing with an interactive process that will constantly adapt to change.

Below, in Figure 2, it is possible to observe the tailored-fit Action Research cycle that considers all the steps in a continuous cycle.
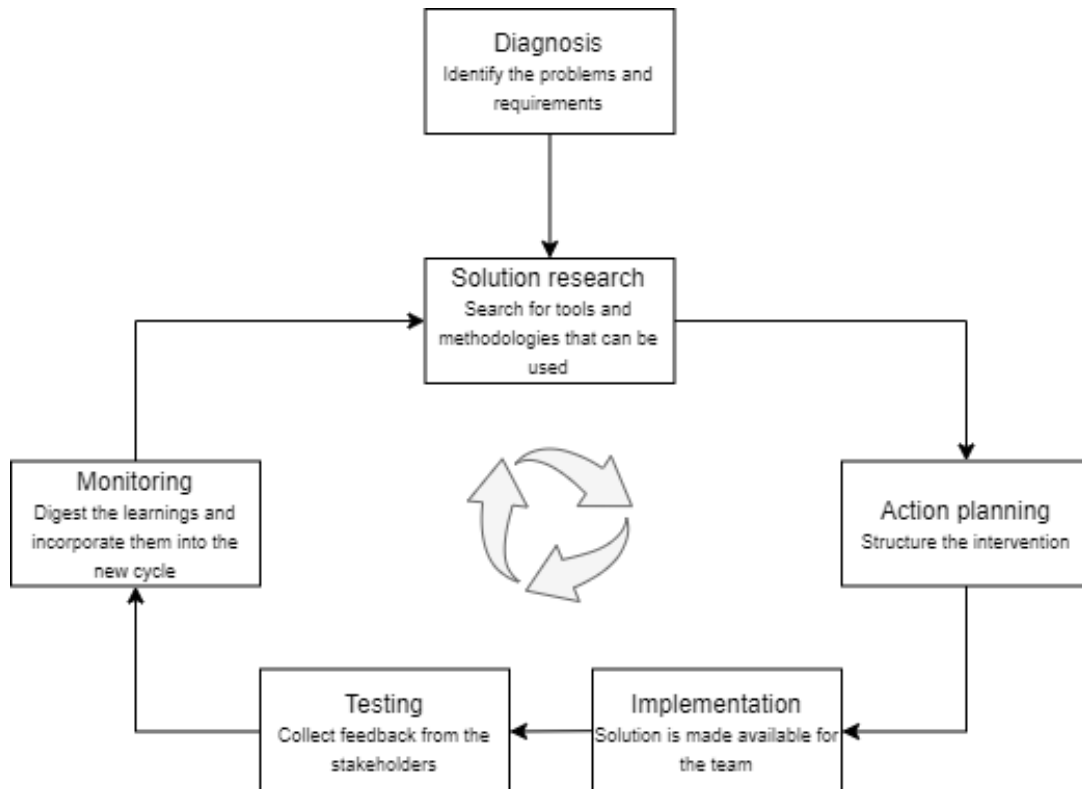
Figure 2 - Action Research tailored-fit cycle

1.5   Structure of the Dissertation

This dissertation is divided into six chapters. The first one concerns the introduction and the core objectives, hereinafter it is done an extensive literature review in the second chapter - focused on the basic concepts, the tools, and methodologies associated with this work. Then, on the third part, it is provided a wider description of the company, later we gently move to the description of the challenges proceeding with the necessary analyses to define the specific objectives and constraints. The third chapter is completed with the presentation of the algorithm and *MS Excel®* tool that will allow the managers to efficiently allocate activities and measure the workload. In the fourth chapter, the conclusions of the work are presented alongside relevant observations. Later, the information sources are referenced and in the sixth and final chapter, the appendices are presented.

BIBLIOGRAPHIC WORK

2 BIBLIOGRAPHIC WORK

In the second chapter of this work, it is accomplished the bibliographic review of a group of pre-defined topics, mostly focused on Project Management, Allocation, and Analysis tools.

The first challenge of the researcher is to translate the questions into a list of concepts and keywords because this will be the entry point to indexing and searching documents, the second step is focused on the document selection, based on the scope, how relevant the contents are for the goals of the investigation and the specific language (Fayemi *et al.*, 2016).

2.1 Project Management

Project management is one of the most researched subjects of the last decades, and it is focused on providing the organizations the ability to move from problems or ideas to effective results. The Project Management Institute defines project management as the application of knowledge, tools, skills, and techniques to the project activities that permit the achievement of the project requirements (PMBOK, 6th edition, 2017).

In the decade of 1950, we see the beginning of the modern project management era, where several project management techniques have started to be developed to answer the challenges of the non-repetitive processes that were emerging across different sectors – in contrast to the well-defined repetitive processes that have been the essence of the industry since the Industrial Revolution. Some examples of those early techniques are the Critical Path Method (CPM) (Kelly *et al.*, 1959) and the Program Evaluation and Review Technique (PERT) (Malcolm *et al.*, 1959) that were focused on allowing the scheduling of tasks inside of a project.

Throughout the decade of 1960, the Project Management Institute was already collecting substantial sets of information related to the project management activities, allowing this organization to gain weight as an authority in the field. Across the years to follow, this huge amount of information has been condensed, summarized, and made available, allowing many companies to improve their project management practices, permitting them to be more efficient and to manage their projects more professionally (Lima *et al.*, 2019). Today's compilation of the Project Management Institute is the well-known Project Management Book of Knowledge (PMBOK). Currently, it is estimated the existence of 1,000,000 professionals with the internationally recognized certificate of Project Management Professional® (PMP), emitted by the Project Management Institute (Project Management Institute, https://www.pmi.org/certifications/types/project-management-pmp , 2020).

Even if the previous numbers may seem astonishing, the reality is that new surveys show that the demand for project managers will continue to increase in the upcoming years. Across the globe, it seems to exist a significant gap between the employer's need for skilled and experienced project managers and the professionals available.

On top of that, it is well-known that the world is rapidly shifting to more automatized ways of producing goods and knowledge. Some of the so-called "developing countries" are going straight from almost zero technology, procedures, and innovation, into twenty-one-century processes and methodologies. Yet, they face challenges in terms of timing and availability of skilled professionals.

There are a few rational reasons for the increase in demand for Project Managers in particular:
- Increase in the number of jobs requiring project management-oriented skills.
- The so-called attrition rates, including professionals that are getting retired.
- Increasing demand in developing countries such as China and India.
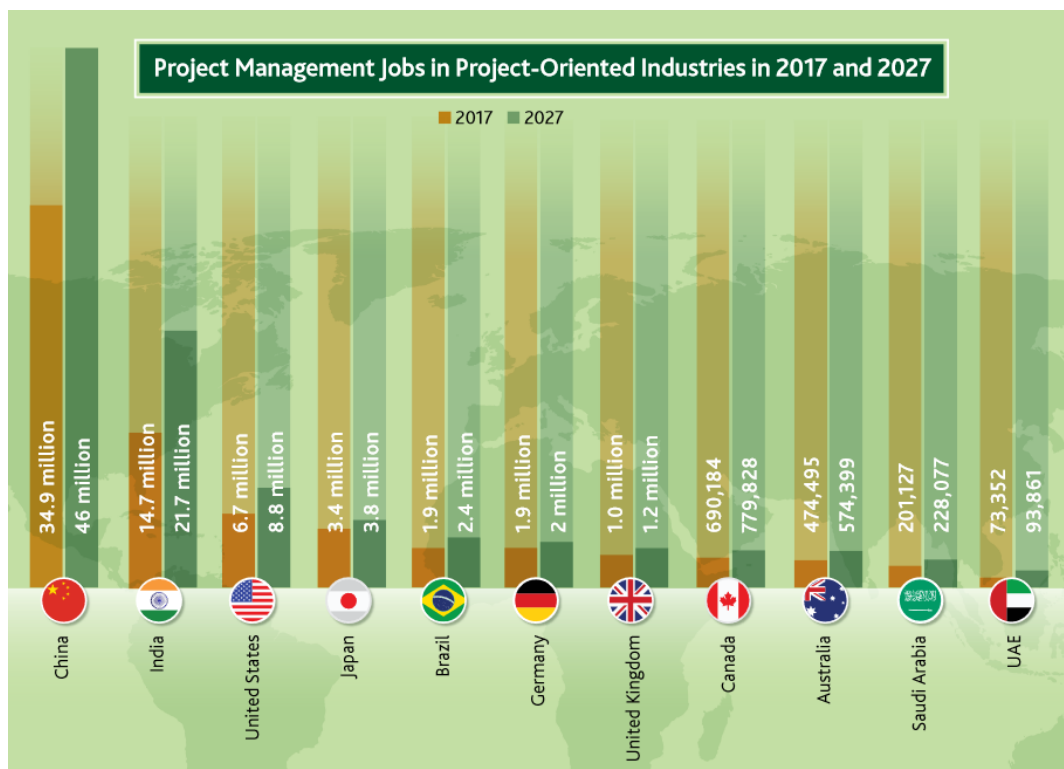
Figure 3 - Project Management Job Growth (Job Growth and Talent Gap 2017-2027, PMI 2017)

By inspecting Figure 3 it is clear the increase of demand for this group of professionals across the globe. By 2027 it is estimated that nearly 90 million individuals will need to fulfill project-management roles, while the shortage of those talented and well-trained professionals can potentially create losses of nearly US$208 billion in the GDP of the affected economies (Project Management Job Growth and Talent Gap 2017–2027. PMI (2017)).

Considering the studies and the pulse of the market, it is plausible to consider that for several business domains it is mandatory to ensure great project management professionals within the organization. As the world and several industries move into the Industry 4.0 alongside the digitalization, automatization of processes and the high adaptability demanded by the clients, the project managers have a huge opportunity to bring value to the organizations, while having a great responsibility on the outcomes – either good or bad.

2.1.1 The Importance of Project Management

Project Management practices are set to be a key ingredient for the success of any project. However, the usage of the PM does not ensure full and plain success, as it will not solve all hurdles of a project. Still, it is proved that even in the more unexpected situations, the implementation of project management methods and techniques will improve the outcome (Sözüer and Spang, 2014).

Nevertheless, one of the key objectives of the project management discipline is to find the balance between the three vertices of the so-called "Project Management Triangle". Even with all the variants that can be found across the literature, as we can see in Figure 4 the key ingredients for any project are the Time, Cost, and Scope (this is a simplified version of the well-known "Iron Triangle" or "Project Management Triangle").

Therefore, the project management professionals attempt to address the challenges of the projects no matter which domain, trying to find the right balance between the TIME, COST, and SCOPE while ensuring a suitable quality that will meet the customer/business expectations.
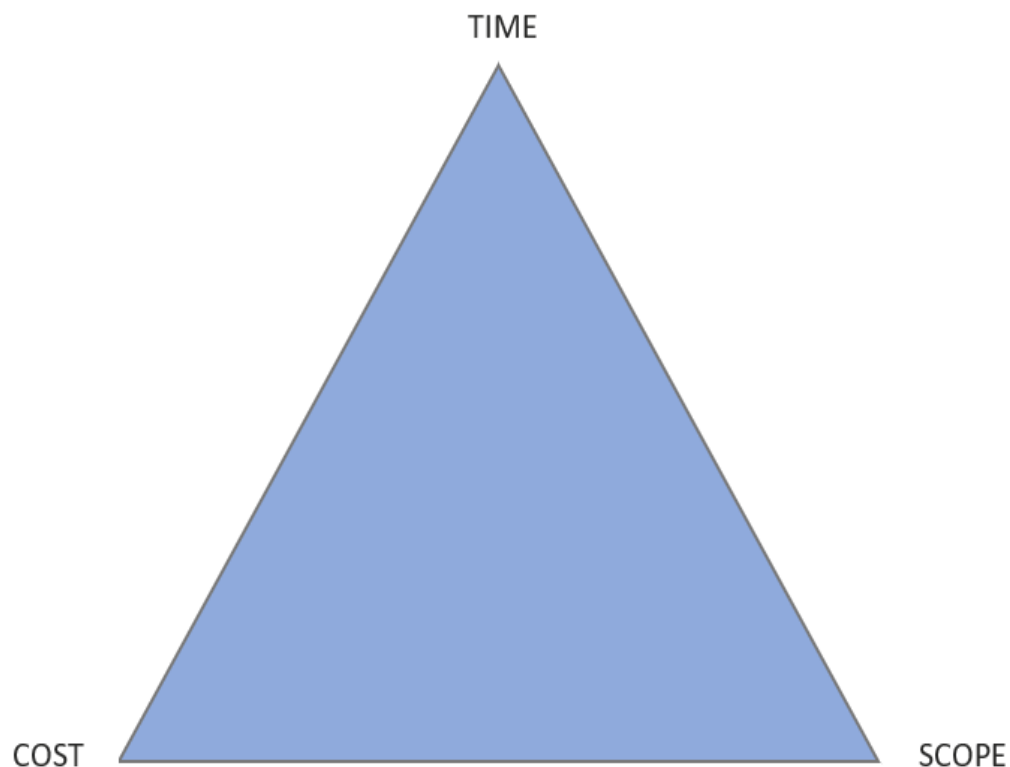
Figure 4 - The project management triangle

As commonly recognized, the implementation and maintenance of PM best practices may require relevant resources and precious time from the organization. Nevertheless, it is also being verified that the application of such methodologies should be considered as an investment (Levin *et al.*, 2017). In Table 1 it was intended to offer a resume of scientific articles that explored the benefits of using Project Management principles.

Table 1 – Article review, why companies should use PM and the clear benefits

Reference	Work description
Sözüer and Spang, 2014	This study was centered in a Transport Infrastructure project management problem, in terms of planning and running the operational model. After investigated how to improve outcomes using project management methodologies, it is stated: "It is obvious that not all of the causes which are figured out can be solved by project management. But the systematic use of project management methods and techniques may help to reduce many of the causes."
Rasnacis and Berzisa, 2017	The authors went through a deep analysis regarding the implementation of Agile methodology in an IT structure. They have concluded that the implementation of agile PM methodologies improves the processes: fewer bugs, faster delivery, more and effective communication, better quality, better risk analysis, and fewer costs. Thus, in this specific case while using Agile Methodologies the Researchers found evidence co-relating the usage of PM methodologies with the overall improvement on efficacity and efficiency of the process.
Levin *et al.*, 2017	In this study the researchers looked into the impact of project management in the service quality inside the advertising industry, considering a highly competitive and fast-changing environment. The paper resulted in some clear conclusions about the benefits of the PM tools and methodologies to the overall service improvement: "Whilst project management and planning can be tedious and time-consuming, this process should be seen by both parties as an investment. The return on investment is that the project runs on time, to budget and achieves the desired outcomes, ultimately delivering value to both organizations."
Sanchez *et al.*, 2017	The researchers have explored different ways to improve the cost and time project management within IT projects, the major goal was to identify the most suitable practices to be put in place in the organization. As conclusions, they confirmed that the application of PM principals can improve the success of resource allocation, project prioritization, and the overall success of the projects affecting the performance of the team and the organization.
Rew *et al.*, 2020	This study applied to a medical domain found evidence that PM methodologies and practices can improve projects and support different business areas. In conclusion, the authors stated: "We noted that the details inherent in having a nursing research project run smoothly, on time, and within budget can be assured by applying principles of project management as detailed in the PMBOK Guide. We encourage nurse educators and researchers alike to familiarize themselves with these tools and techniques and consider using them in future projects."

The articles from different business areas concluded that even with all the specificities of the project, the different domains, and scope, it is recommended to utilize PM methodologies. They have proved that the implementation of PM best practices creates efficiency and efficacity improvements. Also, some of the researchers openly encourage professionals in the same domain to start using PM methodologies to improve their project results.

2.1.2   Project Management Methodologies

Different authors have tried to present a complete definition of project management methodologies, such as Charvat (2013) who defines it as a set of principles and guidelines that can be adapted and implemented to distinct situations – going from simple task lists or check-boxes to complex sets of documentation and writing procedures.

Cockburn (2003) was forthright by stating in his work that, any principle used by the team to achieve the project's success can be considered a project management methodology. The Project Management Institute has published an updated version of the PM standards (PMBOK, 2008), that are composed of nine knowledge areas and five process stages. On the same PMBOK, the same organization also describes a set of methods, techniques, procedures, templates, rules, and best practices to be used in PM. A huge number of tools (using PM methodologies) are being released in the market, where the vast majority is too general to be applicable for high complexity projects. The focus should not reside in using one tool or methodology (*one size fits all*), because as projects tend to be bigger they will also become more specific and more complex, with a higher demand for resources and the participation of multiple supply chain participants (Yun, 2013). In Figure 5 the nine of the most popular methodologies for PM.

Figure 5 - Nine popular Project Management Methodologies (https://thedigitalprojectmanager.com)

The company concerned by this dissertation (Philp Morris International) which is working with a hybrid project management system (Agile / Waterfall), seems to be aligned with the global tendency as, 89% of the project management professionals that participated in the survey of Project Management Institute stated that their organization was using hybrid project management practices (Pulse of the Profession, Project Management Institute, 2019).

Thus, this seems to be the regular practice, as many companies try to bring the best of each methodology and apply hybrid solutions that better fit their specificities. The professionals that become well-versed in different methodologies are capable of mesh together various practices aligning with what is the current need of the organization, adding significant value to their projects. As presented in Table 2, different theoreticians of project management have recognized the need of applying different methodologies in different circumstances taking into consideration the country, industry sector, and size of the organization (Sanchez, 2017).

Table 2 - Article review, usage of PM methodologies in different situations and its impacts

Reference	Work description
Marcelino-Sábada *et al.*, 2014	The authors of this study tried to find a PM methodology that could be easily implemented and yet able to bring added value to small and mid-sized companies. They propose a methodology applicable to all project phases and adaptable to different projects and companies, it uses few resources and does not require extensive training. Through a simplified methodology and a group of tools such as checklists, templates, and indicators, they were able to ensure a good picture of project status reducing mistakes.
Turner et Ledwith, 2016	The researchers looked into small and mid-sized companies to understand the impact of PM methodologies and the main benefits of its implementation. As a result, they have to draft two relevant conclusions. Firstly, even with the perceived bureaucracy as a barrier to the adoption of those methodologies, it was confirmed by this study that the benefits outweigh the costs. Secondly, the authors state that small and mid-sized companies need different practices while comparing with larger companies because there are many different characteristics in terms of capabilities and even in the project's specificities.
Sanchez *et al.*, 2017	The researchers raised the importance of combining different practices and constant review and re-adaptation of the PM methodologies to ensure efficiency. They go further and state: "merely adopting these individual practices is not sufficient to ensure the project management success of IT projects."
Annual State of Agile Report, 2020	This reported is based on 40,000 surveys completed by practitioners, consultants, and executives using at least one of the Agile Frameworks. Organizations are reluctant to change the methodologies, may present inadequate management and lack of support and sponsorship. This survey also states that SCRUM is the most spread Agile framework with about 75% of the professionals admitting the usage of SCRUM, by itself, or in conjugation with other frameworks. Another insight is that around 50% of the companies of the inquired professionals are already moving into the usage of PM methodologies, or plan to do it in the short term.

It is possible to understand that methodologies alone will not solve the organizations' problems, good leadership and strong culture will greatly help the integration of effective PM practices. Also, simple methodologies seem to produce positive effects on the outcomes. Plus, most professionals use hybrid systems, adapting the methodology to the project.

2.1.3   Agile vs Traditional approach

The traditional approach to PM may be defined as a specific way to think about projects and about their management, using a standard format document that describes the established norms, methods, processes, and practices (Bredillet, 2010). For example, the PMBOK brings to the PM professionals a traditional or conventional PM approach with a full set of tools and methodologies that promise to be applicable by any organization (Shenhar and Dvir, 2007).

What we name today as a traditional approach may well have started to be defined with the new-age PM principles that started to be developed back in the 1950s. The core idea behind that approach is that the projects would overall be relatively simple, predictable, and usually have clear limits. The objective of this approach is optimization and efficiency by following an initial detailed project plan while having to respect a static definition of time, budget, and scope. Even today it is usual to find organizations that only use the traditional approach without even considering why, or how things can be done differently.

The traditional approach reinforces the strength and the amount of information in which it is based as part of the advantages, attempting to find solutions for all hurdles of PM using the same type of methods and techniques – that could be applied to all projects uniformly. Nowadays, that approach may have some advantages, taking into consideration the complexity and the fast-pace and globalized environment we are living in (Yun, 2013). Several authors over the last decades have brought up the concern that "one size may not fit all" in terms of project management tools and techniques (Söderlund, 2008).

It can be considered that the environment in which the project is running also influences the outcomes (Cicmil *et al.*, 2009), which brings the need for more flexible approaches. Also, that change is imminent, the need for adjustments is unpredictable and there is always the possibility to be presented with dynamic changes coming from the project itself (Collyer *et al.*, 2010). All those factors have promoted the creation of several different methodologies over the last two decades. In this context, as described by Spundak (2014), the most common designation is "agile" or "adaptive" project management.

It is in the early 2000's that a new concept is brought to the table by a group of IT professionals. The Manifesto for Agile Software Development, that was written and released by a group of professionals dedicated to a new thinking crusade. It has presented the four core values of the agile approach: *"individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, responding to change over following a plan"* (Agile Manifesto, 2001).

Through the literature, it is possible to find that Agile and adaptive approaches seem to present greater suitability in projects that have unclear goals at the start, or that include a high level of uncertainty associated with possible changes in scope or the project environment that would demand more flexible and adaptative project management (Spundak, 2014). In Table 3 it is possible to assess some of the differences between, Agile and Traditional Approaches.

Table 3 - Article review, Agile vs Traditional approaches

Reference	Work description
Cicmil *et al.*, 2006	This work analyses the existence of huge sets of information regarding the traditional project management approaches and little concerning the newly proposed approaches. They believe the new approaches may reflect in a better way the real situation and the challenges of the companies. They argue in the conclusion: "One of the key assertions is that the understanding which drives much of project management literature does not satisfactorily explain the richness of what occurs in project environments. This implies an alternative view on managerial knowledge and competencies, challenging the traditional image of the *professional* project manager as thinking, purposive, decisive, and rational."
Shenhar and Dvir, 2007	The researchers looked into the implementation of different PM methodologies. They state that PM is one of the fastest-growing disciplines, in terms of interest and implementation by the organizations, but the projects still underperform. For them, PM is too complex to be explained by one unified theory, and that even if some of the PM references such as PMBOK have tried to bring together all relevant tools and best practices, it is not risk-free. Also, it emphasizes the importance of using standardized procedures for project management.
Collyer *et al.* 2010	They reflect on the challenge of a rapidly changing environment in PM. They state that traditional approaches, oriented around process control, maybe considered suboptimal and may not be suited for the challenges ahead. In conclusion, they found that PM practitioners in dynamic environments may encounter the following causes of rapid change: materials, resources, tools, techniques, interdependence, objectives, or a combination of these causes. This may lead to drawing some conclusions on the better suitability of Agile approaches to meet the needs of project managers embedded in such an environment.
Spundak, 2014	The author investigates agile vs traditional projects, and their use in the same environment. He concludes that both Agile and Traditional have advantages and disadvantages. The author also recommends a cautious review of all the project and organization characteristics before choosing which approach should be used in a specific situation, as the methodology can be adapted to the project, but the project should not the opposite. The article is concluded with some relevant questions for approach selection and for further studies – "Is it possible and how to build methodology with methodology elements based on different approaches? What is the level of detail needed from the methodology element to build methodology?"

It is possible to infer that PM has greatly evolved in the last decades and that nowadays the Traditional and Agile methods live together in the workplace, as they will be applied to projects or companies depending on their products, services, and specificities. They also open the door to a constant review of practices, alongside with the search to integrate the need for standardized principles with the psychological traits of the people involved in the project.

2.1.4 Project Manager (a leader, a human)

The project manager is responsible for ensuring effective communication with the stakeholders of the project, to manage the cost-estimation of time and materials, to create schedules and to be the ultimate responsibility for the quality of the deliverables while granting the efficient use and allocation of the resources (Rivera and Kashiwagi, 2016).

The project manager (PM) should align the expectations of the organization with the team and with the project stakeholders. Thus, it is critical for this professional to master social skills and to hold a relevant management capacity. In highly changing environments, mostly with the presence of the Agile methodologies in which the team is more interventive and the change is a constant, the project manager should act as a servant leader and should hold different types of leadership competencies.

A successful PM should be able to balance technical knowledge and performance with the human traits, allowing him/her to maximize his/her performance and the performance and well-being of the other people involved in the project. On the top of the basic principles of ethics (King, 1997) the literature talks about the importance of owning the following traits - *Justice* (fair conduct), *Mutual Respect* (respect for others), *Stewardship* (human beings are only the stewards of the natural resources) and *Honesty* (truthfulness and integrity) (Turner et al., 2007).

Alongside ethics, it is indispensable to consider the different leadership competencies and the distinct styles that may define a project manager. In Table 4 it is possible to find the fifteen leadership competencies suggested by Dulewicz and Higgs.

Table 4 - Fifteen leadership competencies and three styles of leadership after Dulewicz and Higgs (2003)

Group	Competency	Goal oriented	Involving	Engaging
Intellectual (IQ)	1. Critical analysis & judgment	High	Medium	Medium
	2. Vision and imagination	High	High	Medium
	3. Strategic perspective	High	Medium	Medium
Managerial (MQ)	4. Engaging communication	Medium	Medium	High
	5. Managing resources	High	Medium	Low
	6. Empowering	Low	Medium	High
	7. Developing	Medium	Medium	High
	8. Achieving	High	Medium	Medium
Emotional (EQ)	9. Self-awareness	Medium	High	High
	10. Emotional resilience	High	High	High
	11. Motivation	High	High	High
	12. Sensitivity	Medium	Medium	High
	13. Influence	Medium	High	High
	14. Intuitiveness	Medium	Medium	High
	15. Conscientiousness	High	High	High

Table 5 – Articles review, links of personal traits and ethics with performance

Reference	Work description
Dulewicz, Higgs, 2005	In this study, several correlations were identified between, success leading projects and personality characteristics. Managers considered extraverted and emotionally well adjusted, specifically for those with greater strategic perspective and conscientiousness, tended to have higher success ratios on their projects.
Turner, 2007	This work evokes the complexity of taking decisions and leading people while respecting the core values and the "good ethics". It states that all managers, especially project managers are several times pressured to take short cuts, improve the figures, and get immediate results, those facts put them under ethical pressure. To be able to deal with that pressure while maintaining the ethical traits is a challenge and a must-have for the professional and organization.
Muller and Turner, 2010	The authors analyzed the impact of certain competencies on the performance of the PM professional. A profiling method was used to identify the most eligible leadership profile of project managers. Results indicate high expressions of one Intellectual sub-dimensions (Critical Thinking) and three of the Emotional sub-dimensions (Influence, Motivation, and Conscientiousness).
Zulch, 2014	The conclusions of this article suggest that the traits and leadership style of the project manager greatly affects the execution of the project. Highly adaptable project managers can change the leadership style when it is needed, leading the team to take responsibility for their work, allowing a better engagement while enhancing the communication and the overall performance of the team members. As a conclusion, it declares that the project manager's communication is not merely based on language, but also by showing character, which includes attitude, behavior, and personality.
Lopes *et al.*, 2016	This article draws some conclusions regarding the interference of the personal traits on the project's success. It states that in the past, PM was considered a technical skill aimed at operationalizing and viably managing projects, in contrast with nowadays where the PM emphasizes the integration of projects with the organization's strategic plans. As PM gets extremely connected to the top management, the behavioral aspects are becoming increasingly important as the commitment between organizations and employees became crucial for projects' success.
Kerzner, 2017	This work explores the concept of leadership as a style of behavior that is designed to align the requirements of the organizations and the personal interests and the pursuit of specific goals. It mentions that project managers are often select to handle projects because of their specific leadership styles.

Several studies have studied the impact of leadership competencies and ethics on effective management. The literature (Table 5) outlines traits that define great professionals while considering a high impact of the social and psychological traits as key to an efficient team and project management. A PM professional needs to have a good set of both hard and soft skills.

2.2   Resources allocation

Resources' allocation is the process of assigning resources to different parts of an organization to accomplish the objectives. As resources are often limited, how to allocate them is a key part while determining a corporation's efficiency and growth. Therefore, the resource allocation model has been an exciting topic for business managers and researchers (Wu *et al.*, 2013).

In project management, one of the key elements is to find the right balance within the so-called Project Management Triangle – how to balance the time, cost, and scope of the project. When we try to boost one element, the other two will need to adapt, as there is a rigorous dependency between them (Chen and Askin, 2009). Thus, as there is a significant cost associated with human resources, we need to effectively allocate those resources to facilitate the balance within the "triangle".

In the last few decades, different professionals investigated the usage of algorithms in the project management discipline, searching for the best processes for resource allocation and scheduling. Over the years the algorithms started to be more efficient and complex, as showed in the work presented by Kolisch and Hartmann (2006).

In the last years, the "algorithms" are in the spotlight mostly due to their programming applications and association with Artificial Intelligence, however, it is well known that the practice applications of algorithms go from completely different fields, from Medicine to Production to Information Technology or even Space Exploration.

Then, **what is an algorithm?** In Figure 6 an attempt to provide a simple definition.
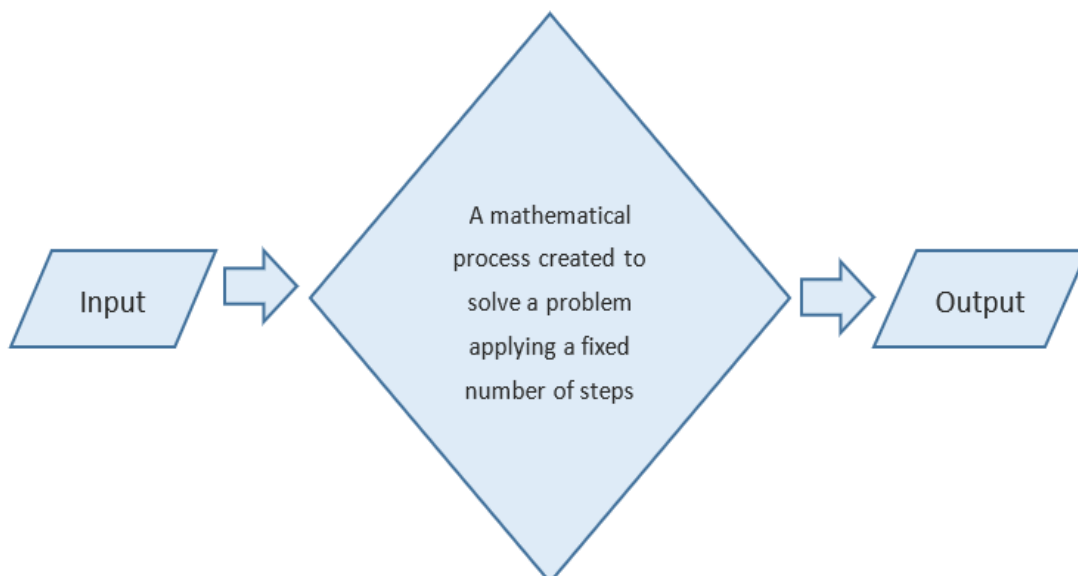
Figure 6 - Definition of algorithm

Later in this work, the tailored-fit algorithm will be characterized, presenting the developed solution that will tackle the allocation problem associated with the management of resources and tasks within the organization's IT Department.

2.2.1   Variables and constraints in allocation problems

As discussed, the concept of algorithm and resources' allocation activity (or distribution) go together as a process focused on bringing the inputs (resources) through a defined group of pre-defined steps (actions) to achieve an optimized result in terms of outputs (efficient results).

Thus, the focus persists in finding the right balance between the variables and constraints to maximize the results. This balance can be pursued through the analyses of various aspects such as risk, internal vs. outsourced work, distribution of resources in different industries, the different business segments, different project types, etc. (Eilat *et al.*, 2006).

One of the constraints in the allocation is the role and actions of the Decision Maker (DM). The DM often reveals when the balance is not obtained, as per claiming that there is "too much" or "too little" resources going into specific activities (Karsu *et al.*, 2014). The associated concept in allocation decisions is fairness (equity), which does not mean that each class or group will receive the same amount of resources - this is the foundation of a solid allocation, that takes into consideration all the variables for each request.

Some companies, that develop allocation tools, have tried to define the common problems within the resource allocation. It is referred the example of a Polish company named Teamdeck® (https://teamdeck.io/) which defines Changes, Resources availability, Inter and Intra-dependencies, Uncertainties and constant re-prioritization as some of the challenges to keep in mind while thinking about allocation of resources. In Figure 7 a view of these challenges.

• Client changes	• Resources availability	• Project dependencies
The clients may change their scope, the delivery time or the budget.	The members can be sick, or may exist multiple projects to be delivered in the same date.	Relationships between projects may create bottle necks or dependencies.

• Project uncertainties	• Priorities across the company
Even with initial analysis it may be needed to shift resources from other projects or re-assigning them.	Often the resources will be shared between departments and projects, the priorities may be re-negotiated.

Figure 7 - Common challenges of resource's allocation

Table 6 - Article review on allocation constraints and variables

Reference	Work description
Baker and Freeland, 1975	The authors state in their work that: "one of the most important limitations of present R&D project selection models is the inadequate treatment of project interrelationships concerning both value and resource utilization".
Eilat *et al.*, 2006	This work accesses the construction and analysis of efficient, effective, and balanced project portfolios. The problem is then divided into two major classes, dynamic vs. static projects. In the static projects, it is evaluated the allocation of resources, such as budget, human power, etc., to a group of candidate projects. This is done while assessing the risk and rewards of each, and trying to take into consideration the possible change requests and the final outputs. The author also states that the problem of interactions among projects received little attention in the literature associated with PM and resource allocation.
Bell *et al.*, 2011	This work is focused on the optimization of alert sites for homeland defense. Thus, it needs to be highly flexible to adapt to new locations and changes the requests of the decision-makers (DM). They conclude with the following statements: "The model is flexible enough to facilitate future re-evaluation as new areas of interest require coverage or new candidate alert sites are introduced to produce a new optimal network. Numerous what-if scenarios can be posed to see how the network configuration is affected. The location models used in this research can also be used to optimally locate aircraft based on desired proximity to threats, response requirements, and desired target coverage. Additionally, the model produces solutions to economize the use of forces to prevent overlap of resources."
Yu *et al.*, 2013	The authors state that if the structure of a process changes in the short term, it can cause organizational resistance and reduce performance. The high variability in demand creates severe allocation issues and increases the demand for more flexible models.
Teamdeck workbook, 2016	This company defines in the guidelines – available for prospects and clients – the challenges and benefits of a correct allocation while considering the challenges and constraints. They declare that a centralized schedule of resources makes it possible to be constantly aware of the capabilities and resources available and, as a result, enables smart project-related decisions. Also, a transparent relationship with the resource management team, thus, PM is then less likely to be surprised by any major team-related changes.

Reinforced by the contents exposed in Table 6, it is conceivable to deduce from the investigation that the resource interactions, the expected benefits, and the results or outputs of the projects are some of the constraints of the project itself. The client/requestor may change his requests during the development, also the resources are often limited and shared by different projects – which creates the need for constant review and often negotiation and re-prioritization. The variability adds complexity to the efficient resource's allocation of a project or task, therefore it is important to find flexible models that may address the projected challenges.

2.2.2   Models and approaches in allocation optimization

Only 26% of the organizations are persistently using allocation tools to assign resources to their tasks (Pulse of the Profession, Project Management Institute, 2017). The same study shows that almost 70% of the projects fulfill the scope, less than 60% of the projects respect the original budget, and only about 50% respect the deadline. If we recall the three variables of PM (Cost, Time, and Scope) we can tell by analyzing the metrics exposed in Figure 8 that there is still much work to be done in terms of efficiency in project management.
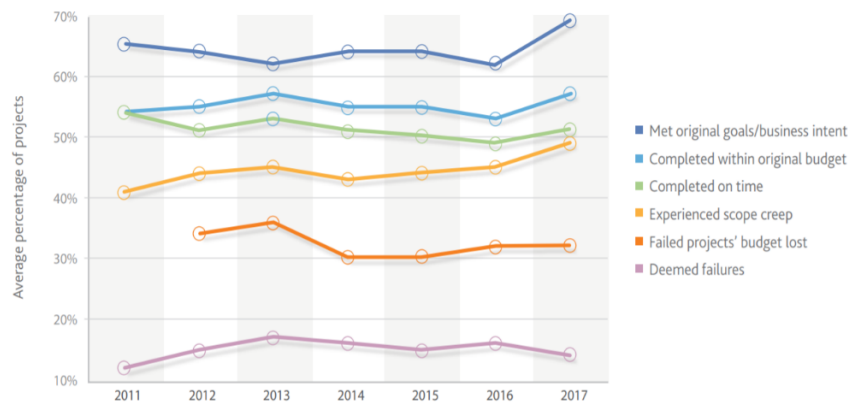
Figure 8 - Project Performance Metrics (Pulse of the Profession, 2017)

Several models can fit the dissertation scenario, such as multi-project management (MPM), the project portfolio or the program management, etc. It is intended to understand the definition of the MPM as a model that considers the management of multiple projects sharing resources (Figure 9), it can be defined as "Short-term tactical management of a set of projects in execution that share the same resources" (Ponsteen and Kusters, 2015).
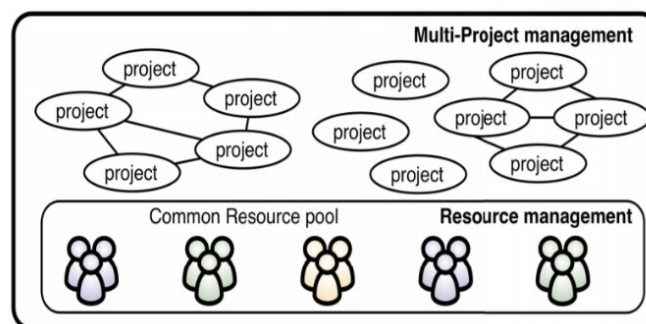
Figure 9 - Multi-project management by Ponsteen and Kusterks, 2015

It is possible to define two of the most common approaches to solve the resource allocation problems, considering either the exact methods or the heuristic methods. As nowadays the allocation problems are mostly defined as Non-deterministic, the use of exact methods is not advised with the exception, if the goal is to merely schedule and assign tasks without considering any other variants. However, the heuristic models may be too complex for a common usage or development within organizations, as they depend on the development of algorithms and consider the scope as a constraint and not a variable – yet, it would be suitable for time and capacity allocations (Browning and Yassine, 2010).

Table 7 - Article review, models, and approaches

Reference	Work description
Schmidt, 1993	The model developed in this work deals with multiple inputs and outputs within a project. It uses a nonlinear integer program with multiple quadratic constraints. This work seems interesting to support the representation of interactions.
Karsu, 2014	This work searches to incorporate the balance in resource allocation decisions. It navigates between the usage of imbalance indicators (review of balance distribution taking into consideration the data provided by the Decision Maker) and a multi-criteria model, comparing two different natures, Discrete allocation model against a Continuous allocation model. In the conclusions of their work they mention: "We note that the nature of the allocation, i.e. whether it is discrete or continuous, affects the type of models developed."
Fang, 2015	The author uses the data envelopment analysis (DEA) framework, as an approach to measure the performance of resource allocation under centralized environments. In this model, a central unit can simultaneously control all the other units, this would reduce the input consumption. As a conclusion of this study, the authors state: "Through our approach, the central decision-maker can obtain a sequence of intermediate benchmark targets and provide a step-wise improvement path for the DMUs (decision-making units) to reach their ultimate targets on the efficient frontier in a more practically feasible way."
Boukherroub *et al.*, 2017	In this study, the researchers tried to maximize a sustainable forest resource allocation in Canada. They have used Linear programming to determine the optimal wood volumes to allocate to the mills. One approach tries to maximize the total value created by all mills and the second to allocate wood to the mills considering their performance. The proposed framework allows the government and companies from different sectors to shift from a rudimental wood allocation process based on economic interests or historical privileges into a clearest one, supported by data.
Rudek and Heppner, 2020	They propose a mathematical model for a discrete resource allocation problem under digressively proportional constraints. Later, it is compared to the usage of both Proportional division and Degressively proportional isolated or in combination. As a conclusion of the work, two systems are proposed to tackle the case studies of the seat distribution on the European Parliament and the share of the costs of a conduct infrastructure.

From the article revision done in Table 7 and across the literature it is clear there are many proposed models and frameworks, which diverge in complexity, applicability, and flexibility. It was observed the board application of resources' allocation methods.

Nevertheless, throughout the research, it was not possible to find any model that could have been directly employed to the dissertation's challenge. A tailored-fit algorithm will be developed and presented later in the "Development" chapter of this document.

2.2.3 Allocation of Human Resources

Good management of human resources is indispensable for an organization's success, as the costs of human resources are substantial, mainly in projects demanding complex skill sets and deep technical knowledge from the employees (Zwikael and Unger-Aviram, 2010). Thus, many investigations have been done in this domain during the last decades, applying different techniques and approaches to overcome the challenges faced by organizations when reflecting on the assignment of resources to specific tasks of a project (Silva and Costa, 2013). In Table 8, it is possible to find a group of articles related to the "human resources allocation" matter.

Table 8 - Article review, human resources allocation

Reference	Work description
Barreto *et al.*, 2008	The researchers run an optimization-based approach to support the human resources allocation in the scope of a software project, where they try to solve it through a constraint satisfaction problem. They consider the specificities of the assigned activities, the available human resources and the organization constrains. Yet, it does not consider the difference between tasks within the same project – in terms of requests and productivity impacts.
Otero *et al.*, 2008	In this article, the researchers propose a methodology used for the assignment of tasks to the employees. This methodology is called Best-Fitted Resource (BFR) and it is a systematic approach to decide the best match between an employee skillset and the skills required for the task. For that, it is used as a relationship-ability table, which should allow us to understand how the current set of skills of the employee will allow him to learn new skills. However, this approach does not consider the specificities of the project in which the employee will be involved/assigned.
Kang *et al.*, 2011	In this study, the researchers propose a constraint-based allocation for human resources within software projects. They use the accelerated simulated annealing and propose task assignment and productivity estimation by using different effort estimation models. Thus, it is noticeable that when the number of constraints increases, it is harder to implement the proposed model.
Yu *et al.*, 2013	This study is focused on the allocation and re-allocation of human resources in airports. It accesses different strategies in the short, medium, and long term. In the conclusions, they state that communication is key in the short term, in the middle-term, they focus on the existence of contracted and regular staff to be flexible in terms of adaptation to demand. In the long-term, the focus is on reducing the costs with personal by improving the efficiency using a different scheduling model.

The allocation of Human Resources seems to be a big challenge for the organizations, principally due to the costs and the impact on the outcome of the projects. Many studies are proposing different models, but due to the specificities of the projects and the different requested skills, none of them seems to be applied across domains or ensuring an "off-the-shelf" implementation. As a synopsis, it is possible to assume the need for additional investigation and exploration of the Human Resources Allocation domain.

2.3 Analysis tools

To properly monitor and assess the specificities of each new challenge that is presented to an organization, it is necessary to use tools that have been largely applied and validated across different domains, which will ensure the correct analysis of each situation.

There is a group of tools that each organization can apply to achieve a better overview of the reality of each situation. These tools are necessary to collect information, analyze, and support data validation, building a solid view that will allow the decision-makers to make the best decisions founded in evidence (Sokovic *et al.*, 2009).

Some of the best-known tools are the "Seven Quality Tools" developed by Japanese professor Karou Ishikawa in 1968, who was considered one of the first world's references for the discipline of quality and management tools. This concept was first introduced in a book of Ishikawa named "Gemba no QC Shuho", in which he presented different management techniques and good practices taking into consideration the learnings on the Japanese industrial sector.

The seven basic tools are:
- Cause-and-effect diagrams (also known as Fishbone or Ishikawa diagrams).
- Check sheets (data tables).
- Control charts.
- Histograms.
- Pareto charts.
- Scatter diagrams.
- Flowchart.
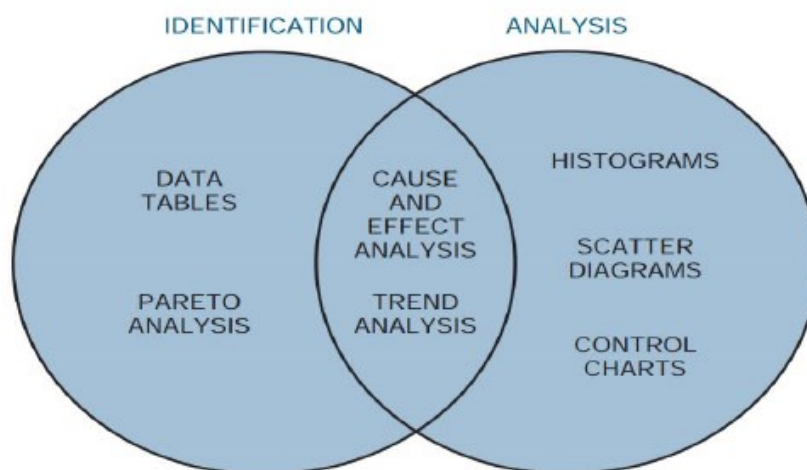
Figure 10 - The seven control tools by Kerzner (2017)

In Figure 10, it is possible to understand the relationships between the seven tools and their applicability for both identification and analysis that can be applied for any project. In this image, it is presented the "trend analysis" and not being considered the flowchart, either case the flowchart would be presented in the "intersection area".

2.3.1   Flowchart

Since its introduction, the Flowchart has been one of the widest spread analysis tools across different industries, applicable in different stages but mostly for the definition and study of a process (flow).

While using this diagram tool, it is easy to understand the need for adding or removing steps, keeping a good ordering and logical structure along the way. It is simple to build and to read and allows the correct display of the different phases or steps of a process while being applicable for both machines and human interactions (Maiczuk *et al.*, 2013).

Tague (2005) states that the creation of a flowchart should contemplate the following steps:

- Definition of the start and end of the process, so it can be draft with precision. It is also important to define from the start the level of detail to be applied.
- Starts with a brainstorm about the activities that exist, or should exist, within the process.
- Sequentially organize the activities and ensure a proper connection between activities that are connected, or dependent on each other.
- Proceed to a review of the flowchart alongside the people that will be affected by its implementation, or for who the process is being built. All layers should be involved in this revision, from management to regular employees which will execute each task within the process. This is crucial as it will allow the whole team to be aligned on the process steps and to ensure that the flow has been designed respecting the needs and objectives of the department or organization.

In Figure 11 an example of a Flowchart representing a manufacturing process.

Figure 11 - Flowchart about weaving manufacturing process (Neves *et al.*, 2018)

2.3.2   SWOT

The SWOT analysis is well known for being effective and easy to build a qualitative method in strategy selection, and it is frequently applied by the companies to analyze new or current projects.

Some authors have investigated the definition and concept of SWOT. Gürel (2017) has built a good theoretical review from which it is possible to extract the following concepts related to SWOT acronym:

- **S**, strengths (characteristics that give an advantage over others in the industry or sector).
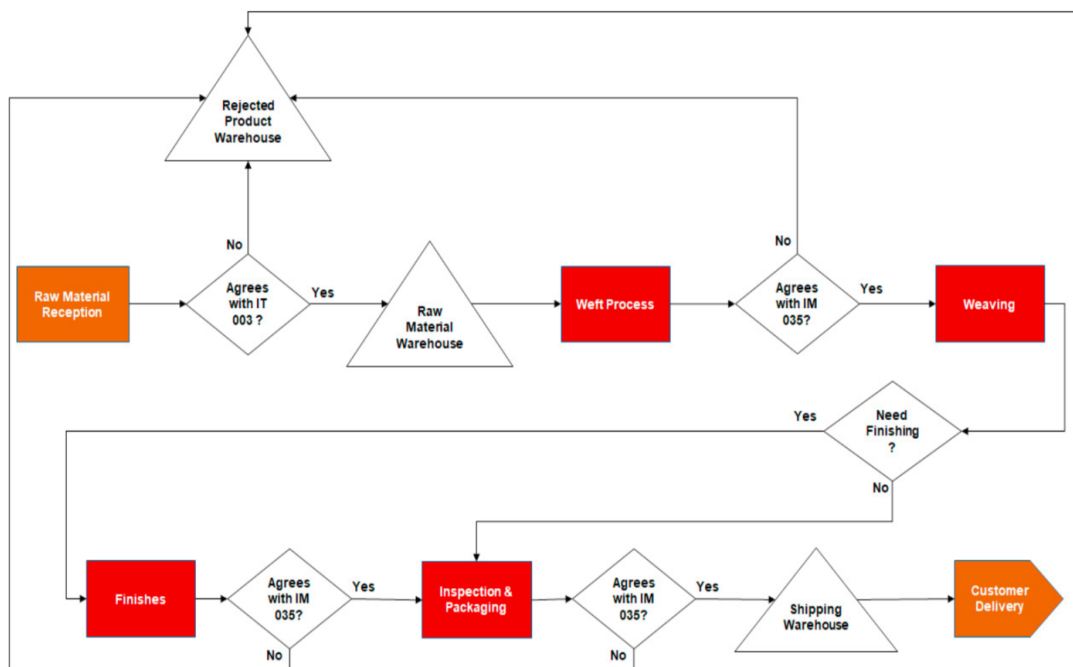- **W**, weaknesses (characteristics that place the organization at a disadvantage relative to other competitors).
- **O**, opportunities (external elements to the company, across the society or environment that give benefits for the organization).
- **T**, threats (external factors to the company present in the environment that could create a disadvantage for the organization).

The same author (Gürel, 2017) offers a good conceptualization, describing the SWOT analysis as a strategic planning framework that helps the managers to identify organizational and environmental factors. It is worth mentioning that this analysis tool has two dimensions, internal and external. The internal dimension includes organizational factors and the mentioned Strengths and Weaknesses. The external dimension is based on the environmental factors in which the situation or organization is inserted, contemplating the opportunities and threats (Zhou, 2019). In Figure 12 it is possible to find an example of a SWOT analysis.

Strenghts
S
- Adaptability to different types of terminals;
- Simplicity in the interaction between the various modules;
- Reduction of mechanical elements crucial to the correct functioning of the machine - "part that does not exist, does not break";
- Competitive solution for crimping special electrical terminals;
- Ease of tuning, even by less experienced operators.

Weaknesses
W
- Dimensions greater than those of the existing tools;
- Total machine cost could be lower;
- Number of components could be less.

Opportunities
O
- Optimization of some components, allowing reductions of cost and dimensions;
- Study option to adapt to presses with heights of BDC different from 135.78 mm;
- Create an option for crimping large terminals (e.g. car battery cables) with the minimum number of changes required.

Threats
T
- Third-party solutions may be more competitive for more common terminals;
- Higher dimensions may be a difficulty for the customer;
- Tool weight can make it difficult to handle during assembly (approximately 25 kg).

Figure 12 - SWOT analysis example related with the optimization of a specific tool for electrical terminals (Castro *et al.*, 2017)

2.3.3   Fishbone diagram (Ishikawa)

This tool has been developed by Kaoru Ishikawa and it is defined as a diagram that presents a group of causes leading to one effect. It is known by different names, such as Diagram cause-effect, Ishikawa's diagram, and Fishbone diagram due to its "fish spine format" representation (Bauer *et al.*, 2006).

The same authors (Bauer *et al.*, 2006) refer to the importance of following some basic steps in the creation of the Ishikawa diagram:
- A good definition of the problem.
- Frame the potential causes of the problem.
- Define a category for each cause.
- Use the diagram to find the root cause of the problem (the head of the fish).

Another author mentions in his book some recommendations when it is intended to use an Ishikawa diagram (Pinto, 2011):
- After the causes have been found and presented, keep in mind that the causes are what we are trying to evaluate and not the symptoms of the problem.
- After the causes are well defined, it is important to group them by having categories while trying to measure the weight of that specific cause in the problem root-cause.
- During the process, and after the diagram is completed, it is important to review everything to avoid duplicates or redundancies.
- When each "spine" (category of the cause) and bone (individual cause) has been represented in the diagram, it is important to ensure that each of them is a singular and discrete event (otherwise it may be needed to create sub-categories within the causes stream).

In the example below, it is possible to analyze a case in which the different categories and individual causes are visible, leading to the root cause, without duplications, and respect a proper segmentation.
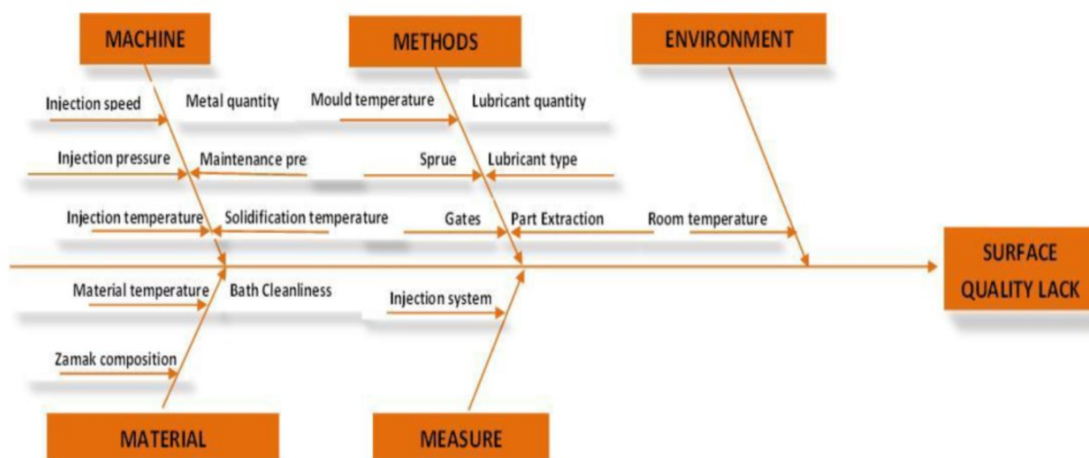
Figure 13 - Ishikawa diagram for a high-pressure die casting process (Silva *et al.*, 2018)

2.3.4   Brainstorming

The Brainstorming is a well-known technique to foster group creativity by which ideas and thoughts are shared among members spontaneously, to reach solutions to practical problems (Gogus, 2012). The main goals of the Brainstorming sessions are to focus on the number of ideas, without criticizing and promoting the wildest ideas to be presented and even developed. Brainstorming is looking for solutions, different approaches, and uncharted paths.

Today's organizations give a big importance to ideas, especially the good ones, as they can help to solve problems, facilitate the development of new projects or services while being the fuel for reputational and financial success. Nevertheless, it is known that in the distant past many great ideas have been considered silly or even a reason for public persecution when presented to the world, this may have caused some people to keep their mouths shut and many amazing works to be left inside the drawers. Would the world be different if, in the past, everyone could freely expose their ideas? The answer is probably "yes". However, nowadays things are different, and in numerous locations, the ideas can be shared and discussed with an open mind, which has been one of the reasons for so many inventions and technological developments in the last decades. In Figure 14, and as presented by Al-Samarraie and Hurmuzan (2018), the Brainstorm techniques can be delivered in three different ways: verbal/traditional brainstorming (TBS), nominal brainstorming (NBS), and electronic brainstorming (EBS).
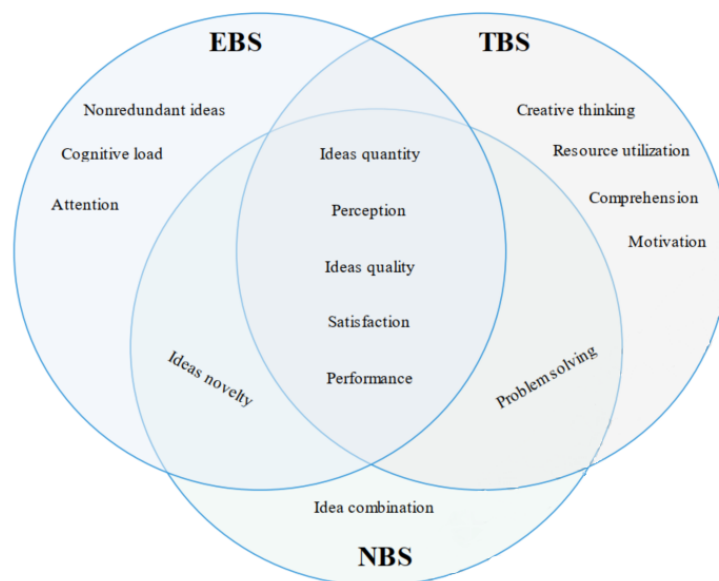
Figure 14 - Brainstorm techniques by Al-Samarraie and Hurmuzan (2018)

The benefits of Brainstorming have been defined by Litcanu (Litcanu *et al.*, 2015) as:
- quick and easy way to obtain new ideas and find possible solutions;
- reduced the costs of new ideas by making use of this method;
- it has wide applicability in almost all areas;
- generates active participation and creates the possibility of contagion of ideas;
- builds creativity, spontaneity, self-confidence through assessment process;
- improves the ability of people to work and perform as a team.

2.3.5   Practical application of the analysis tools

These tools are frequently applied by researchers in numerous works to support the problem review, the collection and analysis of data and to explain the specificities of the projects. In Table 9 it was intended to go through the application of different analysis tools.

Table 9 - Article review, analysis tools practical application

Reference	Work description
Santos *et al.*, 2017	The researchers used the flowchart to frame relevant questions and answer paths, allowing the rapid review of the processes. It is used to exemplify the necessary steps to select cast steels and casting processes for truck components, this allows a quick review of the process's bottlenecks and to improve the process with a direct approach, being able to analyze the issues step by step.
Al-Samarraie and Hurmuzan, 2018	After investigating Brainstorming techniques applied for higher education organizations, they have concluded that the usage of Brainstorming promotes the individual's capacities to generate a big amount of ideas that can be used to solve complex problems, which delivers an added value to any organization. They also state the application of such techniques across different fields with the goals of finding solutions to problems, to develop previous ideas, and to actively engage members into added value discussions.
Neves *et al.*, 2018	Focused on the importance of flowcharts to frame processes. As stated by the authors: "flowcharts are needed to define what can be done at each moment, allowing the company to reply assertively to the market demand in a competitive sense, showing high flexibility, agility and very good quality/price ratio."
Rocha and Pires, 2019	The SWOT analysis was built considering stakeholders' perceptions about the Environmental Declaration. It combined desk research and literature review to mitigate the subjectivity in the strategy-building process. Based on these results, the strategies outlined for Brazil aimed to connect strengths with opportunities, to make up for weaknesses, and to neutralize threats.
Zhou *et al.*, 2019	The researchers have used a SWOT analysis to evaluate a suitable implementation of prefabricated houses. Twelve factors affecting the prefabrication implementation were first identified. The results of the study allowed them to argue on the necessity of different strategies to tackle the different results of the SWOT analysis.
Silva *et al.*, 2020	The focus of the work was to develop a methodology for analyzing the failure mechanisms and classification through the characterization of the materials used in the electrical terminals and the efforts applied during the crimping operation. The authors have used an Ishikawa diagram to present the problems creating defects in an electrical terminal, which was critical for the authors to proceed with the investigation and later to propose a suitable methodology.

It was confirmed the importance of using the analysis tools to ensure a correct assessment of the problem and to guide the researchers from the problem definition to the development of the solution. Likewise, it was found the applicability across different domains and complexities.

THESIS DEVELOPMENT AND RESULTS

3 THESIS DEVELOPMENT AND RESULTS

In this chapter the impacted company will be presented, followed by the problem characterization and analysis, and later in the document, it is done the presentation of the program that intends to help solving the department's hurdles.

3.1 Company Presentation

The Philip Morris International (PMI) is one of the top 10 Fast Moving Consumer Goods (FMCG) companies in the world and the market leader for its segment. The company is changing the paradigm of its traditional products, being currently focused on the development and commercialization of Reduced-Risk Products (RRPs), adapting itself to the market specificities and the needs and demands of the consumers. The company's legal seat is in New York City (USA) and the operational headquarters are in Lausanne, Switzerland.

PMI is among the top performer companies in the world in terms of digital transformation and good management practices. It is a company that genuinely focused on the implementation of Agile methodologies, with remarkably high standards in terms of quality and performance of the employees – starting from the recruitment process to the intensive and continuous training of the workforce. The company is also well known for the exemplary working conditions provided to the employees, as e.g., the Equal Salary certification, which is a good example (employees have the same compensation independently of their gender).

The company is placed in a competitive and highly regulated environment. Over the years the organization has been shifting towards new products, reducing the risk for the consumers, and ensuring the stability of the sales in the long run. In 2019, PMI has achieved a gross revenue of 78 billion dollars (USD), with net revenues of 29 billion dollars (USD). The RRP (reduced risk products) had an 18,7% share in the revenues of the company in 2019, while the remaining 81,3% were generated by the Combustible Products (PMI INC. annual report of 2019 to the United States Securities and Exchange Commission). In Figure 15 the organigram, top to bottom (ending with the position of the researcher – working as IT Analyst & Project Manager).
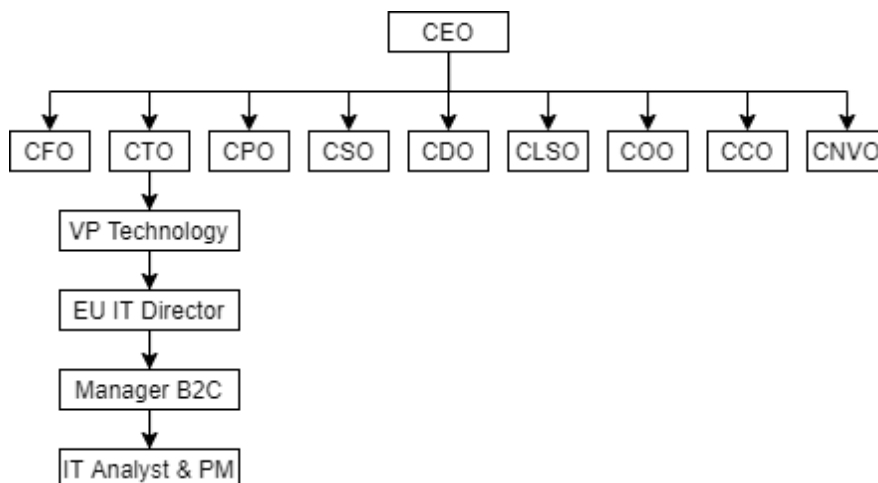

Figure 15 – Organization chart Philip Morris International

3.2   Challenge Characterization

The IT department of the Switzerland market, reporting to the European Union (EU) cluster, needs to improve the allocation of their resources to increase the efficiency and the quality of the deliverables, in both daily tasks and on project development and deployment.

There are different players in this department, some of them are PMI employees, others are temporary assigned workers (Randstad or else) and some are 3rd parties on-site (employees from different Consulting companies that provide technical work/skills to the department for a limited period). Alongside those, there are 3rd parties off-site and even offshore (members of other consulting companies that support development, technical support, and other). All of those need to align themselves with the Project Managers, and on their end, the Project Managers alongside the company Managers need to align with the Business needs (requirements from other departments such as Products and Services, Customer Care, Field Systems, Sales, etc.). In Figure 16 the department's organization chart.
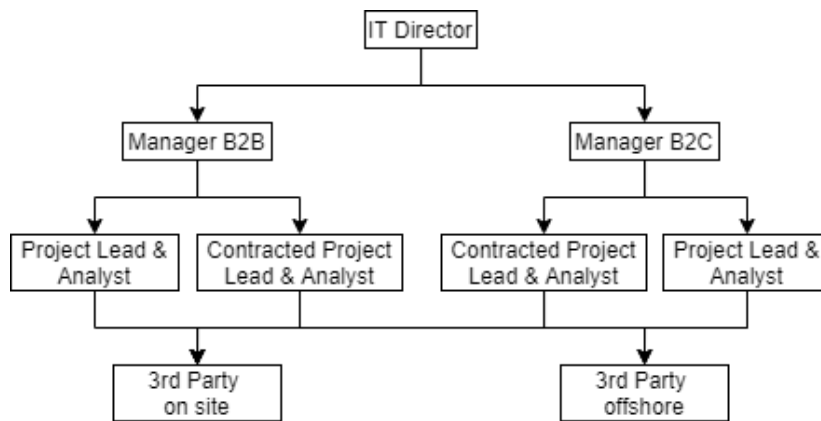
Figure 16 - Example of the internal organization chart

After considering the previous specificities, it is clear this is a heterogenous team within a big and complex organization. The challenge is how to make sense and how to harmonize the work of so many different players to create real value for the company while ensuring the deliverables. Daily, there are different challenges in the department. In the scope of this work, it was decided to tackle the organization and allocation of tasks to the employees, independently if they are PMI employees or externals (in a temporary assignment).

Below, some of the challenges to be addressed during this investigation and for which it will be proposed a model/solution.

- Who is doing what?
- What are the skills of each employee?
- What is the occupation of each employee/team?
- What is the most skilled employee for a certain task?

All the explored topics have been discussed with the managers of the department and it was agreed on the criticality of those subjects. The management also considered there are significant losses of time and money, caused by an ineffective work allocation and the lack of information about each employee's workload and skills.

3.3   Challenge Analysis

This sub-section will be focused on the analysis of the problem/challenges faced by the IT department, starting with the Cause-Effect analysis by using the Ishikawa diagram, following with the use of the SWOT analysis to understand what can be improved, and later, with the brainstorming process, to find the most suitable solution to tackle the problem/challenges. Currently, there is no clear view of the occupation rate (%) of each of the team members. Also, there is not a list of updated skills for each professional. Those two aspects will difficult the decision making of the Manager, troubling the choice of who is the best member to be allocated to a certain task or project, and how reliable is this person to overcome the challenges to completion. The workload of the members should be measured in terms of occupation rate (%) considering an eight-hour shift during a five days' workweek. There are routine tasks to be considered for some members, such as support to other teams, weekly meetings, or pre-defined tasks (e.g. sanity checks, services performance). While considering that different members will have a different allocation to projects/tasks, each of them with a different "error margin of occupation" (e.g. not all support tasks can be, always solved, with 20% of the work-time of one member). It is also relevant to consider that there are different priorities when comparing tasks/projects. E.g. all P1 or P2 issues (bugs/errors/downtime) will be considered as a "priority" when comparing to something else - which can disrupt the current tasks in progress.

3.3.1   Fishbone analysis

Below the Ishikawa/Fishbone diagram with the different points affecting the efficiency of the department. In Figure 17 it can be found the Ishikawa's diagram for the defined problem. Further details to be presented on the next page.
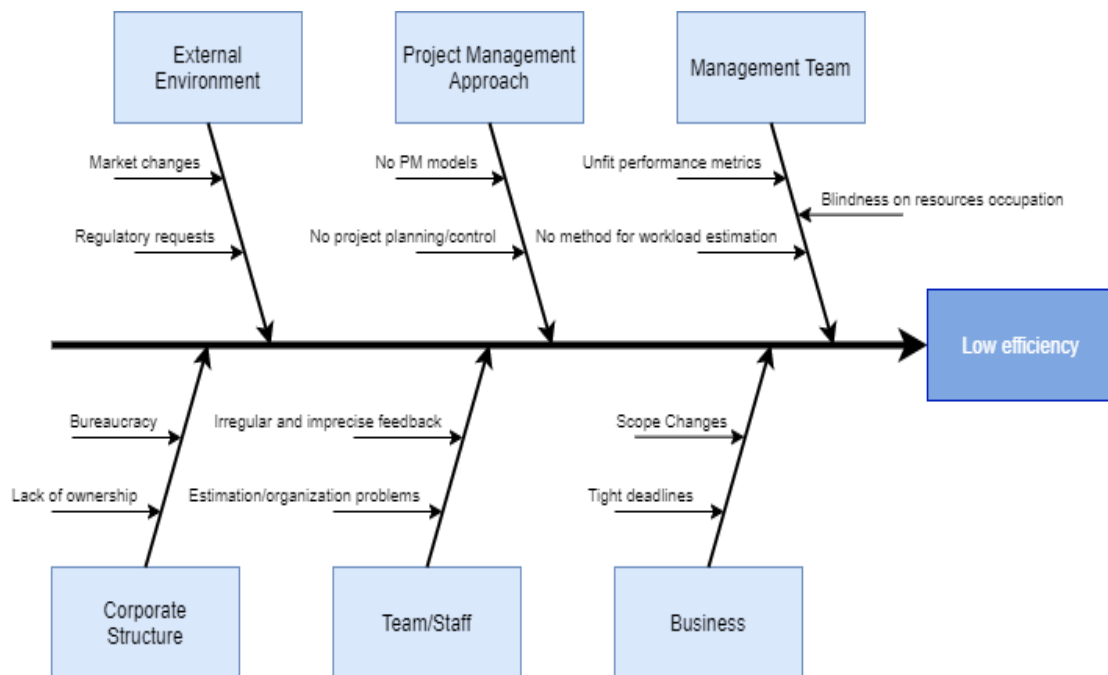

Figure 17 - Ishikawa/Fishbone analysis of the problem

Considering the previous diagram:

- **External Environment**
  - Market changes – as the market/consumers keep changing their behavior the projects may be affected while being developed, increasing the uncertainty.
  - Regulatory requests – as the data protection and security requests may change over time, the projects can be impacted for unknown demands during the development phase, causing further hurdles on the planning and delivery.

- **Corporate structure**
  - Bureaucracy – the decision-making process can be long and painful due to the huge amount of approval requests to move with a certain project or task.
  - Lack of ownership – when a project has high-visibility and great changes in bringing value to the company, different stakeholders want to bless the project. If the project has low-visibility, it is often hard to find ownership from the management.

- **Project Management approach**
  - No project management models – the department, and company in general, misses proper Project Management models and tools. Even with the existence of the Project Management Officer which often regulates conflicts but does not produce or make available any relevant Project Management contents.
  - No project management planning/control – the existing control is dependent on the Project Managers/leaders themselves and it is antiquated in terms of methodology, which difficult the overview of the projects' status.

- **Team/Staff**
  - Irregular and imprecise feedback – the team members are not called, often, to provide their feedback on the project's status and they do not receive the feedback from their superiors. This happens alongside the chain, mostly in lower levels.
  - Estimation/organization problems – as there is no clear view of the occupation of the department employees & externals, all estimations are done in the dark. Regular Project Leads have no visibility on the workload of their colleagues or of the 3rd parties.

- **Management Team**
  - Unfit metrics – employees have no idea about the quality of their job.
  - Blindness on resources occupation – managers have no idea about the workload.
  - No workload estimation – when allocating new tasks, managers do not know the status of the employee's workload, thus, it is done subjectively.

- **Business**
  - Scope changes – the business stakeholders often change their project's scope during the assessment and/or development stage, which causes allocation and deadline issues.
  - Tight deadlines – the given deadlines/dates for delivery are often too short and often do not contemplate the specificities of the project.

3.3.2   SWOT analysis

Following the previous assessments, the next step was to group the different subjects and align them into a SWOT analysis (Figure 18). With this, it will be possible to focus on what is possible to change instead of wasting time struggling to change a large number of procedures.

STRENGTHS

- The organization has a huge amount of resources
- Professionals are skilled and motivated
- There is intent to promote change and improve processes
- Infrastructure is capable to absorve and adapt to changes

WEAKNESSES

- Big and complex structure
- Some employees are reluctant to change
- Time is short for deep changes in the processes/methods

OPPORTUNITIES

- Employees are Agile experienced what can ease the adaptation process
- Big pressure for the management to see changes
- External providers are more flexible and adaptative
- Creation of the PMO office

THREATS

- Tight deadlines and constant scope change of the projects difficult the adaptation/introduction of new management practices and processes
- Management team is mostly focused on financial results
- The stakeholders focus is on conversion of new consumers over changing the bureaucracy

Figure 18 - SWOT analysis

Herewith it was possible to understand, through the *Strengths* analysis, that the organization has the necessary resources and the professionals are capable to adapt to the required changes. Also, the organization is capable to adopt new processes. Therefore, the work will focus on how to leverage those *Strengths* to propose a solution that can conjugate the *Strengths* and *Opportunities* to improve the resources' allocation process.

Simultaneously, it is crucial to understand the *Weaknesses* and *Threats*, since those represent the possible blockers to a successful implementation of the new approach. This being said, it is important to deliver a solution that is easy to learn, truly applicable by the management, in a daily basis, and easy to configure and start using – as there employees reluctant to change, there is no time to spend on unfruitful experiences, and the main focus is on the acquisition of new clients and net financial results.

3.3.3 Brainstorming

To tackle the challenges being presented to the department, it was done a benchmarking regarding the available technologies/software to be used and if there was any tailored-fit solution on the market that could meet the requests. It was also researched allocation models that are or have been used across different industries. After the investigation was done, it was notorious that the specificities of this challenge were too restrictive, for example, the factor of the employee's skills and the projects. Thus, during this stage, it was imagined a possible solution that could contemplate a group of menus, action buttons, and data tables – from which an algorithm could take the needed information to process and to suggest the most suitable person for each task or project. In this stage, it was also clear that a program only based on task/project allocation would be too limited and it could easily be considered useless, as the Manager would need to navigate between other tools or systems to register all the relevant subjects of the employees or tasks.

After those considerations, several attempts were done to find the best way to present and process the information, each of them was presented to the management to collect feedback and further requirements and suggestions. Below, in Figure 19, an example of the "activity allocation" tab, in which it was possible to register new activities, having them linked to an employee and team while updating the occupation and consulting the start/end weeks and duration – at this point, relying only on Excel formulas and tables.

Activity Name	Employee	Team	Occupation in percentage	Start Week	Duration in weeks	End Week
QURE issue	MC	B2C	20%	1	4	4
Task 1	DC	B2C	50%	1	2	2
Task 2	MK	B2B	30%	1	13	13
New T@H thing	YD	B2C	20%	2	1	2
Project 1	MC	B2C	10%	3	3	5
Task 6	FM	B2B	30%	3	3	5
Project 5	DC	B2C	30%	5	2	6
Task 5	MC	B2C	25%	5	2	6
Task 7	SP	B2C	50%	5	4	8
Project 4	FM	B2B	45%	6	3	8
Task 8	SA	B2C	10%	6	5	10
New device	EP	B2B	30%	7	1	7
Project 3	SP	B2C	25%	7	4	10
Project 6	SC	B2B	5%	7	6	12
Project 7	SP	B2C	5%	8	1	8
Task 3	SA	B2C	60%	10	2	11
Task 4	PF	B2B	15%	10	3	12
Task 8	MC	B2C	10%	11	20	30
Project 2	SP	B2C	15%	15	1	15
Extract DB	MC	B2C	10%	16	1	16
Project 8	AK	B2B	15%	17	4	20
Task 10	AK	B2B	2%	17	1	17
Task 10	YD	B2C	20%	17	7	23
Task 9	MC	B2C	4%	17	1	17

Figure 19 - Activity allocation table on an early version of the program

After this first brainstorming phase, it was decided to introduce the Visual Basic capabilities to improve the quality of the user-interface and also the processing capabilities of the program – allowing the cross-check between tabs, the inclusion of the algorithm, further auto-update, and reporting capabilities.

3.4   Presentation of the developed program

To provide the Managers with a tool to tackle the identified challenges, an Excel© based program was developed using Visual Basic programming language ensuring the correct usage of the algorithm, correct management of the data, and user-friendly experience. Throughout the program, it is often used the naming "Task" to refer to both "Tasks and Projects" to simplify the understanding and the operation of the program to avoid duplicates.

3.4.1   Requirements

The developed program needs to answer to the managers' needs in three main categories:
- **Team Management**
- **Task Management**
- **Status/Reporting**

Regarding the **Team Management**, in this area, it should be possible to easily and efficiently add and remove new skills from the database, to add or remove, new employees, and to manage their vacations/out of office periods. This module is deeply connected with the Task Management features, as any new task assignments will depend on the availability and skills of the employees.

Another core element is the **Task Management** where it should be possible to assign and manage the tasks associated with the team members. Also, it will be on the Task Management module that the allocation algorithm will run on the background, supporting the decision of which employees are available and truly skilled for the task to be assigned. It is also important to ensure the problem is flexible to accept changes on the flight, allowing the decision-maker to re-assign the tasks and/or to change the deadlines.

At the bottom of the menu, it is displayed the **Status/Reporting** module, which was considered a must-have feature for the managers, as they need to evaluate the workload and performance of the employees' overtime. The reports will also allow the stakeholders to understand the time expense in specific projects or tasks and the segmentation of the occupation by team or time-frame. Below, in Figure 20, it is possible to see the display and organization of the different groups and buttons on the home-page of the program.
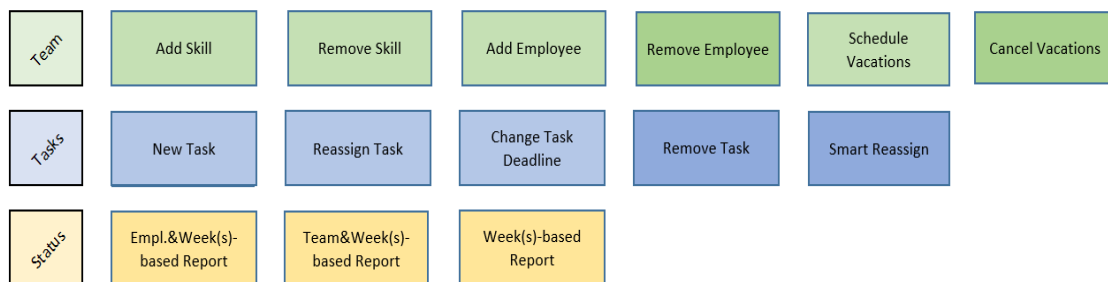

Figure 20 - The home page of the program

3.4.2 Activities flowchart

In the flowchart below (Figure 21), is presented the general process when a new Project or Task is requested to the IT department. Nowadays the best/most suitable employee is selected without any specific criterium, it is simply asked on Team Meetings who have time and capacity to do X or Y. The Flowchart can be found on the Annex, under *6.2 Activities Flow in the IT Department* in a more readable format.
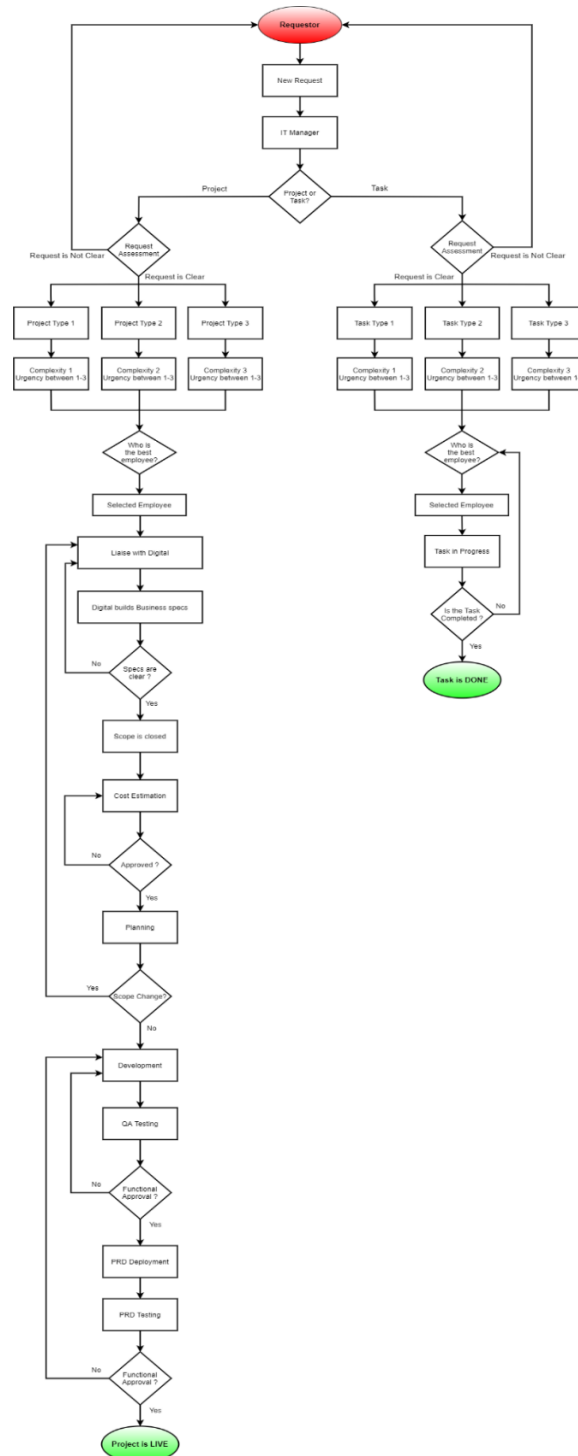

Figure 21 – Current activities flow in the IT Department

3.4.3   Allocation Algorithm

It is worth mentioning that during the investigation the algorithm has been streamlined to better fit the specific requirements and needs of the managers regarding the activity allocation. Nevertheless, building a simple, effective, and efficient algorithm in line with all the specific needs of the department was an interesting and challenging task.

Indices:

i — employee $i \in I$, where

$\qquad I = \{YD, MC, DC, RM, AS, SP, AK, EP, SC, PF, FM, MK\};$

k — week $k \in K$

$\qquad K = \{$weeks in which the task/project will unfold$\};$

Parameters:

$P_k,$ — the percentage of time in week K that the task/project occupies an employee;

$S_i, i \in I$, where I = {Registration, Try at Home, Guided Trial, Physical Lending, MGM…};
The weighting factor of the skills/competencies of the $i \in I$ for the task/project;

$T_{ik}, i \in I; \ k \in K$ — occupation rate of the employee $i \in I$ in the week $k \in K$;

$z_{ik} \in \{0,1\}, i \in I; \ k \in K$ — assume the value 1 if the employee is available/working in the week $k \in K$.

Decision Variables:

$$X_{ik} = \begin{cases} 1 \text{ if the employee } i \text{ is assigned to the task } in \ the \ week \ k \\ 0 \text{ otherwise, the employee is not assigned} \end{cases}$$

Objective function:

$$Max \ \sum_i \sum_k X_{ik} S_i$$

The aim is to maximize the competencies for a certain task/project considering the Human Resources skills.

Restrictions:

$$X_{ik} P_k \leq (1 - T_{ik}) Z_{ik} \quad \forall \ i \in I, k \in K \qquad\qquad (1)$$
$$\sum_i X_{ik} Z_{ik} P_k = 1 \ \forall; k \in K \qquad\qquad\qquad (2)$$
$$X_{ik+1} \geq X_{ik} \forall i \in I, k \in K \qquad\qquad\qquad (3)$$
$$X_{ik} \in \{0,1\} \ \forall i \in I,, k \in K$$

(1) This restriction group ensures that for each week were the task/project is taking place, the allocation of the employee does not go over 100%.

(2) This restriction group ensures that there is an employee assigned to the task/project.

(3) This restriction group ensures that the same employee will always be assigned to the task throughout the K weeks in which the task/project takes place.

3.4.4 Team Management

In this section are presented the functionalities embedded in the Team Management section (Figure 22). This is a pre-work configuration to be done and updated by the Managers, ensuring that all needed skills are listed, that employees are added into the list, and that they have the right value for each of the skills. It also allows the scheduling of the unavailability periods such as sick leaves or vacations.
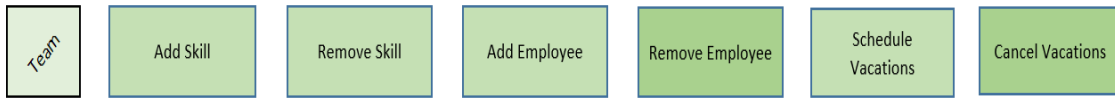

Figure 22 - Team management menu options

3.4.4.1 Add Skill

The goal of the *Add Skill* (Figure 23) feature is to allow the operator to introduce new skills on the database and to have the option to classify straight away each of the employees for this new skill. This menu can be launched from the *Home page* or the *Employees and Skills tab*.
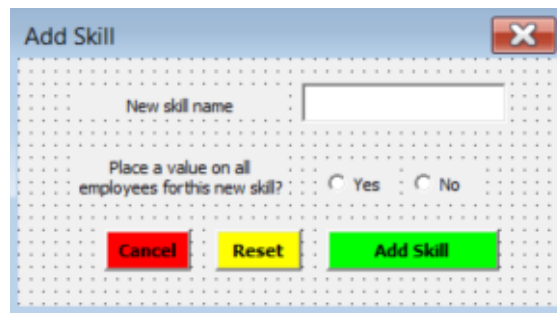

Figure 23 - Adding a new skill to the database

The operator will have the possibility to reset or cancel at any time within this first user form (named as *userform13* in the VBA). If the operator has chosen to classify the employees it will go through the following menu for skills evaluation input (Figure 24). The skills can be evaluated from 1 to 3, in which 1 represents a limited knowledge and 3 represents a high level of knowledge on the mentioned skill. This interval of values was agreed after discussion with the management considering the specificities of the evaluation and the input simplicity.
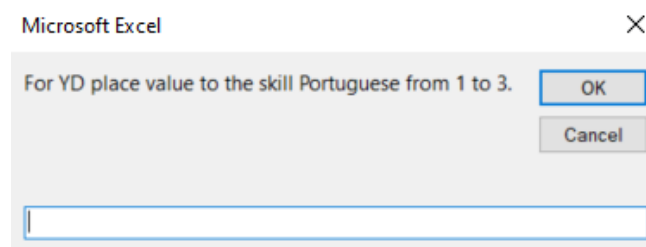

Figure 24 - Inserting values of the skills for each employee

The VBA code referent to this user form and the dependent actions can be found on the Annexes inside *6.1.1 Add Skill Userform*. On the next page, it is presented the flowchart explaining the possible inputs and outcomes resulting from the usage of this user form. In Figure 25 de Flowchart for the *Add Skill* feature.
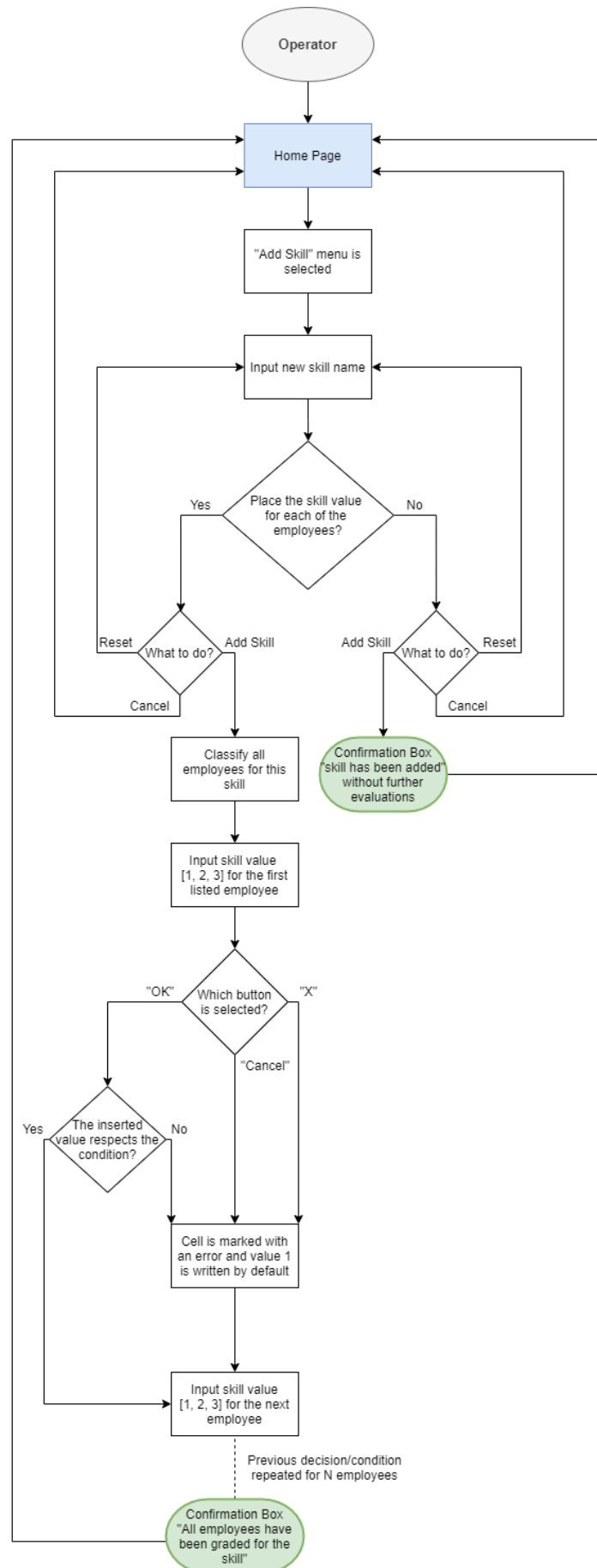
Figure 25 – Flowchart for the add skill feature

3.4.4.2   Remove Skill

It was considered relevant to the existence of the *Remove Skill* feature (Figure 26), to ensure the flexibility of the program and to promote a clean environment for the operators. Hence, when a skill is no longer relevant, or a certain platform is decommissioned, it is possible to remove that *Skill* from the *Employees and Skills* tab. The system will then remove the line with the skill and update all relevant tables.
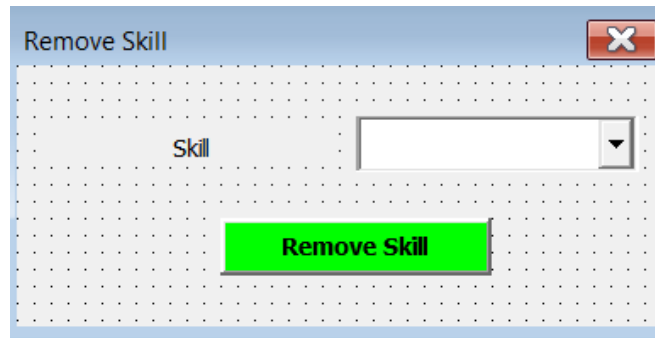

Figure 26 - Remove skill userform

The VBA code for this feature can be found in the *6.1.10 Remove skill feature* in the Annexes. Below in Figure 27, it is presented the workflow for the *Remove Skill* feature.
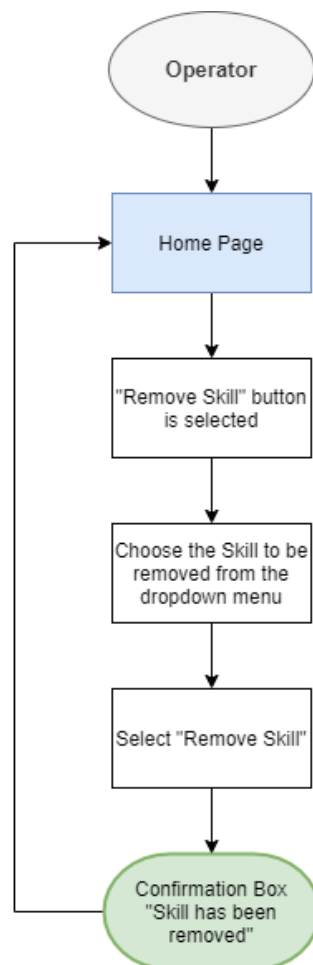

Figure 27 - Flowchart for the remove skill feature

3.4.4.3 Add Employee

It is also indispensable to provide an option to create new employees into the database. Hence, this userform (Figure 28) contemplates the insertion of the employee's name, the team, and the option to introduce the evaluation for each of the available skills. This menu can be launched from the *Home page* or the *Employees and Skills tab*. This user form is placed on the VBA as u*serform12*.
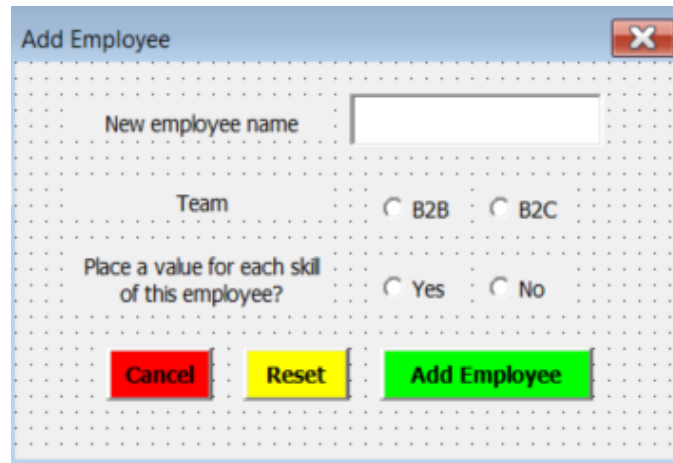

Figure 28 - Userform for adding new employees

The program operator is then able to place a value for each of the existing skills on the database for this newly added employee. It is also possible to jump over this task and assign the values later, but it will be a manual process. Below, in Figure 29 the insertion box for the skills.
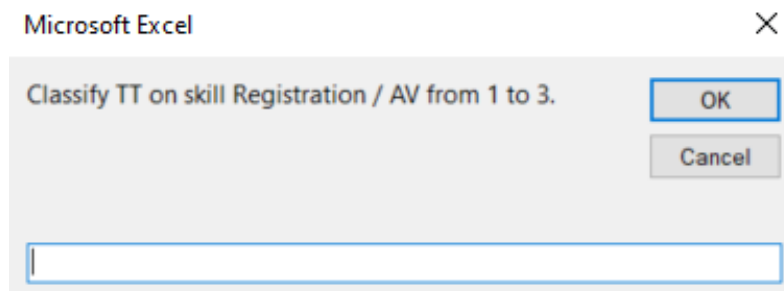
Figure 29 - Classifying new employees on the existing skills

One of the improvements to be added in a future version is to simplify the update of skills for existing employees, as people can improve their skills over time. Nevertheless, this is already possible to be done in the current version of the program but requires some manual steps such as:

- Find the Employee on the "Employees & Skills" table;
- Find the Skill(s) to be updated on the same "Employees & Skills" table;
- Edit the needed skills for the requested employees with the new value.

In Figure 30 it is displayed the flowchart for this feature. The VBA code associated with this functionality can be found in the Annexes inside the *6.1.2 Add Employee Userform*.

Figure 30 - Flowchart for the add employee feature

3.4.4.4 Remove Employee

There is always a turnover of employees in every team and organization, hence, it is important to ensure the option to *R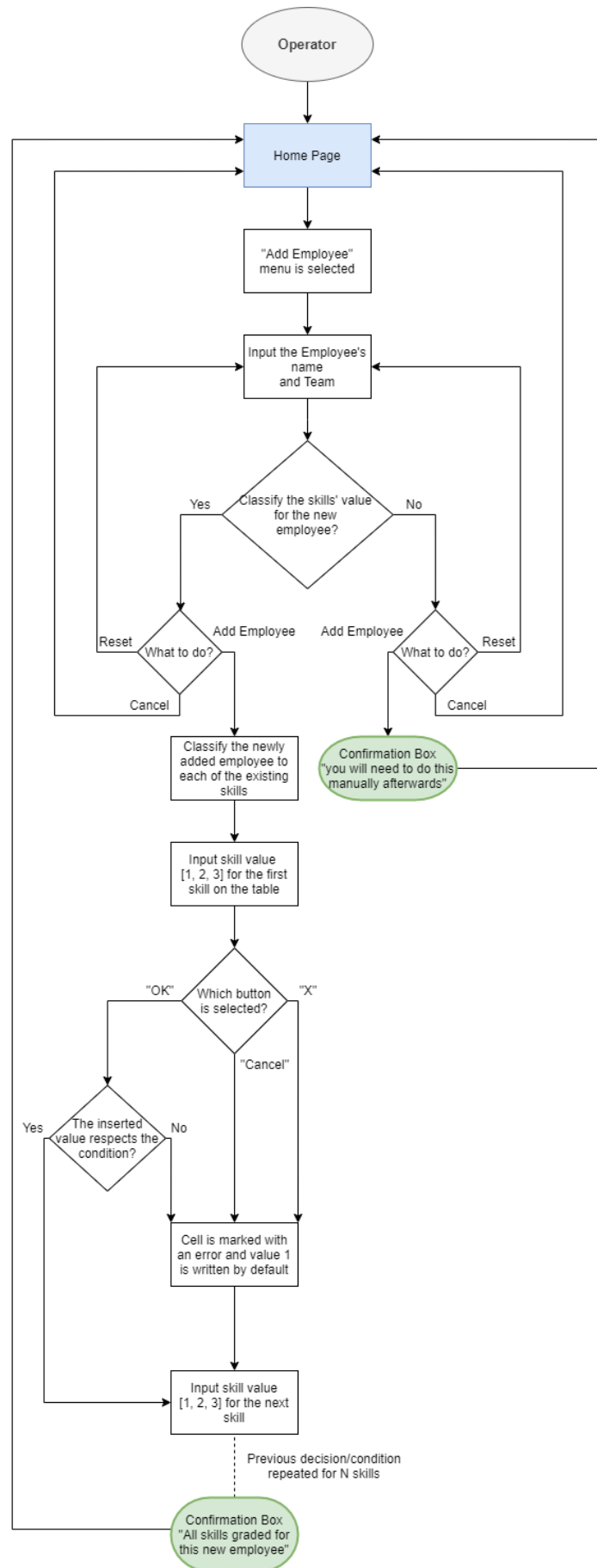emove Employee* (Figure 31) that will allow the managers to keep an updated list of resources. This feature will be connected with the *Smart Reassign* that will be presented later in this work – after removing an employee it is necessary to re-assign the tasks "ongoing" to another resource, ensuring that the task/project is handled and will be completed.
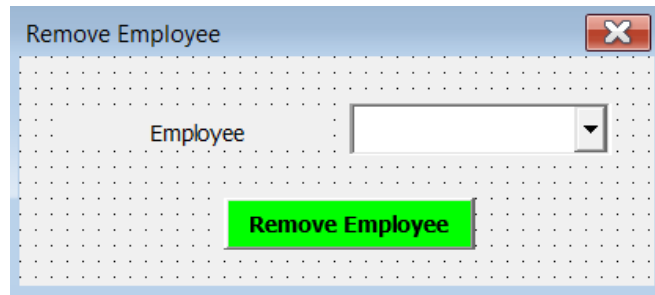
Figure 31 - Remove employee userform

This feature will remove the employee from all relevant tables and it will align the tasks associated with the selected employee in the *Activity Log* tab to alert the manager for the need to use the *Smart Reassign* feature. The VBA code for this feature can be found in the Annexes under *6.1.11 Remove employee feature*. In Figure 32 it is presented the flowchart for this feature.
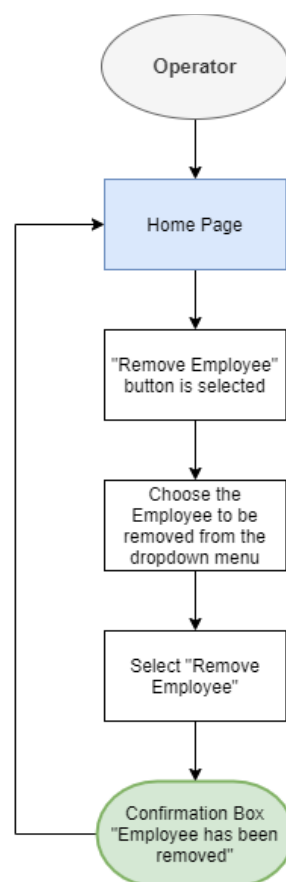
Figure 32 - Flowchart for the remove employee feature

3.4.4.5 Schedule Vacations

In this user form (Figure 33), it is intended to enable the operator to schedule vacations or out-of-office periods for the team members. In the first selection box, it is possible to select the employee and then to introduce the start-date and end-date of the leave.
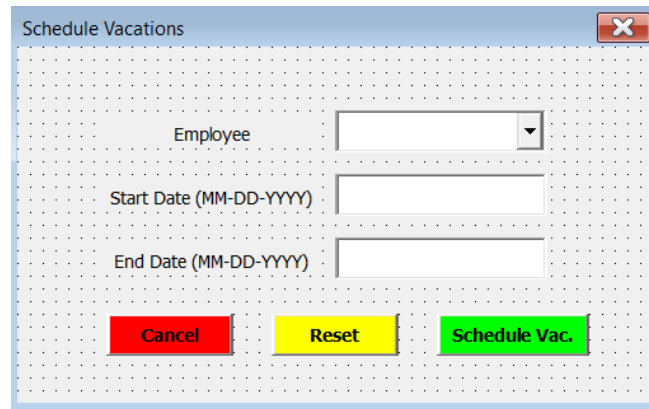
Figure 33 - Schedule vacations user form

The VBA for this user form and respective actions can be found in the *6.1.3 Schedule Vacations user form* in the Annexes. Below, in Figure 34 the Flowchart for this feature.
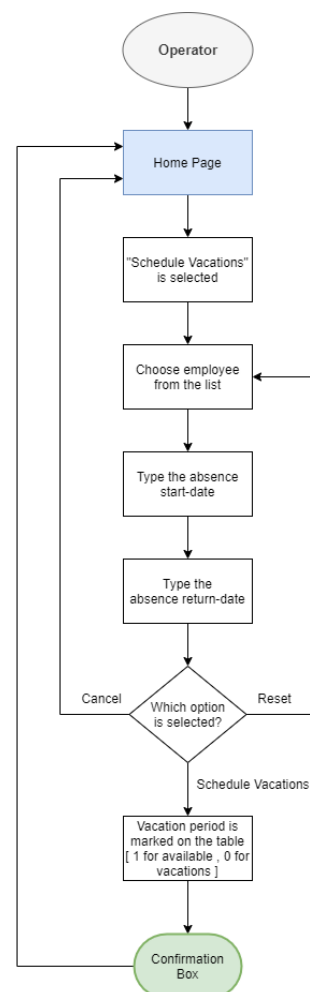
Figure 34 - Flowchart for the schedule vacations feature

3.4.4.6   Cancel Vacations

With this user form (Figure 35), the program operator will be able to cancel the vacations of a certain employee for a specific period.

Figure 35 - Cancel vacations user form

The VBA code for this user form and its actions can be found inside the *6.1.4 Cancel Vacations user form* in the Annexes. In Figure 36 the Flowchart for this feature.
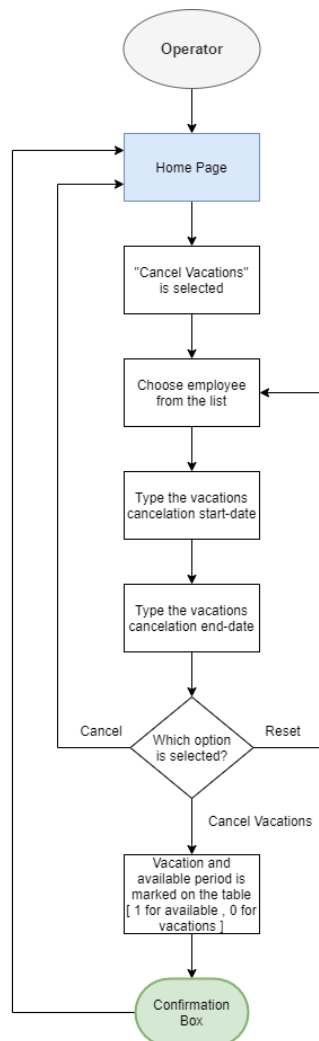
Figure 36 - Flowchart for the cancel vacations feature

3.4.5   Task Management

In the Task Management (Figure 37), it is intended to provide all the options to the operator for correct task management within the team. Here it is possibl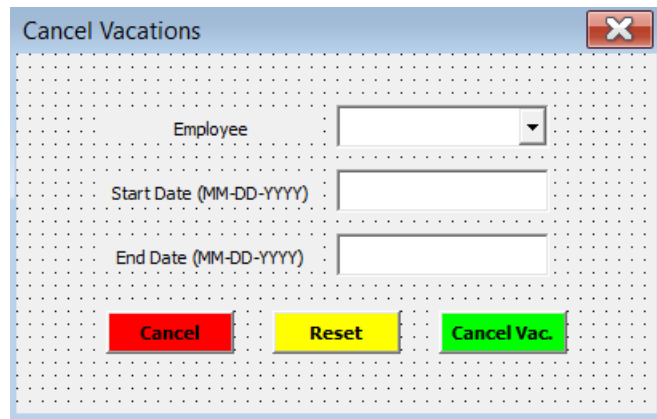e to add new tasks, using the algorithm behind to support the selection of the best option, to re-assign tasks also using the algorithm for a new calculation, selection, and to edit the task's deadline, because the conditions and the deadline may change over time.

Figure 37 - Task management menu options

3.4.5.1   New Task

This feature is one of the core options of the program that relies on a detailed selection of skills and conditions for the task, that will later call the solver – with the algorithm conditions within – to display the best employees to take responsibility for a specified task or project.

This group of options is meant to allow the operator to choose the most suitable employee respecting all the pre-defined conditions, but at the same time, it is flexible to allow him/her to take other decisions considering external factors that may not be contemplated by the allocation algorithm.

The process starts with the display of the Add Task user form (Figure 38), where the operator specifies the task/project name, grade the complexity and priority, defines both allocation and the time-frame.

Figure 38 – Userform for adding tasks

After the user form is completed, it is then possible to "submit", and a second user form will be displayed where the operator needs to select the relevant skills for this task or project (Figure 39). The system will prevent double selection of skills, and allows the selection of one, two, or three skills for the best fit calculation (using the allocation algorithm).

When a new search for the best match is initiated, the allocation algorithm is being called on the background, and through the solver and the VBA conditions, the top suitable employees will be displayed.
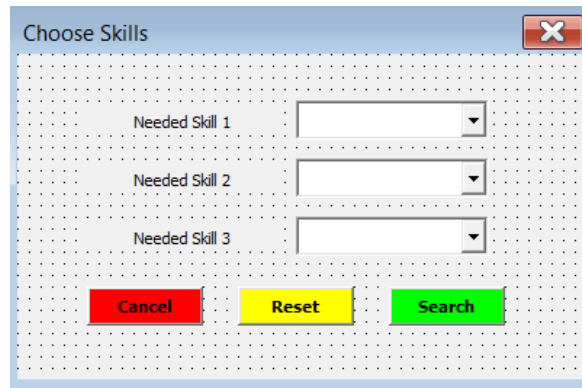
Figure 39 - Userform for skill selection

After the skills are selected (Figure 39) without duplicates, the system is ready to process the allocation algorithm on the background, leading the operator to the final screen of this flow.
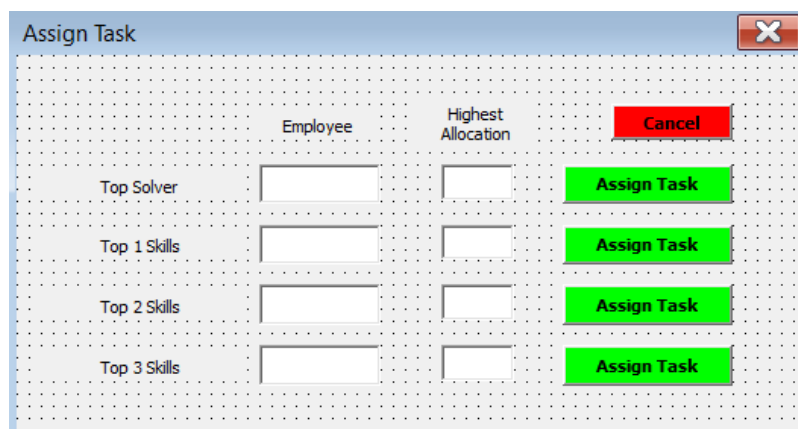
Figure 40 - Userform for task assignment with an algorithm running in the background

In this last userform (Figure 40), the operator will see the name of the employee and the highest work allocation for that same employee in the interval of the task/project that is about to be assigned.

This will allow the operator to make the best decision, as he/she can either go for the top solver (which means, is the best employee based on the conditions of the solver – which respect the conditions and restrictions of the allocation algorithm) or else, he/she can choose to assign the task to another employee (between the top1, top2, top3) even if those employees may not respect the allocation algorithm conditions. The Top Solver and the Top 1 skills may be the same person, this happens if the Top 1 skills also respect the conditions of the allocation algorithm in place. Either case, when reaching this menu the operator has good visibility on the available options.

In the next page, it is presented the workflow for the Task Assignment process. The VBA code for the mentioned user forms and actions can be found in the Annexes under the *6.1.5 New Task feature.* On the next page (Figure 41) the Flowchart for this feature.
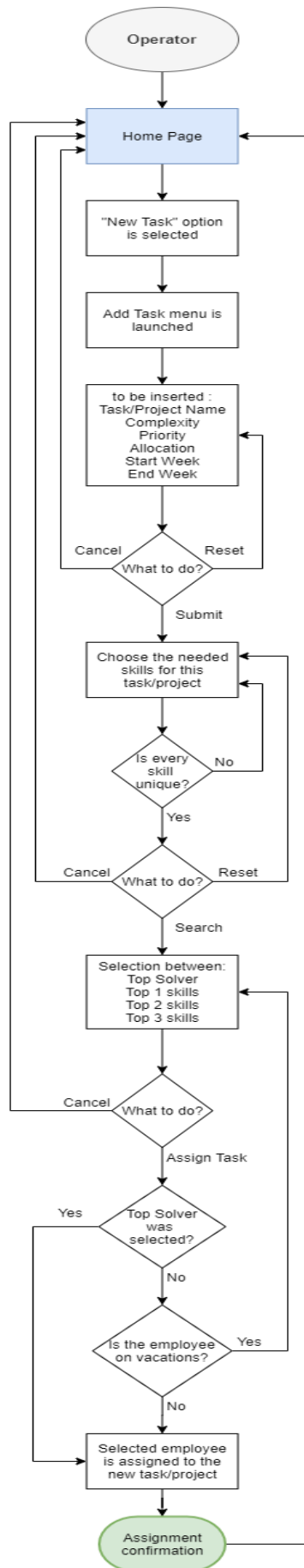
Figure 41 - Flowchart for adding new tasks

3.4.5.2   Re-assign Task

As anticipated, in real-world managers often need to re-assign tasks to their team members. Hence, it was included a complete feature (Figure 42) to ensure that the task can be re-assigned and that this re-assignment process goes in line with the "New Task", ensuring that the allocation algorithm and respective solver is considered throughout the process.
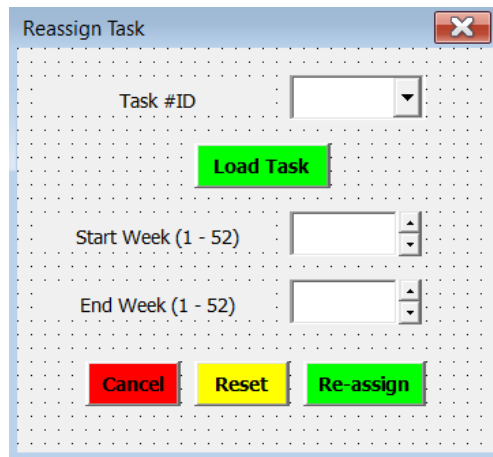
Figure 42 - Userform for re-assigning tasks

The start point of this user form is the select the Task #ID that can be found within the assigned tasks list/table, then the operator will load the task and will see immediately which are the start and end the week of the mentioned task. The next step is to select the new dates (or even if he wants to keep the same dates but just change the employee). The program will then consider the same skills, as the task didn't change in terms of requirements, and it will gently load the solver/algorithm on the background, allowing the operator do choose a new employee. The VBA for this feature can be found under the *6.1.6 Re-assign Task feature* inside the Annexes.
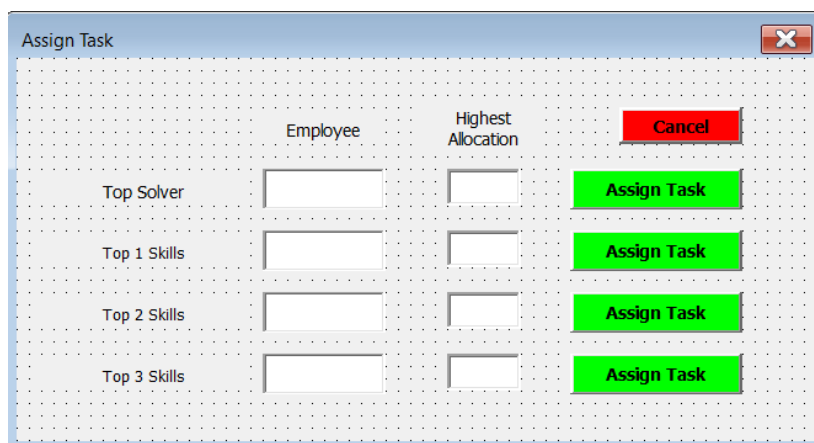
Figure 43 – Userform for assigning tasks

The *Assign Task* for the *Re-assign* (Figure 43) task feature will run through a similar code as the previous *New Task* feature, the difference resides on the need to clean up the previous employee values and to insert the new ones for the selected task (employee, dates, etc). However, the visuals are the same and there is no relevant difference in the flowchart for this step. In Figure 44 the flowchart of this *Re-assign* feature.
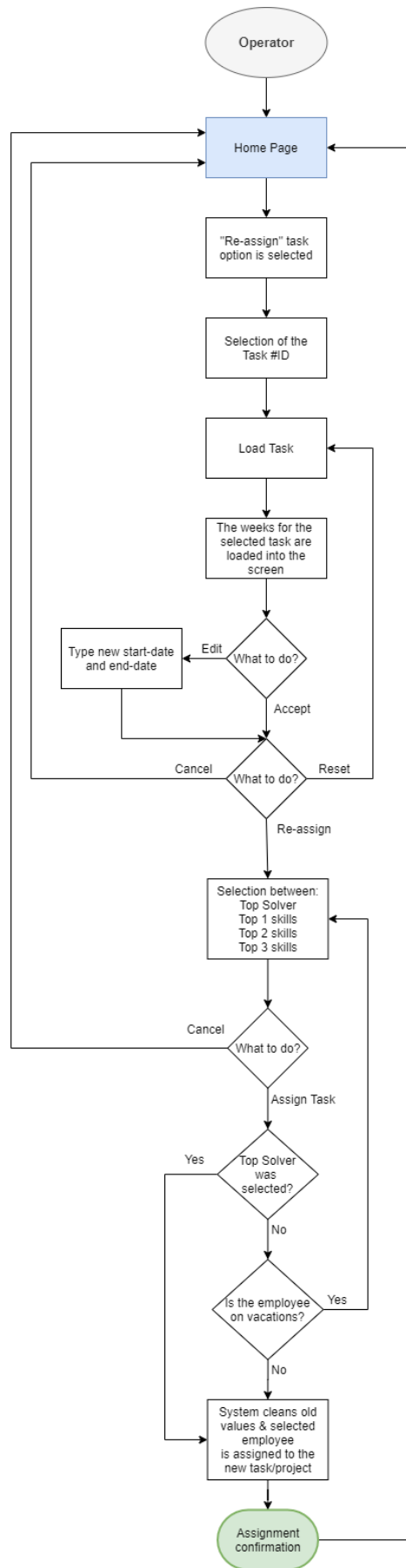
Figure 44 - Flowchart for task re-assignment

3.4.5.3   Change Task Deadline

The objective within this user form (Figure 45) is to allow the operator to change the task/project deadline which is associated with a team member. Thus, it was created an option to load the desired task (by ID) and then display the week interval when it should happen, then the operator will see the current week by default within a new box where it is possible to insert the desired end-week to the task. It is a simple and pragmatic approach to the task deadline rescheduling.
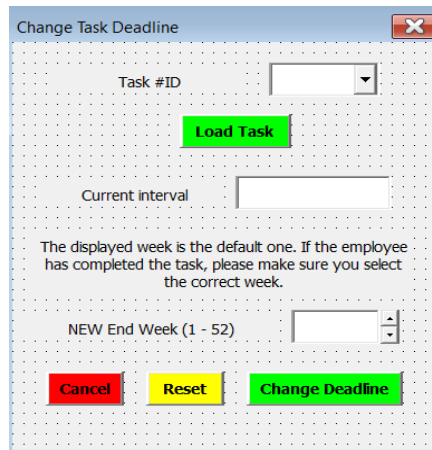
Figure 45 - Change task deadline userform

The respective VBA code for this feature can be found in the Annexes under the *6.1.6.2 Change Task Deadline feature*. Below the workflow for this feature (Figure 46).
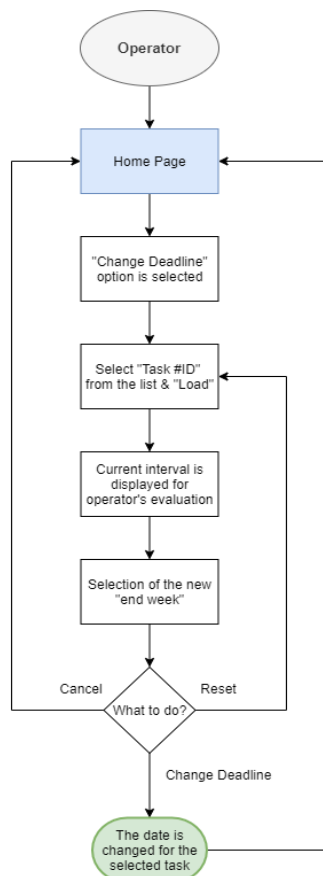
Figure 46 - Change task deadline flowchart

3.4.5.4   Remove Task

This feature exists to allow the manager/program operator to remove tasks from the database. This is useful in different situations, the most common should be the fact that task/projects can be often canceled. The userform for user's interaction can be found in Figure 47.
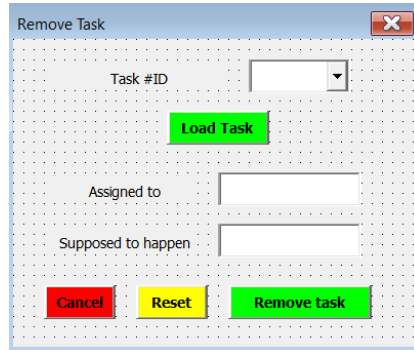
Figure 47 - Remove task userform

The VBA code for this feature can be found in the Annexes under *6.1.12 Remove task feature*. Below, in Figure 48, the Flowchart for this feature.
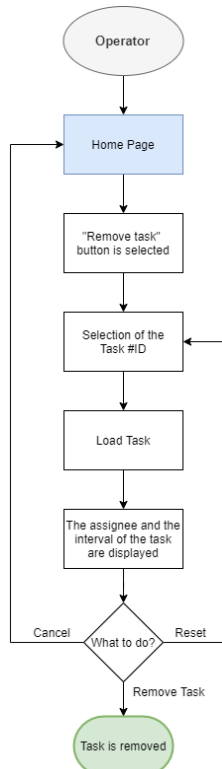
Figure 48 - Remove task flowchart

3.4.5.5   Smart Re-assign

If an Employee has tasks/projects on going when he/she leaves the department, the managers need to re-assign his/her tasks to another person. The system automatically highlights the tasks in need to be re-assigned, and when the button of the Smart Re-assign is selected (Figure 49), the VBA pulls each of those tasks (one by one, top to bottom from the activities' log). The VBA code for this element can be found in the Annexes, under 6.1.13 Smart Re-assign feature. In Figure 50 the flowchart of this feature.
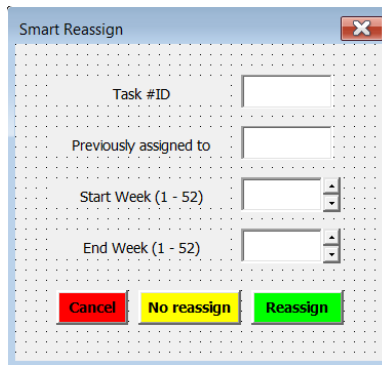
Figure 49 - Smart re-assign userform
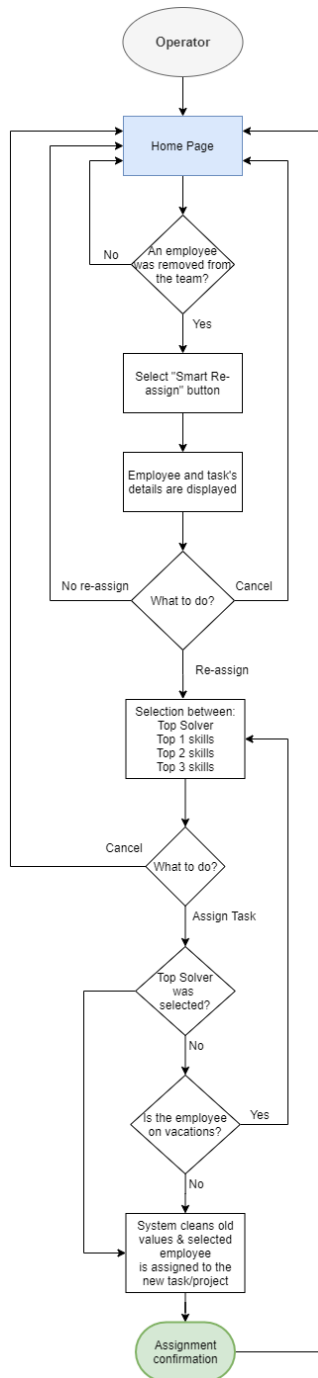
Figure 50 - Flowchart for smart re-assign

3.4.6   Refresh and Reset

The buttons (Figure 51), *Employee-Team (Refresh)* and *Reset All logs (Reset)*, will be part of a hidden page, as they are quite powerful and can jeopardize the normal function of the program – they should only be accessed by knowledgeable operators in case of absolute need. They have been built to ensure data quality. For these features there is no user console/user for, all the actions take place on the backend. The corresponding VBA code for the following can be found under *6.1.7 Refresh and Reset features*.

Employee-Team Refresh	Reset All logs (Activity-Ocupation-Vacations-Solver-Reports) / Reset Tool

Figure 51 - Refresh and reset options

3.4.6.1   Employee and Team Refresh

The *Employee and Team Refresh* button (Figure 51) was created to cover some specificities of the organization, where employees may migrate across teams – which would request a manual edition of all values/entries associated with a certain team member. Then it was decided to build a feature to allow the program to refresh the team and employee references when something is changed on the employee's table. Even if the code was built to ensure an auto-refresh of the date, when any type of edit occurs, it was considered safer – due to the many implications of the employee across different tables – to ensure the "force refresh". The corresponding flowchart is displayed in Figure 52.
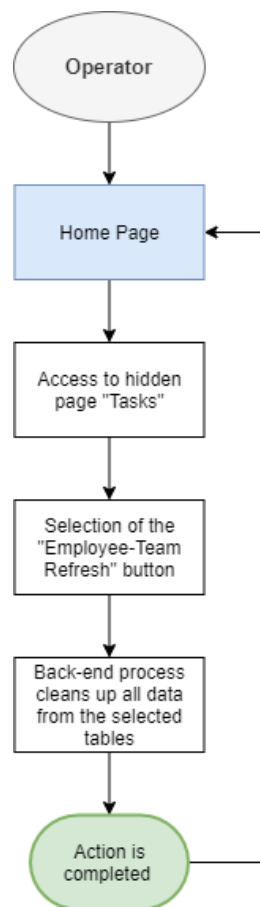
Figure 52 - Employee and team refresh flowchart

3.4.6.2   Reset all logs

Differently, the *Reset all logs* button (Figure 51) was built to ensure the complete reset/clean up of the occupation table, vacations table, solver values, and the reports logs – it can be considered a soft program reset. The respective flowchart can be found in Figure 53.
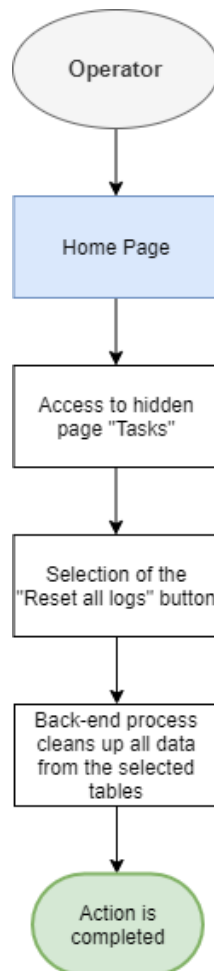
Figure 53 - Reset occupation, vacations, solver and reports flowchart

Nevertheless, this reset feature needs to be used with caution, it is recommended to be kept hidden from regular operators, as it is quite powerful and if wrongly used can create data losses. For this reason, those buttons will be hidden from regular users and will be only available to the developers.

3.4.7   Status and Reporting

The next menu is dedicated to Status and Reporting (Figure 54). It was considered relevant to include the reporting to allow the managers to quickly obtain a view on the workload and status for each employee, team, and per week.

It is important to refer that this is a highly configurable feature, in which, it is possible to add further reporting on-demand – with some VBA development.

In Annexes under the *6.1.8 Status and Reporting feature,* it is possible to find all the VBA behind the three mentioned reports.

Status	Empl.&Week(s)-based Report	Team&Week(s)-based Report	Week(s)-based Report
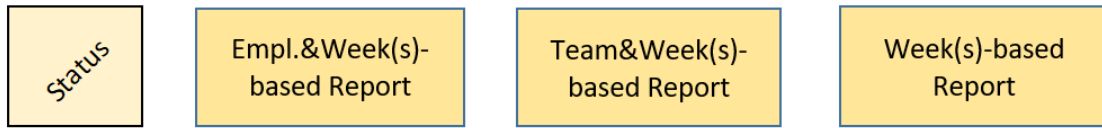
Figure 54 - status and reporting features

3.4.7.1 Employees vs Week Report

With this feature, it is possible for the operator to quickly generate a report based on the employee and a week interval (start weekend week). Quickly and simplistically, the program operator can select from a sliding menu what is the employee to be "reported" and then from the previous selection boxes (that will present the current week by default) it will be able to choose the report time-frame.

The subsequent information will be displayed in a table (Figure 55) and within a pie graphic (Figure 56), which allows the manager to have a quick view of the load generated by each task.

Employee&Week(s)-based Report					
Today	31.07.2020	**Week(s)**	1 to 52	**Av. Ocupation**	2%
Employee	YD	**Team**	B2C	**Tasks No**	3
ID	**Name**	**Complexity**	**Priority**	**Ocupation p/ W**	**Lenght**
2	VBA	3	3	50%	1
8	Making it	2	2	50%	6
11	Development	1	3	10%	5

Figure 55 - Sample of the report output (table)

In Figure 56 the inputted data, plus the average occupation (which is the result of the sum of the occupation divided by the full interval length), and also all the details about the tasks and employee. Below it can be seen the input menu for report creation and an example of the pie chart. In Figure 57 the Flowchart of this reporting feature.
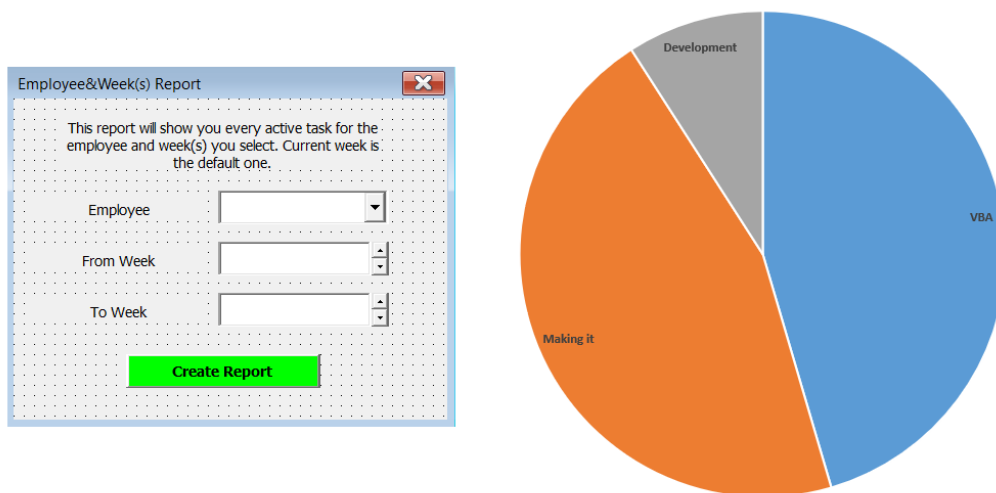
Figure 56 - Employee vs week menu and pie chart example
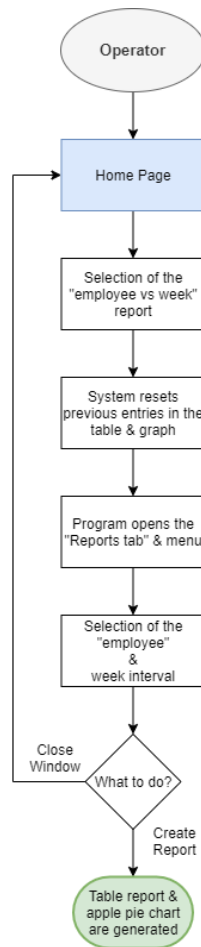
Figure 57 - Employee vs week report flowchart

3.4.7.2   Team vs Week Report

As displayed in Figure 58, the report considers the team and the time interval. This is useful for the managers to have an overview of how the team is doing overtime, for further accuracy the previous report can be used, per employee, or the one we will explore next, per week. It is possible to do the reporting one team at the time or both together.
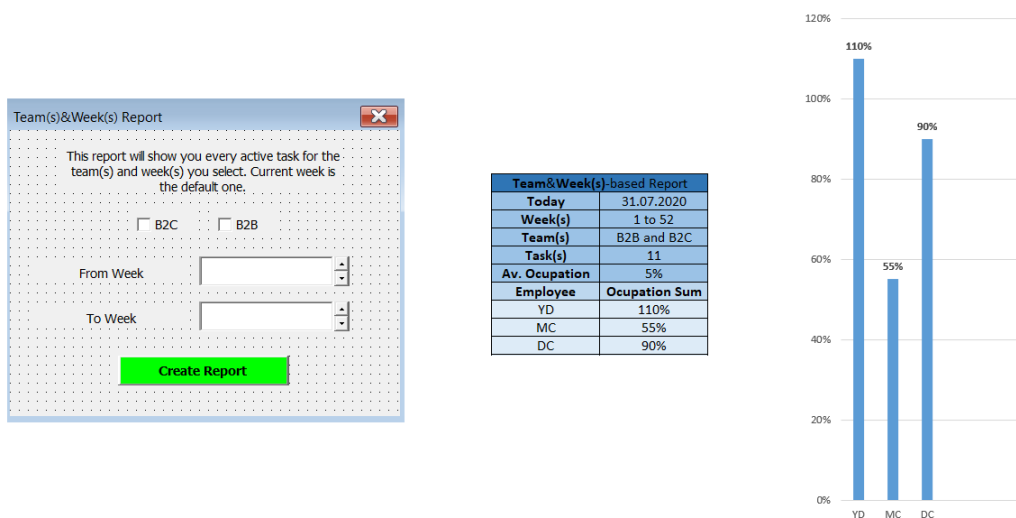
Figure 58 – Input menu, report table, and bars graph

In Figure 58 it is visible the information coming from the input menu plus the average occupation of the employees of the selected team (in this case both teams where selected, and the average is the sum of occupation divided by the number of weeks in the interval). The bars graphic shows the total occupation in the interval per employee. In Figure 59 the corresponding flowchart.
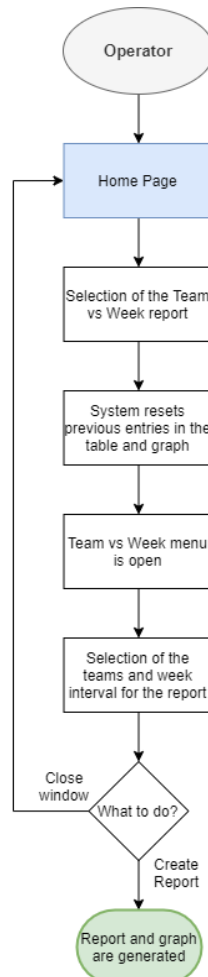
Figure 59 - Team vs week report flowchart

3.4.7.3 Week Overview Report

In this feature (Figure 60) it is possible to generate a report per week that will include all teams for all employees, considering the interval being reviewed. It works in line with the previous two reports but having a wider display and a more generalistic overview in table format.
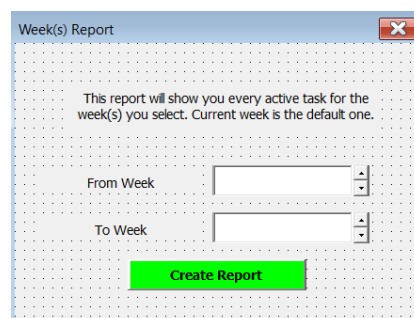
Figure 60 - Week based report menu

Week(s)-based Report									
Today	31.07.2020			Week(s)	1 to 52			Task(s)	11
Employee	Team	ID	Name	Complexity	Priority	Ocupation p/ W	Start Week	Lenght	End Week
YD	B2C	2	VBA	3	3	50%	45	1	45
MC	B2B	3	Excel	2	2	40%	50	6	3
DC	B2C	4	Numbering	3	3	10%	1	15	15
DC	B2C	5	Last one	3	3	15%	50	5	2
DC	B2C	6	Investimentos	3	1	50%	50	30	27
MC	B2B	7	test	2	2	10%	1	5	5
YD	B2C	8	Making it	2	2	50%	50	6	3
MC	B2B	9	test1	2	3	5%	3	1	3
DC	B2C	10	Testing2	2	2	10%	1	3	3
YD	B2C	11	Development	1	3	10%	1	5	5
DC	B2C	12	Deployment	1	2	5%	1	3	3

Figure 61 - Week overview table

In this table (Figure 61), we can see the report date, the week's interval, and the total of tasks. Then, we have the list of all employees and tasks occurring in that interval, ordered by ID. This table provides a generalistic overview and it can be useful to track the work of the whole team, week by week. Below, in Figure 62, the flowchart for the week-based report.
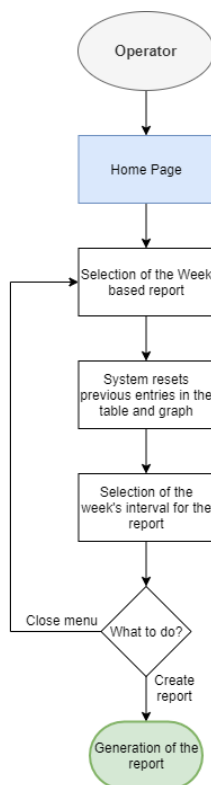
Figure 62 - Week based report flowchart

3.4.8   Program Tabs

In this section, it is intended to present all the pages that exist on the document, although part of them will be hidden from the operator as they are used to record logs or to calculate/run the allocation algorithm. Therefore, a presentation of each page will be done alongside with its utility on the program. All the VBA embedded into the pages can be found under *6.1.9 Tabs and Pages*, on the Annexes part of this work.

3.4.8.1   Home

In the *Home tab* (Figure 20), we have the program menu, where the operator can launch different functionalities. This page will work often as the start/end of the flow for most of the features.

3.4.8.2   Employees & Skills

In this tab, it is possible to find the full log of the employees and skills recorded on the DataBase (Figure 64). Here it is also possible to run two of the commands that are linked with the displayed tables – *Add/Remove Skill, Add/Remove Employee* – these buttons are displayed on this page to facilitate the operators' management of this tab. This tab, due to its utility for tracking proposes should be visible to all operators by default.

Add Skill	Add Employee					
Remove Skill	**Remove Employee**					
Employee		DC	FM	SC	EP	MC
Skills / Teams		B2B	B2C	B2B	B2B	B2C
Registration / AV		3	3	3	3	3
Try at home		2	2	2	2	2
Guided trial		1	1	1	1	1
Physical lending		3	3	3	3	2
EMGM		2	2	2	2	3
MGM		1	1	1	1	2
IQOS Give (Device upgrade)		3	3	3	3	2
IQOS club		2	2	2	2	2
360 view		1	1	1	1	1
Device exchange		3	3	3	3	2
Direct Online sales		2	2	2	2	2
Direct Offline sales		1	1	1	1	2

Figure 63 - Table and buttons inside the employees & skills tab

3.4.8.3   Activity Log

Within this tab, the program records all the tasks and projects that exist on the DataBase (Figure 65). In this tab it is also possible to trigger four different features/controls that are deeply connected to the Activities – *New Tasks, Re-assign Tasks, Change task deadline, Remove task, and Smart re-assign*. The existence of those buttons was considered to simplify the flow in specific conditions if the operator is already consulting this tab he/she does not need to return to the main page to be able to run any of the associated features.

New Task	Reassign Task	Change Deadline	Remove Task	Smart Reassign								
Employee	ID #	Team	Name	Complexity	Priority	Ocupation %	Start week	Lenght	End week	Skill 1	Skill 2	Skill 3
DC	2	B2B	test	Medium	Medium	20	35	11	45	Try at home	EMGM	
DC	3	B2B	test	Medium	Medium	20	36	5	40	Try at home		
FM	4	B2C	test	Medium	Medium	20	36	15	50	Registration / AV		

Figure 64 - Activity tab with table values and control buttons

3.4.8.4   Occupation Log

In this tab, the system records the occupation of the employees (Figure 66). The value starts at 0 (0%) if no occupation at all, and usually it goes up to 1 (100%), hence the value can be higher if there is an over-allocation for a specific employee. This tab may be hidden from the operator as he/she does not need to consult or interact with it in normal circumstances.

Employee	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
DC	0	0	0	0	0	0	0	0	0	0	0	0	0
FM	0	0	0	0	0	0	0	0	0	0	0	0	0
SC	0	0	0	0	0	0	0	0	0	0	0	0	0
EP	0	0	0	0	0	0	0	0	0	0	0	0	0
MC	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 65 - Table inside the occupation log that records the occupation per employee per week

3.4.8.5   Vacations log

Here it will be displayed the log of the vacations per employee and week. There is also a continuous record table displaying the start-date and end-date of the latest vacation period. The values on this table take the values 0 for absent, and 1 for in duty. Those values are relevant as they allow to validate one of the conditions of the allocation algorithm – that will ignore the employee if he/she is on vacation. Also in this tab, there are the two buttons that allow the operator to directly run the schedule vacations or cancel vacations.

This tab can be either hidden or displayed depending on the specific needs of the management. In Figure 67, it is possible to see the table and the action buttons are displayed within the tab.

Schedule Vacations		Cancel Vacations															

	Vacations Automizer																
Employee	Start Date	Start Week	End Date	End Week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
DC		0		0	1	1	1	1	1	1	1	1	1	1	1	1	1
FM		0		0	1	1	1	1	1	1	1	1	1	1	1	1	1
SC		0		0	1	1	1	1	1	1	1	1	1	1	1	1	1
EP		0		0	1	1	1	1	1	1	1	1	1	1	1	1	1
MC		0		0	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 66 - Vacations log table and action buttons

3.4.8.6   Solver

Here is where the solver and allocation algorithm is automatically filled up, calculated, and run (Figure 68), it includes several tables and the list of restrictions to be used in the solver. This tab will be hidden for the operator of the program as what happens within is purely automated. It records the values and allows the edition of the restrictions and solver if needed.

SOLVER AND DATA COLLECTION

Needed skills to complete the task	
Registration / AV	1
	89
	89

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sij	DC	FM	SC	EP	MC	0	0	0	0	0	0	0	0	0	0	0
Sum of Registration / AV + +	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0

Top 1 Skills	3	DC
Top 2 Skills	3	FM
Top 3 Skills	3	SC
Top Solver	DC	

Ocupação da tarefa para as semanas indicadas	
Pk	0,2

Val = 1 , if task to take place in this week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17
Yjk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 67 - Solver tab, where the allocation algorithm feeds himself and from where the solver runs

3.4.8.7   Reports

In this tab (Figure 69), it is possible to consult and create reports, the reports can be also launched from the home page. This is mostly a view tab and it will be visible for the operators as it is the way for them to consult the information given by the reports.
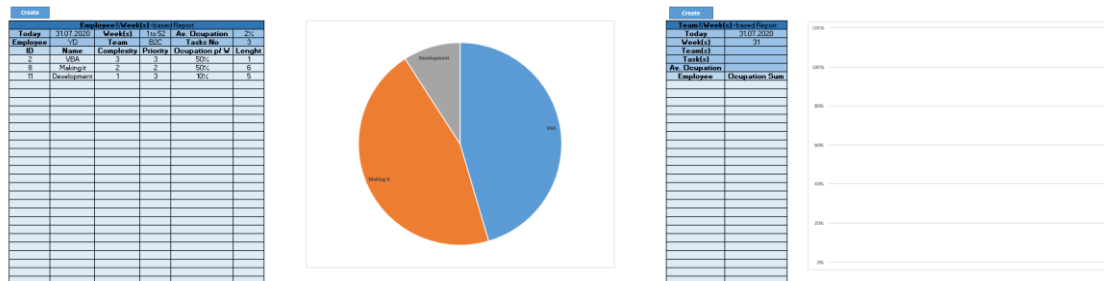

Figure 68 - Reports tab, information and manual creation

3.4.8.8   Task

In this tab, the program will record everything that happens on the Activity tab (Figure 70). This allows the operator to keep track of the Activities' allocation and also to know when a certain task was created, edited, and so on. This tab will be hidden from the operator and will only be consulted in very specific situations, such as inspections or issue-tracing.

Employee	ID #	Team	Creation Date	Last Edition	Complexity	Priority	Ocupation %	Start week	End week
DC	2	B2B	29.8.20 5:21 PM	29.8.20 5:24 PM	Medium	Medium	20	35	45
DC	3	B2B	30.8.20 1:13 PM		Medium	Medium	20	36	40
FM	4	B2C	30.8.20 1:15 PM	30.8.20 2:12 PM	Medium	Medium	20	36	50

Figure 69 – Refresh and reset buttons and the activities history

3.5   Critical Analysis of the Obtained Results

The project management and activity's management have been considered in the past as purely technical subjects, nevertheless, the conclusions of the work of Lopes *et al.* (2016) tell us that noways they should be embedded into the organization's strategic plan, thus, it was important to keep that in mind during the development of the Allocation Algorithm and the Excel/VBA program. More than a tool that improves efficiency from the management's point of view, it also permits to quickly give visibility of what is happening in the department and what are the constraints or possible bottlenecks.

Thus, it was possible to validate through implementation what was stated in the mentioned work, as the organization's managers have confirmed within the first weeks of use of the program that it greatly facilitates their overview of the team status and allows them to improve their self-organization and team management. In conclusion, giving better and suitable tools to the managers permits the integration of project management activities into the organization's strategic plans. Yu *et al.* (2013) refer in their work that the constant changes on the project's scope can cause organizational resistance and reduce performance, and therefore it is required to have a better overview of what is going on, and a more flexible re-assignment of activities to the right people when the requirements change in the middle of the project.

Aligned with this article, the developed program allows the managers to have a clear view on which skills are being used, what is the time consumption for each task or activity, and which are both start-date and expected deadlines for each project or task. Hence, the allocation algorithm and the Excel/VBA program allows the management to reduce the organizational stress – by ensuring clear reporting and available status – to improve the performance, by ensuring the correct allocation of the best person to each task, and also ensuring the possibility to re-schedule the deadlines and even to re-assign different employees to a certain task – always considering their skills and the specific requirements of the task or activity.

When comparing to the work of Fang (2015), where it is being used the data envelopment analysis framework to measure the performance of resource allocation under a centralized environment, or with the work of Rudek and Heppner (2020) where it is used a discrete resource allocation with digressively proportional constraints, it is clear that the proposed Allocation Algorithm for this work is less multifaceted. That was a manifested decision, as the scope of this project is less complex than others in the literature. However, it was meant to be like this as the goal of this work was to decomplexify the algorithm so it will only contain the restrictions that are truly relevant for the allocation challenge in question. Also, the more complex it is the less flexible it will be in terms of change requests from the management team, as it would be a bigger nest of interrelated conditions and which would also increase the required time to implement any changes or small improvements. As a resume, it was intended to have an allocation algorithm that is as simple as possible, including all the critical requirements and conditions for a good function of the program – working and useful software that can be evolved on demand. Otero *et al. (2008)* have done an amazing allocation work by applying the Best-Fitted Resource as a systematic approach do decide the best match between the needed skills for a certain task and the skills of the available employees. Yet, in their work, it is not taken into consideration the specificities of the project (such as Priority and Complexity being used in this work). Also, Kang *et al.* (2011) developed an impressive work of constraint-based allocation for human resources within software projects, yet their work seems to start to over complexify the challenge and they got some bottlenecks while trying to put the model into practice – in real-life situations. Contrary to those two studies, the present allocation algorithm and Excel/VBA program are less complex but fully applicable and scalable in the middle and long term, as the program can include new features and the algorithm can be easily configured to contain more or different constraints.

In this work, one of the main objectives was to solve a very specific allocation challenge within the organization, while building the foundations for new features and more complex sets of data or algorithms, to be included if they are truly needed. As stated by *Sanchez et al.* (2017), adopting individual practices is not sufficient to ensure the project management success of IS/IT projects. Therefore, it is important to provide one additional tool that can be summed to the whole, and not an attempt to deliver a holy grail that will solve all organization's problems by using this single tool. The presented solution is a simple, flexible, and it is a solid tool that supports the organization by solving the difficulties of resource allocation on different types of activities. Likewise, it is usable alongside other best-practices and methodologies, promoting relevant improvements in the organization's capacity to efficiently and effectively develop and deliver projects.

CONCLUSIONS

4   CONCLUSIONS AND PROPOSALS OF FUTURE WORKS

4.1   CONCLUSIONS

An efficient allocation of human resources to all sorts of activities, and the management of those same human resources over time, proved to be a significant challenge, mostly when in a rapidly changing environment, where time is gold and the costs of inefficiency can be enormous. This work intended to solve real-life challenges, through an extensive revision of the literature and bench-marking of Project Management methodologies and off-the-shelf software. There were several discussions with the management and with the team members, which sponsored the constant revision of the tool that intends to improve the organization's efficiency and efficacity.

Table 10 – Objectives' revision and conclusions

Objectives	Conclusions	Evaluation
Acquire knowledge from reviewing the literature, in terms of Project Management, Allocation, and Analysis Tools.	Through the study of the literature, it was possible to enhance the knowledge of the core issues of this work, which is also reflected in the quality of the outcomes.	✔
Analyze and review the challenges faced by the managers and by the team.	This was a very interesting stage, as it allowed the author to perform a self-review of the executed tasks, and the common activities of the team. In the end, there is a better understanding of what is relevant for the management and what is imperative to be improved.	✔
Analysis of the current state of activities through the usage of different tools, boards, flowcharts, and diagrams.	Using the SWOT, Ishikawa, and flowcharts it was possible to identify the pain-points of the current process and also to have a clear view on which direction to follow in terms of solution development.	✔
Investigation and bench-marking of which are the best practices to fight this kind of challenge and which kind of technology can be used to provide a suitable solution.	Starting with Excel to handle some relevant data, which has been collected from the previous investigations, then started using the VBA ensuring correct data management and positive user experience in terms of features and tools that are made available inside the program.	✔
Supply a tool to the organization that can be used for the management of human resources, allocation of activities, and reporting.	A full-stack solution was developed which includes correct management of the employees and skills. The program also has embedded a tailored-fit allocation algorithm and a vast group of options and reports that are valuable for the management.	✔

After the development and release of the final version of the program, it was observed with much joy that the results went way above the initial expectations. A small example is the introduction of a *Home Page* that allows the operators to launch any command from the same page, and which works also as an end-point for most of the features/flows, ensuring a flawless cycle. In addition to studying, reviewing, presenting the problems and possible solutions, this project achieved something remarkable – the development of a fully customized tool which was developed converging to the specific needs of the organization and that includes a tailored-fit allocation algorithm that allows a mathematical selection of who is the best person for each task. Besides the obvious advantages that are brought to the management in terms of visibility, time-saving and cost-saving, it is also imperative to mention that the team members are also benefited, as they are now able to organize their tasks and projects more efficiently, knowing which are the relevant skills for each activity and which are the expectations of the management for each task or project.

More than four dozens scientific articles, several books, and over a dozen websites and online documentation have contributed to this dissertation. They have been read, reviewed, and quoted all through this work. Over one hundred hours were spent coding, reviewing menus, tables, user forms, and testing each feature, proved to be a rewarding effort as the results speak for themselves - in terms of usability, features, and real-life application. Overall, it was a long period of work-weeks with 80 hours, where the personal challenge was immense, but also the learning. This dissertation genuinely contributed to increasing the author's knowledge of the referred subjects and paved the way for new efficiency and efficacity improvements in the team and organization.

4.2   PROPOSALS OF FUTURE WORKS

Human resources allocation to tasks and projects is a theme that can and should be further explored, numerous improvements can be achieved by integrating new and more complex mathematical algorithms, through the usage of AI (Artificial Intelligence), by using different digital tools and through many other technological advances.

Consequently, the program that was developed as a result of this work, and the incorporated allocation algorithm can still be improved. Mostly, there are two areas where possible improvements are more obvious:

- The algorithm can be more complex, including additional scenarios and restrictions;
- The program itself can be further developed within different platforms, and with a different user interface, it can also be implanted in the *Cloud* so it can be scalable to more teams or organizations.

Those will request additional investigation, the collaboration of professionals from mathematics and digital areas, extra costs, and revision of the organization(s) requirements and expectations.

This work is just a contribution to the brave new world of Project Management and Human Resources Allocation, creating user-friendly instruments that can enhance the potential of the employees and organization.

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SOURCES OF INFORMATION

5 REFERENCES AND OTHER SOURCES OF INFORMATION

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ANNEXES

6 ANNEXES

6.1 Visual Basic program

6.1.1 Add skill user form

6.1.1.1 Add skill button

```vba
Private Sub CommandButton1_Click()
Dim i, u As String

Sheet1.Activate
Range("C5").Activate

 Do Until ActiveCell = blank

   ActiveCell.Offset(1, 0).Activate

 Loop

ActiveCell = TextBox5.Value

ActiveCell.Offset(0, 1).Activate

' GroupName = ClassSkill

 If OptionButton3.Value = True Then i = "y"
 If OptionButton4.Value = True Then i = "n"

If (i = "y") Or (i = "yes") Then

 Do Until ActiveCell.Offset(-1, 0) = blank
 Unload Me

   Do Until ActiveCell.Offset(-1, 0) = blank
      ActiveCell.Offset(-1, 0).Activate
   Loop

   u = ActiveCell

   Do Until ActiveCell.Offset(1, 0) = blank
      ActiveCell.Offset(1, 0).Activate
   Loop
```

```
  ActiveCell.Offset(1, 0) = InputBox("Classificate " & u & " on skill " & TextBox5.Value & " from 1
to 3.")
   If ActiveCell.Offset(1, 0) = blank Or ActiveCell.Offset(1, 0) > 3 Or ActiveCell.Offset(1, 0) < 1
Then
      ActiveCell.Offset(1, 0) = "1"
      ActiveCell.Offset(1, 0).Interior.ColorIndex = 40
   End If


  ActiveCell.Offset(0, 1).Activate


  Loop


  MsgBox "All employees have been graded on this skill (" & TextBox5.Value & ").", vbInformation


Else
 Unload Me
 MsgBox "That's fine. However. you will have to do it manually and before adding a new skill!",
vbExclamation


End If


End Sub
```

6.1.1.2   Reset button

```
Private Sub CommandButton2_Click()
TextBox5.Value = ""
OptionButton3.Value = False
OptionButton4.Value = False
End Sub
```

6.1.1.3   Cancel button

```
Private Sub CommandButton3_Click()
Unload Me
End Sub
```

6.1.2   Add employee user form

6.1.2.1   Add employee button

```
Private Sub CommandButton1_Click()
Dim i, n, s As String


Sheet1.Activate
```

```
Range("C4").Activate

 Do Until ActiveCell = blank

   ActiveCell.Offset(0, 1).Activate

 Loop

ActiveCell = TextBox5.Value

' GroupName = Team

 If OptionButton1.Value = True Then ActiveCell.Offset(1, 0) = "B2B"
 If OptionButton2.Value = True Then ActiveCell.Offset(1, 0) = "B2C"


ActiveCell.Offset(2, 0).Activate

' GroupName = ClassColab

 If OptionButton3.Value = True Then i = "y"
 If OptionButton4.Value = True Then i = "n"


If (i = "y") Or (i = "yes") Then

  Do Until ActiveCell.Offset(0, -1) = blank

  Unload Me

   Do Until ActiveCell.Offset(0, -1) = blank
      ActiveCell.Offset(0, -1).Activate
   Loop

   s = ActiveCell

   Do Until ActiveCell.Offset(0, 1) = blank
      ActiveCell.Offset(0, 1).Activate
   Loop

  ActiveCell.Offset(0, 1) = InputBox("Classify " & TextBox5.Value & " on skill " & s & " from 1 to
3.")
   If ActiveCell.Offset(0, 1) = blank Or ActiveCell.Offset(0, 1) > 3 Or ActiveCell.Offset(0, 1) < 1
Then
      ActiveCell.Offset(0, 1) = "1"
```

```
      ActiveCell.Offset(0, 1).Interior.ColorIndex = 40
   End If
```

```
  ActiveCell.Offset(1, 0).Activate
```

```
  Loop
```

```
  MsgBox "All skills have been graded for this employee (" & TextBox5.Value & ").",
vbInformation
```

```
Else
```

```
   MsgBox "That's fine. However, you will have to do it manually before adding a new
employee!", vbExclamation
End If
 Unload Me
End Sub
```

6.1.2.2   Reset button

```
Private Sub CommandButton2_Click()
TextBox5.Value = ""
OptionButton1.Value = False
OptionButton2.Value = False
OptionButton3.Value = False
OptionButton4.Value = False
End Sub
```

6.1.2.3   Cancel button

```
Private Sub CommandButton3_Click()
Unload Me
End Sub
```

6.1.3   Schedule vacations user form

6.1.3.1   Schedule vacations button

```
Private Sub CommandButton2_Click()
ComboBox1.Value = ""
TextBox2.Value = ""
TextBox1.Value = ""
End Sub
```

```
Private Sub CommandButton3_Click()
```

```
Unload Me
End Sub

Private Sub CommandButton4_Click()

Dim n As String
Dim s, e, i, ec As Integer

 Range("C4").Activate

 n = ComboBox1.Value

 Do Until ActiveCell = n

  ActiveCell.Offset(1, 0).Activate

  Loop

   ActiveCell.Offset(0, 1) = TextBox1.Value
   ActiveCell.Offset(0, 3) = TextBox2.Value

   s = ActiveCell.Offset(0, 2)
   e = ActiveCell.Offset(0, 4)

If s <= e Then

   ' WRITE 0s on SPECIFIC EMPLOYEE STRING

   Do While s <= e

   ActiveCell.Offset(0, s + 4) = "0"
   s = s + 1

   Loop

   ' WRITE 1s on SPECIFIC EMPLOYEE STRING

   Range("C4").Activate

   Do Until ActiveCell = n

   ActiveCell.Offset(1, 0).Activate

   Loop
```

```
    ActiveCell.Offset(0, 5).Activate

  For i = 0 To 51 Step 1

   If ActiveCell = "0" Then

     ActiveCell = "0"

    Else

      ActiveCell = "1"

    End If

      ActiveCell.Offset(0, 1).Activate

   Next i

Else

  ' WRITE 0s on SPECIFIC EMPLOYEE STRING

  Do Until s = 53

  ActiveCell.Offset(0, s + 4) = "0"
  s = s + 1

  Loop

  ec = 1

  Do Until ec = e + 1

  ActiveCell.Offset(0, ec + 4) = "0"
  ec = ec + 1

  Loop

  ' WRITE 1s on SPECIFIC EMPLOYEE STRING

  Range("C4").Activate

  Do Until ActiveCell = n

  ActiveCell.Offset(1, 0).Activate
```

```
    Loop

    ActiveCell.Offset(0, 5).Activate

   For i = 0 To 51 Step 1

    If ActiveCell = "0" Then

      ActiveCell = "0"

    Else

      ActiveCell = "1"

    End If

     ActiveCell.Offset(0, 1).Activate

   Next i
End If

   MsgBox "Vacations scheduled for " & ComboBox1.Value & " successfully.", vbInformation
   Unload Me
End Sub
```

6.1.3.1.1   Schedule vacations reset button

```
Private Sub CommandButton2_Click()

ComboBox1.Value = ""
TextBox2.Value = ""
TextBox1.Value = ""

End Sub
```

6.1.3.1.2   Schedule vacations cancel button

```
Private Sub CommandButton3_Click()

Unload Me

End Sub
```

6.1.4   Cancel vacations user form

6.1.4.1   Cancel vacations button

Private Sub CommandButton4_Click()

```
Dim n As String
Dim s, e, i, ec As Integer

 Range("C4").Activate

 n = ComboBox1.Value

 Do Until ActiveCell = n

  ActiveCell.Offset(1, 0).Activate

  Loop

  ActiveCell.Offset(0, 1) = TextBox1.Value
  ActiveCell.Offset(0, 3) = TextBox2.Value

  s = ActiveCell.Offset(0, 2)
  e = ActiveCell.Offset(0, 4)

If s <= e Then

  ' WRITE 0s on SPECIFIC EMPLOYEE STRING

   Do While s <= e

   ActiveCell.Offset(0, s + 4) = "1"
   s = s + 1

   Loop

   ' WRITE 1s on SPECIFIC EMPLOYEE STRING

   Range("C4").Activate

   Do Until ActiveCell = n

   ActiveCell.Offset(1, 0).Activate

   Loop
```

```vba
    ActiveCell.Offset(0, 5).Activate

  For i = 0 To 51 Step 1

   If ActiveCell = "1" Then

     ActiveCell = "1"

   Else

     ActiveCell = "0"

   End If

     ActiveCell.Offset(0, 1).Activate

  Next i

Else

  ' WRITE 0s on SPECIFIC EMPLOYEE STRING

  Do Until s = 53

  ActiveCell.Offset(0, s + 4) = "1"
  s = s + 1

  Loop

  ec = 1

  Do Until ec = e + 1

  ActiveCell.Offset(0, ec + 4) = "1"
  ec = ec + 1

  Loop

  ' WRITE 1s on SPECIFIC EMPLOYEE STRING

  Range("C4").Activate

  Do Until ActiveCell = n
```

```vba
ActiveCell.Offset(1, 0).Activate

  Loop

  ActiveCell.Offset(0, 5).Activate
    For i = 0 To 51 Step 1

   If ActiveCell = "1" Then

      ActiveCell = "1"

    Else

      ActiveCell = "0"

    End If

     ActiveCell.Offset(0, 1).Activate

    Next i
End If

   MsgBox "Every vacation day during the mentioned period for " & ComboBox1.Value & " has
been successfully removed.", vbInformation
   Unload Me
End Sub
```

6.1.4.2   Cancel vacations reset button

```vba
Private Sub CommandButton2_Click()
ComboBox1.Value = ""
TextBox2.Value = ""
TextBox1.Value = ""
End Sub
```

6.1.4.3   Cancel vacations cancel button

```vba
Private Sub CommandButton3_Click()
Unload Me
End Sub
```

6.1.5   New task feature

6.1.5.1   Add task user form

6.1.5.1.1   Add task submit button

```
Private Sub CommandButton1_Click()

 Dim team As String
 Dim s, e As Integer

 Sheet2.Activate
 Range("C3").Activate

    Do Until ActiveCell = blank
        ActiveCell.Offset(1, 0).Activate
    Loop

If IsNumeric(ActiveCell.Offset(-1, 1)) Then
 ActiveCell.Offset(0, 1) = ActiveCell.Offset(-1, 1) + 1
Else
 ActiveCell.Offset(0, 1) = "1"
End If

 ActiveCell.Offset(0, 3) = TextBox5.Value
' GroupName = Complexity

 If OptionButton1.Value = True Then ActiveCell.Offset(0, 4) = "1"
 If OptionButton2.Value = True Then ActiveCell.Offset(0, 4) = "2"
 If OptionButton3.Value = True Then ActiveCell.Offset(0, 4) = "3"

' GroupName = Priority

 If OptionButton4.Value = True Then ActiveCell.Offset(0, 5) = "1"
 If OptionButton5.Value = True Then ActiveCell.Offset(0, 5) = "2"
 If OptionButton6.Value = True Then ActiveCell.Offset(0, 5) = "3"

 ' Ocupation

 ActiveCell.Offset(0, 6) = TextBox7.Value

 ' Start Week

 ActiveCell.Offset(0, 7) = TextBox1.Value

 ' Lenght
```

```vba
If TextBox2.Value > TextBox1.Value Then
  ActiveCell.Offset(0, 8) = 1 + TextBox2.Value - TextBox1.Value
ElseIf TextBox2.Value = TextBox1.Value Then
  ActiveCell.Offset(0, 8) = "1"
Else
  ActiveCell.Offset(0, 8) = 53 - TextBox1.Value + TextBox2.Value
End If

' End week

ActiveCell.Offset(0, 9) = TextBox2.Value

s = TextBox1.Value
e = TextBox2.Value

Sheet5.Activate

Range("D17") = TextBox7.Value / 100
Range("C21").Activate
Range("D21:BC21").ClearContents

' WRITE 1s

If s <= e Then

 Do While s <= e

  ActiveCell.Offset(0, s) = "1"
  s = s + 1

  Loop

Else

  Do Until s = 53

  ActiveCell.Offset(0, s) = "1"
  s = s + 1

  Loop

  ec = 1

  Do Until ec = e + 1
```

```
    ActiveCell.Offset(0, ec) = "1"
  ec = ec + 1


  Loop


End If


 ' WRITE 0s


 Range("C21").Activate


 ActiveCell.Offset(0, 1).Activate


  For i = 0 To 51 Step 1


   If ActiveCell = "1" Then


     ActiveCell = "1"
        Else
        ActiveCell = "0"
        End If
        ActiveCell.Offset(0, 1).Activate


   Next i


 Sheet2.Activate
  Unload Me
  End Sub
```

6.1.5.1.2   Add task reset button

```
Private Sub CommandButton2_Click()
TextBox1.Value = ""
TextBox2.Value = ""
TextBox5.Value = ""
TextBox7.Value = ""
OptionButton1.Value = False
OptionButton2.Value = False
OptionButton3.Value = False
OptionButton4.Value = False
OptionButton5.Value = False
OptionButton6.Value = False
End Sub
```

6.1.5.1.3 Add task cancel button

```
Private Sub CommandButton3_Click()
Unload Me
End Sub
```

6.1.5.1.4 Add task other validation conditions and restrictions

```
Private Sub SpinButton1_Change()
TextBox1.Value = SpinButton1.Value
End Sub

Private Sub SpinButton2_Change()
TextBox2.Value = SpinButton2.Value
End Sub

Private Sub SpinButton3_Change()
TextBox3.Value = SpinButton3.Value
End Sub

Private Sub SpinButton4_Change()
TextBox4.Value = SpinButton4.Value

End Sub

Private Sub SpinButton5_Change()
TextBox7.Value = SpinButton5.Value
End Sub

Private Sub TextBox1_Change()
If TextBox1.Value > 52 Then
    TextBox1.Value = ""
End If
End Sub

Private Sub TextBox2_Change()
If TextBox2.Value > 52 Then
    TextBox2.Value = ""
End If
End Sub

Private Sub TextBox7_Change()
If TextBox7.Value > 100 Then
    TextBox7.Value = ""
End If
End Sub
```

```
Private Sub UserForm_Click()

End Sub

Private Sub UserForm_MouseMove(ByVal Button As Integer, ByVal Shift As Integer, ByVal X As
Single, ByVal Y As Single)
End Sub
```

6.1.5.2   Choose skills user form

6.1.5.2.1   Choose skills search button

```
Private Sub CommandButton4_Click()

' Para 2 skills n serem escolhidas >1x

If ComboBox2.Value = ComboBox1.Value Then
    MsgBox "You can't choose 2 times the same skill.", vbCritical
    ComboBox2.Value = ""
ElseIf ComboBox3.Value = ComboBox2.Value Then
    MsgBox "You can't choose 2 times the same skill.", vbCritical
    ComboBox3.Value = ""
ElseIf ComboBox3.Value = ComboBox1.Value Then
    MsgBox "You can't choose 2 times the same skill.", vbCritical
    ComboBox3.Value = ""
Else

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = blank
  ActiveCell.Offset(1, 0).Activate
Loop

ActiveCell.Offset(0, 10) = ComboBox1.Value
ActiveCell.Offset(0, 11) = ComboBox2.Value
ActiveCell.Offset(0, 12) = ComboBox3.Value


Sheet5.Activate

Range("C3") = ComboBox1.Value
Range("C4") = ComboBox2.Value
Range("C5") = ComboBox3.Value
```

```
End If

 If ComboBox1.Value <> blank And ComboBox2.Value <> blank And ComboBox3.Value <> blank
Then

 Unload Me

 End If


 ' Top 1

Range("D9").Activate

Do Until ActiveCell = blank Or (Range("E11") <> blank) And (Range("D11") = ActiveCell.Offset(0,
-1))

 If ActiveCell = Range("D11") And (ActiveCell.Offset(-2, 0) < 100) Then

   Range("E11") = ActiveCell.Offset(-1, 0)

 Else
   Range("E11") = ActiveCell.Offset(-1, 0)

 End If

ActiveCell.Offset(0, 1).Activate

Loop


'Top 2

Range("d9").Activate

Do Until (ActiveCell = blank) Or (Range("E12") <> blank) And (Range("E12") <> Range("E11"))
And (Range("D12") = ActiveCell.Offset(0, -1))

 If (ActiveCell = Range("D12")) And (ActiveCell.Offset(-2, 0) < 100) Then

   Range("E12") = ActiveCell.Offset(-1, 0)

 Else
   Range("E12") = ActiveCell.Offset(-1, 0)
```

```
 End If

ActiveCell.Offset(0, 1).Activate

Loop

' Top 3
Range("D9").Activate

Do Until (ActiveCell = blank) Or (Range("E13") <> blank) And (Range("E12") <> Range("E13"))
And (Range("E11") <> Range("E13")) And (Range("D13") = ActiveCell.Offset(0, -1))

 If ActiveCell = Range("D13") And (ActiveCell.Offset(-2, 0) < 100) Then

    Range("E13") = ActiveCell.Offset(-1, 0)

 Else
   Range("E13") = ActiveCell.Offset(-1, 0)

 End If

ActiveCell.Offset(0, 1).Activate
Loop
 End Sub
```

6.1.5.2.2   Choose skills reset button

```
Private Sub CommandButton2_Click()
ComboBox1.Value = ""
ComboBox2.Value = ""
ComboBox3.Value = ""
End Sub
```

6.1.5.2.3   Choose skills cancel button

```
Private Sub CommandButton3_Click()
Unload Me
End Sub
```

6.1.5.3   Assign task user form

6.1.5.3.1   Assign task buttons

Private Sub CommandButton4_Click()

```
'TOP 1 SKILLS ASSIGN
 Sheet2.Activate
 Range("C3").Activate

 Dim sh, eh, ec As Integer

     Do Until ActiveCell = blank
        ActiveCell.Offset(1, 0).Activate
     Loop

     sh = ActiveCell.Offset(0, 7)
     eh = ActiveCell.Offset(0, 9)


 Sheet4.Activate
 Range("C4").Activate

 Do Until ActiveCell = TextBox1.Value

   ActiveCell.Offset(1, 0).Activate

 Loop

   ' Para garantir que pessoas de férias não podem ser escolhidas, embora sejam mostradas para
Assign

 If ActiveCell.Offset(0, 4 + sh) = 0 Then
   MsgBox (TextBox1.Value & " is on Holidays on Start-date. You need to choose another colab.")

 ElseIf ActiveCell.Offset(0, 4 + eh) = 0 Then
   MsgBox (TextBox1.Value & " is on Holidays on End-date.You need to choose another colab.")

 Else

   Dim id As Integer
   Dim team As String
   Dim time As Double

 Sheet2.Activate
```

```
 Range("C3").Activate

   Do Until ActiveCell = blank
      ActiveCell.Offset(1, 0).Activate
   Loop

    ActiveCell = TextBox1.Value
   id = ActiveCell.Offset(0, 1)

' Record Best Team based on Name

 Sheet1.Activate
Sheet1.Range("C4").Activate

   Do Until ActiveCell = TextBox1.Value
     ActiveCell.Offset(0, 1).Activate
   Loop

   team = ActiveCell.Offset(1, 0)

  Sheet1.Range("A1") = team  ' to be removed

' Put the team on the correct place

Sheet2.Activate
Range("D3").Activate

    Do Until ActiveCell = id
       ActiveCell.Offset(1, 0).Activate
    Loop

   ActiveCell.Offset(0, 1) = team
   s = ActiveCell.Offset(0, 6)
   e = ActiveCell.Offset(0, 8)
   o = ActiveCell.Offset(0, 5)

Sheet5.Activate
time = Range("C88")

Sheet2.Activate

If ActiveCell.Offset(0, 16) = blank Or ActiveCell.Offset(0, 16) = "N/A" Then
 ActiveCell.Offset(0, 16) = time
Else
 ActiveCell.Offset(0, 17) = time
```

```
End If

' Write on Ocupation log

Sheet3.Activate
Sheet3.Range("C4").Activate

Do Until ActiveCell = TextBox1.Value
    ActiveCell.Offset(1, 0).Activate

 Loop

If s <= e Then

 Do While s <= e

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

Else

 Do Until s = 53

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

 ec = 1

 Do Until ec = e + 1

   ActiveCell.Offset(0, ec) = ActiveCell.Offset(0, ec).Value + o / 100
   ec = ec + 1

 Loop
 End If


Sheet2.Activate
MsgBox "Best employee for this task has been filtered by skills (Top 1): team has been added
and ocupation was added to Ocupation Log.", vbInformation
```

```
Unload Me

  End If
End Sub

Private Sub CommandButton5_Click()
'TOP 2 SKILLS ASSIGN
 Sheet2.Activate
 Range("C4").Activate

 Dim sh, eh, ec As Integer

     Do Until ActiveCell = blank
        ActiveCell.Offset(1, 0).Activate
     Loop

     sh = ActiveCell.Offset(0, 7)
     eh = ActiveCell.Offset(0, 9)


 Sheet4.Activate
 Range("C4").Activate

 Do Until ActiveCell = TextBox2.Value

  ActiveCell.Offset(1, 0).Activate

 Loop


 If ActiveCell.Offset(0, 4 + sh) = 0 Then
   MsgBox (TextBox2.Value & " is on Holidays on Start-date. You need to choose another colab.")


  ElseIf ActiveCell.Offset(0, 4 + eh) = 0 Then
   MsgBox (TextBox2.Value & " is on Holidays on End-date.You need to choose another colab.")

  Else

     Dim id As Integer
    Dim team As String
    Dim time As Double

  Sheet2.Activate
```

```
 Range("C3").Activate

     Do Until ActiveCell = blank
        ActiveCell.Offset(1, 0).Activate
     Loop


      ActiveCell = TextBox2.Value
     id = ActiveCell.Offset(0, 1)


' Record Best Team based on Name

 Sheet1.Activate
Sheet1.Range("C4").Activate

   Do Until ActiveCell = TextBox2.Value
     ActiveCell.Offset(0, 1).Activate
   Loop


   team = ActiveCell.Offset(1, 0)

   Sheet1.Range("A1") = team  ' to be removed

' Put the team on the correct place

Sheet2.Activate
Range("D3").Activate

     Do Until ActiveCell = id
        ActiveCell.Offset(1, 0).Activate
     Loop


   ActiveCell.Offset(0, 1) = team
   s = ActiveCell.Offset(0, 6)
   e = ActiveCell.Offset(0, 8)
   o = ActiveCell.Offset(0, 5)


Sheet5.Activate
time = Range("C88")

Sheet2.Activate

If ActiveCell.Offset(0, 16) = blank Or ActiveCell.Offset(0, 16) = "N/A" Then
  ActiveCell.Offset(0, 16) = time
Else
  ActiveCell.Offset(0, 17) = time
```

```
End If

' Write on Ocupation log

Sheet3.Activate
Sheet3.Range("C4").Activate

Do Until ActiveCell = TextBox2.Value
    ActiveCell.Offset(1, 0).Activate

 Loop

If s <= e Then

 Do While s <= e

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

Else

 Do Until s = 53

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

 ec = 1

 Do Until ec = e + 1

   ActiveCell.Offset(0, ec) = ActiveCell.Offset(0, ec).Value + o / 100
   ec = ec + 1

 Loop
 End If


Sheet2.Activate
MsgBox "Best employee for this task has been filtered by skills (Top 2): team has been added
and ocupation was added to Ocupation Log.", vbInformation
```

```
Unload Me

  End If
End Sub

Private Sub CommandButton6_Click()
'TOP 3 SKILLS ASSIGN
 Sheet2.Activate
 Range("C4").Activate

 Dim sh, eh, ec As Integer
 Dim time As Double

    Do Until ActiveCell = blank
       ActiveCell.Offset(1, 0).Activate
    Loop

    sh = ActiveCell.Offset(0, 7)
    eh = ActiveCell.Offset(0, 9)


 Sheet4.Activate
 Range("C4").Activate

 Do Until ActiveCell = TextBox3.Value

   ActiveCell.Offset(1, 0).Activate

 Loop


 If ActiveCell.Offset(0, 4 + sh) = 0 Then
   MsgBox (TextBox3.Value & " is on Holidays on Start-date. You need to choose another colab.")



  ElseIf ActiveCell.Offset(0, 4 + eh) = 0 Then
    MsgBox (TextBox3.Value & " is on Holidays on End-date. You need to choose another colab.")

  Else

    Dim id As Integer
   Dim team As String

 Sheet2.Activate
```

```
 Range("C3").Activate

    Do Until ActiveCell = blank
       ActiveCell.Offset(1, 0).Activate
    Loop


     ActiveCell = TextBox3.Value
    id = ActiveCell.Offset(0, 1)

' Record Best Team based on Name

 Sheet1.Activate
Sheet1.Range("C4").Activate

   Do Until ActiveCell = TextBox3.Value
      ActiveCell.Offset(0, 1).Activate
    Loop

   team = ActiveCell.Offset(1, 0)

  Sheet1.Range("A1") = team  ' to be removed

' Put the team on the correct place

Sheet2.Activate
Range("D3").Activate

    Do Until ActiveCell = id
       ActiveCell.Offset(1, 0).Activate
    Loop

   ActiveCell.Offset(0, 1) = team
   s = ActiveCell.Offset(0, 6)
   e = ActiveCell.Offset(0, 8)
   o = ActiveCell.Offset(0, 5)

Sheet5.Activate
time = Range("C88")

Sheet2.Activate

If ActiveCell.Offset(0, 16) = blank Or ActiveCell.Offset(0, 16) = "N/A" Then
 ActiveCell.Offset(0, 16) = time
Else
 ActiveCell.Offset(0, 17) = time
```

```
End If

' Write on Ocupation log

Sheet3.Activate
Sheet3.Range("C5").Activate

Do Until ActiveCell = TextBox3.Value
    ActiveCell.Offset(1, 0).Activate

 Loop

If s <= e Then

 Do While s <= e

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

Else

 Do Until s = 53

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

 ec = 1

 Do Until ec = e + 1

   ActiveCell.Offset(0, ec) = ActiveCell.Offset(0, ec).Value + o / 100
   ec = ec + 1

 Loop
 End If


Sheet2.Activate
MsgBox "Best employee for this task has been filtered by skills (Top 3): team has been added
and ocupation was added to Ocupation Log.", vbInformation
```

```
Unload Me

  End If
End Sub

Private Sub CommandButton7_Click()
' SOLVER ASSIGN
' Put correct name on the correct place

   Dim id, ec As Integer
   Dim team As String
   Dim time As Double

 Sheet2.Activate
 Range("C3").Activate

    Do Until ActiveCell = blank
       ActiveCell.Offset(1, 0).Activate
    Loop

     ActiveCell = TextBox4.Value
     id = ActiveCell.Offset(0, 1)

' Record Best Team based on Name

 Sheet1.Activate
Sheet1.Range("C4").Activate

   Do Until ActiveCell = TextBox4.Value
     ActiveCell.Offset(0, 1).Activate
   Loop

   team = ActiveCell.Offset(1, 0)

' Put the team on the correct place

Sheet2.Activate
Range("D3").Activate

    Do Until ActiveCell = id
       ActiveCell.Offset(1, 0).Activate
    Loop

   ActiveCell.Offset(0, 1) = team
   s = ActiveCell.Offset(0, 6)
```

```
    e = ActiveCell.Offset(0, 8)
    o = ActiveCell.Offset(0, 5)

Sheet5.Activate
time = Range("C88")

' History

Sheet2.Activate

If ActiveCell.Offset(0, 16) = blank Or ActiveCell.Offset(0, 16) = "N/A" Then
  ActiveCell.Offset(0, 16) = time
Else
  ActiveCell.Offset(0, 17) = time
End If

' Write on Ocupation log

Sheet3.Activate
Sheet3.Range("C4").Activate

Do Until ActiveCell = TextBox4.Value
    ActiveCell.Offset(1, 0).Activate

 Loop

If s <= e Then

 Do While s <= e

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

Else

 Do Until s = 53

   ActiveCell.Offset(0, s) = ActiveCell.Offset(0, s).Value + o / 100
   s = s + 1

 Loop

 ec = 1
```

```
 Do Until ec = e + 1

   ActiveCell.Offset(0, ec) = ActiveCell.Offset(0, ec).Value + o / 100
   ec = ec + 1

 Loop

End If

Sheet2.Activate
MsgBox "Solver identified best employee for this task: team has been added and ocupation was
added to Ocupation Log.", vbInformation

Unload Me
End Sub

Private Sub UserForm_Click()

End Sub

Private Sub UserForm_Initialize()
TextBox1.Value = Sheet5.Range("E11")
TextBox2.Value = Sheet5.Range("E12")
TextBox3.Value = Sheet5.Range("E13")
TextBox4.Value = Sheet5.Range("D14")

Dim s, e As Integer

' Solver Outcome

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = blank
   ActiveCell.Offset(1, 0).Activate
Loop

    s = ActiveCell.Offset(0, 7)
    e = ActiveCell.Offset(0, 9)

Sheet5.Activate
Range("C25").Activate
Range("BE26:BE51").ClearContents ' ONLY HERE
```

```
    Do Until ActiveCell = Range("D14")
        ActiveCell.Offset(1, 0).Activate
    Loop


If s <= e Then
  Do While s <= e
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop
Else

  Do Until s = 53
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop

  ec = 1

  Do Until ec = e + 1
    If ActiveCell.Offset(0, ec) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, ec)
    End If
    ec = ec + 1
  Loop
End If

TextBox5.Value = ActiveCell.Offset(0, 54) * 100 & "%"

' Top 1 Skills Outcome

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = blank
  ActiveCell.Offset(1, 0).Activate
Loop

    s = ActiveCell.Offset(0, 7)
    e = ActiveCell.Offset(0, 9)

Sheet5.Activate
```

```
Range("C25").Activate

    Do Until ActiveCell = Range("E11")
        ActiveCell.Offset(1, 0).Activate
    Loop


If s <= e Then
  Do While s <= e
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop
Else

  Do Until s = 53
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop

  ec = 1

  Do Until ec = e + 1
    If ActiveCell.Offset(0, ec) > ActiveCell.Offset(0, 54) Then
       ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, ec)
    End If
    ec = ec + 1
  Loop
End If

TextBox6.Value = ActiveCell.Offset(0, 54) * 100 & "%"

' Top 2 Skills Outcome

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = blank
   ActiveCell.Offset(1, 0).Activate
Loop

    s = ActiveCell.Offset(0, 7)
    e = ActiveCell.Offset(0, 9)
```

```
Sheet5.Activate
Range("C25").Activate

    Do Until ActiveCell = Range("E12")
        ActiveCell.Offset(1, 0).Activate
    Loop

If s <= e Then
  Do While s <= e
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop
Else

  Do Until s = 53
    If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
    End If
    s = s + 1
  Loop

  ec = 1

  Do Until ec = e + 1
    If ActiveCell.Offset(0, ec) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, ec)
    End If
    ec = ec + 1
  Loop
End If

TextBox7.Value = ActiveCell.Offset(0, 54) * 100 & "%"

' Top 3 Skills Outcome

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = blank
   ActiveCell.Offset(1, 0).Activate
Loop
```

```
    s = ActiveCell.Offset(0, 7)
    e = ActiveCell.Offset(0, 9)


Sheet5.Activate
Range("C25").Activate

    Do Until ActiveCell = Range("E13")
        ActiveCell.Offset(1, 0).Activate
    Loop


If s <= e Then
   Do While s <= e
     If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
     End If
     s = s + 1
   Loop
Else

   Do Until s = 53
     If ActiveCell.Offset(0, s) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, s)
     End If
     s = s + 1
   Loop

   ec = 1

   Do Until ec = e + 1
     If ActiveCell.Offset(0, ec) > ActiveCell.Offset(0, 54) Then
        ActiveCell.Offset(0, 54) = ActiveCell.Offset(0, ec)
     End If
     ec = ec + 1
   Loop
End If


TextBox8.Value = ActiveCell.Offset(0, 54) * 100 & "%"


End Sub
```

6.1.5.3.2   Assign task cancel button

```
Private Sub CommandButton3_Click()
Unload Me
```

```
Sheet2.Activate
Range("C4").Activate

Do Until ActiveCell = blank
   ActiveCell.Offset(1, 0).Activate
Loop

ActiveCell.Offset(0, 1).ClearContents
ActiveCell.Offset(0, 2).ClearContents
ActiveCell.Offset(0, 3).ClearContents
ActiveCell.Offset(0, 4).ClearContents
ActiveCell.Offset(0, 5).ClearContents
ActiveCell.Offset(0, 6).ClearContents
ActiveCell.Offset(0, 7).ClearContents
ActiveCell.Offset(0, 8).ClearContents
ActiveCell.Offset(0, 9).ClearContents
ActiveCell.Offset(0, 10).ClearContents
ActiveCell.Offset(0, 11).ClearContents
ActiveCell.Offset(0, 12).ClearContents

End Sub
```

6.1.6   Re-assign task feature

6.1.6.1   Re-assign task user form

6.1.6.1.1   Load task button

```
Private Sub CommandButton4_Click()
Dim n As Integer
Dim o As Integer
Dim s1, s2, s3 As String

Sheet2.Activate
Range("D3").Activate

Range("B3").Value = ComboBox2.Value
n = ComboBox2.Value

Do Until ActiveCell = n

ActiveCell.Offset(1, 0).Activate

Loop
```

```
TextBox1.Value = ActiveCell.Offset(0, 6)
TextBox2.Value = ActiveCell.Offset(0, 8)


ActiveCell.Offset(0, -3) = ComboBox2.Value
ActiveCell.Offset(0, -2) = ActiveCell.Offset(0, -1)
ActiveCell.Offset(0, 12) = ActiveCell.Offset(0, 6)
ActiveCell.Offset(0, 13) = ActiveCell.Offset(0, 8)
s1 = ActiveCell.Offset(0, 9)
s2 = ActiveCell.Offset(0, 10)
s3 = ActiveCell.Offset(0, 11)
o = ActiveCell.Offset(0, 5)


Sheet5.Activate


Range("C3") = s1
Range("C4") = s2
Range("C5") = s3


' Top 1


Range("D9").Activate


Do Until ActiveCell = blank Or (Range("E11") <> blank) And (Range("D11") = ActiveCell.Offset(0, -1))

 If ActiveCell = Range("D11") And (ActiveCell.Offset(-2, 0) < 100) Then

   Range("E11") = ActiveCell.Offset(-1, 0)

 Else
   Range("E11") = ActiveCell.Offset(-1, 0)

 End If

ActiveCell.Offset(0, 1).Activate

Loop

'Top 2

Range("d9").Activate

Do Until (ActiveCell = blank) Or (Range("E12") <> blank) And (Range("E12") <> Range("E11"))
And (Range("D12") = ActiveCell.Offset(0, -1))
```

```
If (ActiveCell = Range("D12")) And (ActiveCell.Offset(-2, 0) < 100) Then

   Range("E12") = ActiveCell.Offset(-1, 0)

 Else
   Range("E12") = ActiveCell.Offset(-1, 0)

 End If

ActiveCell.Offset(0, 1).Activate

Loop


' Top 3

Range("D9").Activate

Do Until (ActiveCell = blank) Or (Range("E13") <> blank) And (Range("E12") <> Range("E13"))
And (Range("E11") <> Range("E13")) And (Range("D13") = ActiveCell.Offset(0, -1))

 If ActiveCell = Range("D13") And (ActiveCell.Offset(-2, 0) < 100) Then

    Range("E13") = ActiveCell.Offset(-1, 0)

 Else
   Range("E13") = ActiveCell.Offset(-1, 0)

 End If

ActiveCell.Offset(0, 1).Activate

Loop

Range("D17") = o / 100
Range("C21").Activate
Range("D21:BC21").ClearContents

End Sub
```

6.1.6.1.2   Re-assign task button

```
Private Sub CommandButton1_Click()
```

```vba
Dim s, e, ec, s1, e1, ec1, o As Integer
Dim u As String


s = TextBox1.Value
e = TextBox2.Value


 Sheet2.Activate
 ActiveCell.Offset(0, 14) = TextBox1.Value
 ActiveCell.Offset(0, 15) = TextBox2.Value
 ActiveCell.Offset(0, 6) = TextBox1.Value ' Start date



  ' Lenght

 If TextBox2.Value > TextBox1.Value Then
  ActiveCell.Offset(0, 7) = TextBox2.Value - TextBox1.Value + 1
 ElseIf TextBox2.Value = TextBox1.Value Then
  ActiveCell.Offset(0, 7) = "1"
 Else
  ActiveCell.Offset(0, 7) = 52 - TextBox1.Value + TextBox2.Value + 1
 End If



 ActiveCell.Offset(0, 8) = TextBox2.Value ' End date
 ActiveCell.Offset(0, -1) = ""
 ActiveCell.Offset(0, 1) = ""

s = ActiveCell.Offset(0, 14)
e = ActiveCell.Offset(0, 15)

 Sheet5.Activate

 Range("C21").Activate
 Range("D21:BC21").ClearContents

 ' WRITE 1s

If s <= e Then

 Do While s <= e

  ActiveCell.Offset(0, s) = "1"
  s = s + 1

 Loop
```

```
Else

    Do Until s = 53

    ActiveCell.Offset(0, s) = "1"
  s = s + 1

    Loop

    ec = 1

    Do Until ec = e + 1

    ActiveCell.Offset(0, ec) = "1"
  ec = ec + 1

    Loop

End If

 ' WRITE 0s

  Range("C21").Activate

  ActiveCell.Offset(0, 1).Activate

   For i = 0 To 51 Step 1

    If ActiveCell = "1" Then

      ActiveCell = "1"

     Else

       ActiveCell = "0"

     End If

       ActiveCell.Offset(0, 1).Activate

     Next i
Unload Me

   ' Start thinking about removing Ocupation
```

```
Sheet2.Activate
Range("D3").Activate

  Do Until ActiveCell = Range("B3")

  ActiveCell.Offset(1, 0).Activate

  Loop

u = ActiveCell.Offset(0, -2)
o = ActiveCell.Offset(0, 5)
s1 = ActiveCell.Offset(0, 12)
e1 = ActiveCell.Offset(0, 13)

  ' Write (remove) on Ocupation log

Sheet3.Activate
Range("C4").Activate
Do Until ActiveCell = u
    ActiveCell.Offset(1, 0).Activate
Loop

If s1 <= e1 Then

 Do While s1 <= e1

   ActiveCell.Offset(0, s1) = ActiveCell.Offset(0, s1).Value - o / 100
   s1 = s1 + 1

 Loop

Else

 Do Until s1 = 53

   ActiveCell.Offset(0, s1) = ActiveCell.Offset(0, s1).Value - o / 100
   s1 = s1 + 1

 Loop

 ec1 = 1

 Do Until ec1 = e1 + 1
```

    ActiveCell.Offset(0, ec1) = ActiveCell.Offset(0, ec1).Value - o / 100
    ec1 = ec1 + 1

 Loop

End If

Sheet2.Activate
Unload Me
Sheet5.Activate
End Sub

6.1.6.1.3   Reset button

Private Sub CommandButton2_Click()
TextBox1.Value = ""
TextBox2.Value = ""
ComboBox2.Value = ""
End Sub

6.1.6.1.4   Cancel button

Private Sub CommandButton3_Click()
Unload Me
End Sub

6.1.6.1.5   Assign task button

Same as *6.1.5.3.1 Assign Task buttons*

6.1.6.1.6   Cancel task assignment button

Same as 6.1.5.3.2 Assign Task Cancel button

6.1.6.1.7   Other buttons

Private Sub SpinButton1_Change()
TextBox1.Value = SpinButton1.Value
End Sub

Private Sub SpinButton2_Change()
TextBox2.Value = SpinButton2.Value
End Sub

Private Sub SpinButton3_Change()
TextBox3.Value = SpinButton3.Value
End Sub

```
Private Sub SpinButton4_Change()
TextBox4.Value = SpinButton4.Value
End Sub


Private Sub SpinButton5_Change()
TextBox5.Value = SpinButton5.Value
End Sub
```

6.1.6.2   Change task deadline feature

6.1.6.2.1   Load task button

```
Private Sub CommandButton4_Click()
 Dim n As Integer
 Dim o As Integer
 Dim w, ew, sw As Integer
 Dim time As Double

 Sheet7.Activate
 Range("F4") = "=WEEKNUM(D4)"
 w = Range("F4")
 TextBox2.Value = w

 Sheet2.Activate
 Range("D3").Activate

 Range("B3").Value = ComboBox2.Value
 n = ComboBox2.Value

 Do Until ActiveCell = n

 ActiveCell.Offset(1, 0).Activate

 Loop

  ActiveCell.Offset(0, -3) = ComboBox2.Value
 ActiveCell.Offset(0, -2) = ActiveCell.Offset(0, -1)
 ActiveCell.Offset(0, 12) = ActiveCell.Offset(0, 6)
 ActiveCell.Offset(0, 13) = ActiveCell.Offset(0, 8)
 ew = ActiveCell.Offset(0, 8)
 sw = ActiveCell.Offset(0, 6)

 If ew <> sw Then
   TextBox3.Value = "from week " & sw & " to " & ew
 Else
```

   TextBox3.Value = "on week " & sw
 End If

End Sub

6.1.6.2.2   Change deadline button

```
Private Sub CommandButton1_Click()
Dim s, e, ec, s1, s11, e1, ec1, o, s2, s22, e2, ec2 As Integer
Dim u As String
Dim time As Double

e = TextBox2.Value

  Sheet2.Activate
  ActiveCell.Offset(0, 14) = ActiveCell.Offset(0, 12)
  ActiveCell.Offset(0, 15) = TextBox2.Value
  ActiveCell.Offset(0, 8) = TextBox2.Value

' Lenght

 If ActiveCell.Offset(0, 15) > ActiveCell.Offset(0, 14) Then
   ActiveCell.Offset(0, 7) = ActiveCell.Offset(0, 15) - ActiveCell.Offset(0, 14) + 1
 ElseIf ActiveCell.Offset(0, 15) = ActiveCell.Offset(0, 14) Then
   ActiveCell.Offset(0, 7) = "1"
 Else
   ActiveCell.Offset(0, 7) = 52 - ActiveCell.Offset(0, 14) + ActiveCell.Offset(0, 15) + 1
 End If


  ActiveCell.Offset(0, 8) = TextBox2.Value

s = ActiveCell.Offset(0, 14)
e = ActiveCell.Offset(0, 15)

 ' Start thinking about removing Occupation

Sheet2.Activate
Range("D3").Activate

 Do Until ActiveCell = Range("B3")

 ActiveCell.Offset(1, 0).Activate

 Loop
```

```
u = ActiveCell.Offset(0, -2)
o = ActiveCell.Offset(0, 5)
s1 = ActiveCell.Offset(0, 12)
s11 = ActiveCell.Offset(0, 12)
e1 = ActiveCell.Offset(0, 13)
s2 = ActiveCell.Offset(0, 14)
s22 = ActiveCell.Offset(0, 14)
e2 = ActiveCell.Offset(0, 15)

Sheet5.Activate
time = Range("C88")

Sheet2.Activate
ActiveCell.Offset(0, 17) = time

 ' Remove on Occupation log

Sheet3.Activate

Range("C4").Activate

Do Until ActiveCell = u
    ActiveCell.Offset(1, 0).Activate
Loop

If s1 <= e1 Then

 Do While s1 <= e1

   ActiveCell.Offset(0, s1) = ActiveCell.Offset(0, s1).Value - o / 100
   s1 = s1 + 1

 Loop

Else

 Do Until s11 = 53

   ActiveCell.Offset(0, s11) = ActiveCell.Offset(0, s11).Value - o / 100
   s11 = s11 + 1

 Loop

 ec1 = 1
```

```
Do Until ec1 = e1 + 1

  ActiveCell.Offset(0, ec1) = ActiveCell.Offset(0, ec1).Value - o / 100
  ec1 = ec1 + 1

 Loop

End If

 ' Add on Occupation log

Range("C4").Activate

Do Until ActiveCell = u
    ActiveCell.Offset(1, 0).Activate
Loop

If s2 <= e2 Then

 Do While s2 <= e2

  ActiveCell.Offset(0, s2) = ActiveCell.Offset(0, s2).Value + o / 100
  s2 = s2 + 1

 Loop

Else

 Do Until s22 = 53

  ActiveCell.Offset(0, s22) = ActiveCell.Offset(0, s22).Value + o / 100
  s22 = s22 + 1

 Loop

 ec2 = 1

 Do Until ec2 = e2 + 1

  ActiveCell.Offset(0, ec2) = ActiveCell.Offset(0, ec2).Value + o / 100
  ec2 = ec2 + 1

 Loop
```

End If

Sheet2.Activate

Unload Me

Range("A1:B1000").ClearContents
Range("A1:P2").ClearContents
Range("P1:S1000").ClearContents

End Sub

6.1.6.2.3   Reset button

Private Sub CommandButton2_Click()

TextBox2.Value = ""
TextBox3.Value = ""
ComboBox2.Value = ""

End Sub

6.1.6.2.4   Cancel button

Private Sub CommandButton3_Click()

Unload Me

End Sub

6.1.6.2.5   Menu button

Private Sub ComboBox2_Change()

End Sub

6.1.7   Refresh and reset features

6.1.7.1   Employee and team refresh

Public Sub manualrefresh()

' Employee-Team Refresh

Dim u, t, t1 As String
Sheet2.Activate

```
Range("C4").Activate

Do Until ActiveCell = blank
   u = ActiveCell
   t = ActiveCell.Offset(0, 2)

   Sheet1.Select
   Application.Goto "colabx"
      Do Until ActiveCell = u
         ActiveCell.Offset(0, 1).Activate
      Loop

      If ActiveCell.Offset(1, 0) = t Then
         Sheet2.Activate
         ActiveCell.Offset(1, 0).Activate
      Else
         t1 = ActiveCell.Offset(1, 0)
         Sheet2.Activate
         ActiveCell.Offset(0, 2) = t1
         ActiveCell.Offset(1, 0).Activate
      End If
Loop
Sheet6.Activate
End Sub
```

6.1.7.2   Reset occupation-vacations-solver-reports

```
Public Sub resetocvacsolverrep()

' Reset all logs except Activity (IN USE)

Sheet3.Range("D5:BC100") = "0" ' Ocupation Log
Sheet4.Range("H5:BG100") = "1" ' Vacation Log
Sheet5.Range("C3:C5").ClearContents '  Solver
Sheet5.Range("E11:E13").ClearContents '  Solver
Sheet5.Range("D14").ClearContents '  Solver
Sheet5.Range("D17").ClearContents '  Solver
Sheet5.Range("D21:BC21").ClearContents '  Solver
Sheet5.Range("D86:AM86").ClearContents '  Solver
' Rep
Sheet7.Range("C7:H100").ClearContents
Sheet7.Range("O10:P100").ClearContents
Sheet7.Range("AB6:AK100").ClearContents
Sheet7.Range("H4").ClearContents
Sheet7.Range("H5").ClearContents
```

```
Sheet7.Range("D5").ClearContents
Sheet7.Range("F5").ClearContents

Sheet7.Range("P6").ClearContents
Sheet7.Range("P7").ClearContents
Sheet7.Range("P8").ClearContents

Sheet7.Range("AK4").ClearContents

End Sub
```

6.1.8 Status and reporting feature

6.1.8.1 Employee vs week report

```
Private Sub ComboBox1_Change()

End Sub

Private Sub CommandButton1_Click()
Dim weeknumbs, weeknumbe, id, complexity, priority, ocupation, ocupationcounter,
taskscounter, lenght, s, e As Integer
Dim u, team, name As String

Sheet7.Activate
u = ComboBox1.Value
weeknumbs = TextBox1.Value 'ws
weeknumbe = TextBox2.Value 'we
Range("E2") = weeknumbs
Range("F2") = weeknumbe
weeknumbs = Range("E2") 'ws
weeknumbe = Range("F2") 'we
Sheet2.Activate
Range("C4").Activate

Do Until ActiveCell = blank

id = ActiveCell.Offset(0, 1)
team = ActiveCell.Offset(0, 2)
name = ActiveCell.Offset(0, 3)
complexity = ActiveCell.Offset(0, 4)
priority = ActiveCell.Offset(0, 5)
ocupation = ActiveCell.Offset(0, 6)
s = ActiveCell.Offset(0, 7)
lenght = ActiveCell.Offset(0, 8)
```

```
e = ActiveCell.Offset(0, 9)

If s <= e Then

    If (ActiveCell = u And s >= weeknumbs And e <= weeknumbe) Or (ActiveCell = u And s >=
weeknumbs And s <= weeknumbe) Or (ActiveCell = u And e <= weeknumbe And e >=
weeknumbs) Or (ActiveCell = u And s <= weeknumbs And e >= weeknumbe) Then
        ocupationcounter = ocupationcounter + ocupation
        taskscounter = taskscounter + 1
        Sheet7.Activate
        Range("C6").Activate
            Do Until ActiveCell = blank
                ActiveCell.Offset(1, 0).Activate
            Loop
        ActiveCell = id
        ActiveCell.Offset(0, 1) = name
        ActiveCell.Offset(0, 2) = complexity
        ActiveCell.Offset(0, 3) = priority
        ActiveCell.Offset(0, 4) = ocupation / 100
        ActiveCell.Offset(0, 5) = lenght
    End If

Else

    If (ActiveCell = u And s <= weeknumbe And e >= weeknumbs) Or (ActiveCell = u And s <=
weeknumbe And e <= weeknumbs) Or (ActiveCell = u And s >= weeknumbe And e >=
weeknumbs) Then
        ocupationcounter = ocupationcounter + ocupation
        taskscounter = taskscounter + 1
        Sheet7.Activate
        Range("C6").Activate
            Do Until ActiveCell = blank
                ActiveCell.Offset(1, 0).Activate
            Loop
        ActiveCell = id
        ActiveCell.Offset(0, 1) = name
        ActiveCell.Offset(0, 2) = complexity
        ActiveCell.Offset(0, 3) = priority
        ActiveCell.Offset(0, 4) = ocupation / 100
        ActiveCell.Offset(0, 5) = lenght
    End If
End If

Sheet2.Activate
ActiveCell.Offset(1, 0).Activate
```

```
Loop
Unload Me


Sheet7.Activate

' HEADER EMPLOYEE & WEEK(s)

Range("D5") = u
Range("f5") = team
    If taskscounter = 0 Then
      Range("C7") = "N/A"
      Range("H5") = "0"
      Range("H4") = "0%"
      Else
      Range("H5") = taskscounter
      Range("H4") = ocupationcounter / 100 / (weeknumbe - weeknumbs + 1)
    End If



' TO WRITE ON WEEK(S)

If Range("e2") <> Range("f2") Then
    Range("f4") = weeknumbs & " to " & weeknumbe
Else
    Range("f4") = weeknumbs
End If

' TO CALCULATE TASK WEIGHT
'Range("K6").Activate
'Do While ActiveCell.Offset(0, -1) <> blank
'    ActiveCell = ActiveCell.Offset(0, -4) / Range("m4")
'    ActiveCell.Offset(1, 0).Activate
'Loop



' TO CLEAR STRING 2
Range("C2:L2").ClearContents

End Sub


Private Sub Label2_Click()

End Sub
```

```
Private Sub SpinButton1_Change()
TextBox1.Value = SpinButton1.Value
End Sub


Private Sub SpinButton2_Change()
TextBox2.Value = SpinButton2.Value
End Sub


Private Sub UserForm_Click()


End Sub


Private Sub UserForm_Initialize()


Sheet7.Activate
Range("H4").ClearContents
Range("H5").ClearContents
Range("D5").ClearContents
Range("F5").ClearContents
Range("C7:H100").ClearContents



Range("F4") = "=WEEKNUM(D4)"
TextBox1.Value = Range("F4")
TextBox2.Value = Range("F4")
End Sub
```

6.1.8.2   Team vs week report

```
Private Sub CheckBox1_Click()


End Sub


Private Sub CheckBox2_Click()


End Sub


Private Sub CommandButton1_Click()
Dim weeknumbs, weeknumbe, id, complexity, priority, ocupation, ocupationcounter, oc,
taskscounter, lenght, s, e As Integer
Dim ub, uc, un, team, name As String


Sheet7.Activate
```

```
' Regular option boxes

If UserForm8.CheckBox1.Value = True And UserForm8.CheckBox2.Value = False Then
    uc = "B2C"
    ub = 0
ElseIf UserForm8.CheckBox2.Value = True And UserForm8.CheckBox1.Value = False Then
    ub = "B2B"
    uc = 0
ElseIf UserForm8.CheckBox2.Value = True And UserForm8.CheckBox1.Value = True Then
    ub = "B2B"
    uc = "B2C"
ElseIf UserForm8.CheckBox2.Value = False And UserForm8.CheckBox1.Value = False Then
    MsgBox "No team selected = every team selected!", vbInformation
    ub = "B2B"
    uc = "B2C"
End If

weeknumbs = TextBox1.Value
weeknumbe = TextBox2.Value
Range("O2") = weeknumbs
Range("P2") = weeknumbe
weeknumbs = Range("O2") 'ws
weeknumbe = Range("P2") 'we

Sheet2.Activate
Range("C4").Activate

Do Until ActiveCell = blank ' START
u = ActiveCell
id = ActiveCell.Offset(0, 1)
team = ActiveCell.Offset(0, 2)
name = ActiveCell.Offset(0, 3)
complexity = ActiveCell.Offset(0, 4)
priority = ActiveCell.Offset(0, 5)
ocupation = ActiveCell.Offset(0, 6)
s = ActiveCell.Offset(0, 7)
lenght = ActiveCell.Offset(0, 8)
e = ActiveCell.Offset(0, 9)

' UC
If uc = "B2C" And ub = 0 Then
If s <= e Then
```

```
   If (ActiveCell.Offset(0, 2) = uc And s >= weeknumbs And e <= weeknumbe) Or
(ActiveCell.Offset(0, 2) = uc And s >= weeknumbs And s <= weeknumbe) Or (ActiveCell.Offset(0,
2) = uc And e <= weeknumbe And e >= weeknumbs) Or (ActiveCell.Offset(0, 2) = uc And s <=
weeknumbs And e >= weeknumbe) Then
       ocupationcounter = ocupationcounter + ocupation
       taskscounter = taskscounter + 1
       Sheet7.Activate
       Range("O6").Activate
          Do Until ActiveCell = blank Or ActiveCell = u
              ActiveCell.Offset(1, 0).Activate
          Loop
       ActiveCell = u
       ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If

Else

   If (ActiveCell.Offset(0, 2) = uc And s <= weeknumbe And e >= weeknumbs) Or
(ActiveCell.Offset(0, 2) = uc And s <= weeknumbe And e <= weeknumbs) Or (ActiveCell.Offset(0,
2) = uc And s >= weeknumbe And e >= weeknumbs) Then
       ocupationcounter = ocupationcounter + ocupation
       taskscounter = taskscounter + 1
       Sheet7.Activate
       Range("O6").Activate
          Do Until ActiveCell = blank Or ActiveCell = u
              ActiveCell.Offset(1, 0).Activate
          Loop
       ActiveCell = u
       ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If
End If
End If

'UB
If ub = "B2B" And uc = 0 Then
If s <= e Then

   If (ActiveCell.Offset(0, 2) = ub And s >= weeknumbs And e <= weeknumbe) Or
(ActiveCell.Offset(0, 2) = ub And s >= weeknumbs And s <= weeknumbe) Or (ActiveCell.Offset(0,
2) = ub And e <= weeknumbe And e >= weeknumbs) Or (ActiveCell.Offset(0, 2) = ub And s <=
weeknumbs And e >= weeknumbe) Then
       ocupationcounter = ocupationcounter + ocupation
       taskscounter = taskscounter + 1
```

```
      Sheet7.Activate
      Range("O6").Activate
         Do Until ActiveCell = blank Or ActiveCell = u
            ActiveCell.Offset(1, 0).Activate
         Loop
      ActiveCell = u
      ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If

Else

   If (ActiveCell.Offset(0, 2) = ub And s <= weeknumbe And e >= weeknumbs) Or
(ActiveCell.Offset(0, 2) = ub And s <= weeknumbe And e <= weeknumbs) Or (ActiveCell.Offset(0,
2) = ub And s >= weeknumbe And e >= weeknumbs) Then
      ocupationcounter = ocupationcounter + ocupation
      taskscounter = taskscounter + 1
      Sheet7.Activate
      Range("O6").Activate
         Do Until ActiveCell = blank Or ActiveCell = u
            ActiveCell.Offset(1, 0).Activate
         Loop
      ActiveCell = u
      ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If
End If
End If

'UB & UC
If ub = "B2B" And uc = "B2C" Then
If s <= e Then

   If ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) = uc) And s >= weeknumbs And e <=
weeknumbe) Or ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) = uc) And s >=
weeknumbs And s <= weeknumbe) Or ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) =
uc) And e <= weeknumbe And e >= weeknumbs) Or ((ActiveCell.Offset(0, 2) = ub Or
ActiveCell.Offset(0, 2) = uc) And s <= weeknumbs And e >= weeknumbe) Then
      ocupationcounter = ocupationcounter + ocupation
      taskscounter = taskscounter + 1
      Sheet7.Activate
      Range("O6").Activate
         Do Until ActiveCell = blank Or ActiveCell = u
            ActiveCell.Offset(1, 0).Activate
         Loop
```

```
      ActiveCell = u
      ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If

Else

   If ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) = uc) And s <= weeknumbe And e >=
weeknumbs) Or ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) = uc) And s <=
weeknumbe And e <= weeknumbs) Or ((ActiveCell.Offset(0, 2) = ub Or ActiveCell.Offset(0, 2) =
uc) And s >= weeknumbe And e >= weeknumbs) Then
      ocupationcounter = ocupationcounter + ocupation
      taskscounter = taskscounter + 1
      Sheet7.Activate
      Range("O6").Activate
         Do Until ActiveCell = blank Or ActiveCell = u
            ActiveCell.Offset(1, 0).Activate
         Loop
      ActiveCell = u
      ActiveCell.Offset(0, 1) = ActiveCell.Offset(0, 1) + ocupation / 100
   End If
End If
End If

Sheet2.Activate
ActiveCell.Offset(1, 0).Activate
Loop ' END
Unload Me
Sheet7.Activate

' HEADER TEAM(s), Tasks, Ocupation

  If uc = "B2C" And ub = 0 Then
     Range("P6") = uc
  ElseIf ub = "B2B" And uc = 0 Then
     Range("P6") = ub
  ElseIf ub = "B2B" And uc = "B2C" Then
     Range("P6") = ub & " and " & uc
  End If

  If taskscounter = 0 Then
    Range("O10") = "N/A"
    Range("P7") = "0"
    Range("P8") = "0%"
```

```
    Else
      Range("P7") = taskscounter
      Range("P8") = ocupationcounter / 100 / (weeknumbe - weeknumbs + 1)
    End If


' HEADER WEEK(S)


If Range("O2") <> Range("P2") Then
    Range("P5") = weeknumbs & " to " & weeknumbe
Else
    Range("P5") = weeknumbs
End If


' TO CALCULATE TASK WEIGHT


'Range("X6").Activate
'Do While ActiveCell.Offset(0, -1) <> blank
'   ActiveCell = ActiveCell.Offset(0, -4) / Range("Y4")
'   ActiveCell.Offset(1, 0).Activate
'Loop


' TO CLEAR STRING 2
Range("O2:Y2").ClearContents
End Sub


Private Sub SpinButton1_Change()
TextBox1.Value = SpinButton1.Value
End Sub


Private Sub SpinButton2_Change()
TextBox2.Value = SpinButton2.Value
End Sub


Private Sub UserForm_Click()


End Sub


Private Sub UserForm_Initialize()
Sheet7.Activate
Range("P6").ClearContents
Range("P7").ClearContents
Range("P8").ClearContents
Range("O10:P100").ClearContents
```

```
Range("P5") = "=WEEKNUM(P4)"
TextBox1.Value = Range("P5")
TextBox2.Value = Range("P5")
End Sub
```

6.1.8.3 Week based report

```
Private Sub CommandButton1_Click()

Dim weeknumbs, weeknumbe, id, complexity, priority, ocupation, ocupationcounter,
taskscounter, lenght, s, e As Integer

Dim u, team, name As String


Sheet7.Activate


weeknumbs = TextBox1.Value

weeknumbe = TextBox2.Value

Range("AF2") = weeknumbs

Range("AG2") = weeknumbe

weeknumbs = Range("AF2") ' ws

weeknumbe = Range("AG2") ' we


Sheet2.Activate

Range("C4").Activate


Do Until ActiveCell = blank

u = ActiveCell

id = ActiveCell.Offset(0, 1)

team = ActiveCell.Offset(0, 2)

name = ActiveCell.Offset(0, 3)

complexity = ActiveCell.Offset(0, 4)

priority = ActiveCell.Offset(0, 5)

ocupation = ActiveCell.Offset(0, 6)

s = ActiveCell.Offset(0, 7)
```

```
lenght = ActiveCell.Offset(0, 8)

e = ActiveCell.Offset(0, 9)


If s <= e Then


  If (s >= weeknumbs And e <= weeknumbe) Or (s >= weeknumbs And s <= weeknumbe) Or (e
<= weeknumbe And e >= weeknumbs) Or (s <= weeknumbs And e >= weeknumbe) Then

    ocupationcounter = ocupationcounter + ocupation

    taskscounter = taskscounter + 1

    Sheet7.Activate

    Range("AB6").Activate

      Do Until ActiveCell = blank

        ActiveCell.Offset(1, 0).Activate

      Loop

    ActiveCell = u

    ActiveCell.Offset(0, 1) = team

    ActiveCell.Offset(0, 2) = id

    ActiveCell.Offset(0, 3) = name

    ActiveCell.Offset(0, 4) = complexity

    ActiveCell.Offset(0, 5) = priority

    ActiveCell.Offset(0, 6) = ocupation / 100

    ActiveCell.Offset(0, 7) = s

    ActiveCell.Offset(0, 8) = lenght

    ActiveCell.Offset(0, 9) = e

  End If


Else


  If (s <= weeknumbe And e >= weeknumbs) Or (s <= weeknumbe And e <= weeknumbs) Or (s
>= weeknumbe And e >= weeknumbs) Then

    ocupationcounter = ocupationcounter + ocupation

    taskscounter = taskscounter + 1
```

```
    Sheet7.Activate

    Range("AB6").Activate

       Do Until ActiveCell = blank

          ActiveCell.Offset(1, 0).Activate

       Loop

    ActiveCell = u

    ActiveCell.Offset(0, 1) = team

    ActiveCell.Offset(0, 2) = id

    ActiveCell.Offset(0, 3) = name

    ActiveCell.Offset(0, 4) = complexity

    ActiveCell.Offset(0, 5) = priority

    ActiveCell.Offset(0, 6) = ocupation / 100

    ActiveCell.Offset(0, 7) = s

    ActiveCell.Offset(0, 8) = lenght

    ActiveCell.Offset(0, 9) = e

  End If



End If


Sheet2.Activate

ActiveCell.Offset(1, 0).Activate

Loop

Unload Me


Sheet7.Activate


' HEADER EMPLOYEE & WEEK(s)


  If taskscounter = 0 Then

    Range("AB6") = "N/A"
```

```
    Range("AK4") = "0"

    Else

    Range("AK4") = taskscounter

  End If
```

```
' TO WRITE ON WEEK(S)
```

```
If Range("AF2") <> Range("AG2") Then

    Range("AG4") = weeknumbs & " to " & weeknumbe

Else

    Range("AG4") = weeknumbs

End If
```

```
' TO CALCULATE TASK WEIGHT
```

```
'Range("AL6").Activate
```

```
'Do While ActiveCell.Offset(0, -1) <> blank

'   ActiveCell = ActiveCell.Offset(0, -4) / Range("AM4")

'   ActiveCell.Offset(1, 0).Activate
```

```
'Loop
```

```
' TO CLEAR STRING 2

Range("AA2:AM2").ClearContents

End Sub
```

```
Private Sub SpinButton1_Change()

TextBox1.Value = SpinButton1.Value

End Sub
```

```
Private Sub SpinButton2_Change()

TextBox2.Value = SpinButton2.Value

End Sub


Private Sub TextBox1_Change()


End Sub


Private Sub UserForm_Click()

End Sub


Private Sub UserForm_Initialize()

Sheet7.Activate

Range("AK4").ClearContents

Range("AB6:AK100").ClearContents


Range("AG4") = "=WEEKNUM(AC4)"

TextBox1.Value = Range("AG4")

TextBox2.Value = Range("AG4")

End Sub
```

6.1.9   Tabs and pages

6.1.9.1   Home page

```
Public Sub resetocvacsolverrep()

' Reset all logs except Activity (IN USE)

Sheet3.Range("D5:BC100") = "0" ' Ocupation Log
Sheet4.Range("H5:BG100") = "1" ' Vacation Log
Sheet5.Range("C3:C5").ClearContents '  Solver
Sheet5.Range("E11:E13").ClearContents '  Solver
Sheet5.Range("D14").ClearContents '  Solver
Sheet5.Range("D17").ClearContents '  Solver
```

```
Sheet5.Range("D21:BC21").ClearContents '  Solver
Sheet5.Range("D86:AM86").ClearContents '  Solver
' Rep
Sheet7.Range("C7:H100").ClearContents
Sheet7.Range("O10:P100").ClearContents
Sheet7.Range("AB6:AK100").ClearContents
Sheet7.Range("H4").ClearContents
Sheet7.Range("H5").ClearContents
Sheet7.Range("D5").ClearContents
Sheet7.Range("F5").ClearContents

Sheet7.Range("P6").ClearContents
Sheet7.Range("P7").ClearContents
Sheet7.Range("P8").ClearContents

Sheet7.Range("AK4").ClearContents

End Sub

Public Sub employeeweekbasedreport()

Sheet7.Activate
Call UserForm7.Show

End Sub

Public Sub teamweekbasedreport()
Sheet7.Activate
Call UserForm8.Show

End Sub

Public Sub weekbasedreport()

Sheet7.Activate
Call UserForm9.Show
End Sub
```

6.1.9.2   Employees and skills page

```
Public Sub addcolabuf()
' Add Employee

Sheet1.Activate
```

```
Call UserForm12.Show
Sheet6.Activate
End Sub

Public Sub addskilluf()
' Add Skill

Sheet1.Activate
Call UserForm13.Show
Sheet6.Activate
End Sub
```

6.1.9.3 Activity log page

```
Public Sub addtaskproject()

' New Task

Dim name, team As String
Dim id, s, e As Integer
Dim o As Double

Sheet2.Activate
Call UserForm3.Show
Call UserForm4.Show

' Solver

Sheet5.Activate
Range("D86:AM86").ClearContents

Application.Calculation = xlCalculationAutomatic

  Solverreset

  solverok setcell:="$D$94", maxminval:=1, bychange:="$D$86:$AM$86", _
  engine:=2, enginedesc:="Simplex LP"

  solveradd cellref:="$L$97:$L$132", relation:=1, formulatext:="$N$97:$N$132"
  solveradd cellref:="$L$134:$L$139", relation:=2, formulatext:="$N$134:$N$139"
  solveradd cellref:="$D$86:$AM$86", relation:=5, formulatext:="binary"

solversolve userfinish:=True
```

```vba
' Record Best Name

Sheet5.Range("C86").Activate

    Do Until ActiveCell = "1"
        ActiveCell.Offset(0, 1).Activate
    Loop

    name = ActiveCell.Offset(-1, 0)

    Sheet5.Range("D14") = name

Call UserForm5.Show
Sheet6.Activate
End Sub

Public Sub manualrefresh()

' Employee-Team Refresh

Dim u, t, t1 As String
Sheet2.Activate
Range("C4").Activate

Do Until ActiveCell = blank
    u = ActiveCell
    t = ActiveCell.Offset(0, 2)

    Sheet1.Select
    Application.Goto "colabx"
        Do Until ActiveCell = u
            ActiveCell.Offset(0, 1).Activate
        Loop

        If ActiveCell.Offset(1, 0) = t Then
            Sheet2.Activate
            ActiveCell.Offset(1, 0).Activate
        Else
            t1 = ActiveCell.Offset(1, 0)
            Sheet2.Activate
            ActiveCell.Offset(0, 2) = t1
            ActiveCell.Offset(1, 0).Activate
        End If
```

```
Loop
Sheet6.Activate
End Sub

Public Sub reassigntaskproject()

' Reassign Ta.

Dim name As String

Call UserForm6.Show

' Solver

Sheet5.Activate
Range("D86:AM86").ClearContents

Application.Calculation = xlCalculationAutomatic

  Solverreset

  solverok setcell:="$D$94", maxminval:=1, bychange:="$D$86:$AM$86", _
  engine:=2, enginedesc:="Simplex LP"

  solveradd cellref:="$D$97:$D$132", relation:=1, formulatext:="$F$97:$F$132"
  solveradd cellref:="$D$134:$D$139", relation:=2, formulatext:="$F$134:$F$139"
  solveradd cellref:="$D$86:$AM$86", relation:=5, formulatext:="binary"
  solveradd cellref:="$D$145:$D$174", relation:=3, formulatext:="$F$145:$F$174"

solversolve userfinish:=True

' Record Best Name

Sheet5.Range("C86").Activate


  Do Until ActiveCell = "1"
    ActiveCell.Offset(0, 1).Activate
  Loop

name = ActiveCell.Offset(-1, 0)
Sheet5.Range("D14") = name
```

```
Call UserForm5.Show

Range("A1:B1000").ClearContents
Range("A1:P2").ClearContents
Range("P1:S1000").ClearContents

Sheet6.Activate
End Sub

Public Sub changedeadline()
' Ch. Deadline
Sheet2.Activate
Call UserForm10.Show
Sheet6.Activate
End Sub
```

6.1.9.4   Occupation log page

Only written values, no VBA code embedded in the page.

6.1.9.5   Vacations log page

```
Public Sub schedulevac()
' Schedule Vacations

Sheet4.Activate
Call UserForm2.Show
Sheet6.Activate

End Sub

Public Sub cancelvac()

' Cancel Vacations

Sheet4.Activate
Call UserForm11.Show
Sheet6.Activate
End Sub
```

6.1.9.6   Solver page

```
Public Sub solver()

Solverreset
```

```
solverok setcell:="$D$94", maxminval:=1, bychange:="$D$86:$L$86", _
 engine:=2, enginedesc:="Simplex LP"

solveradd cellref:="$D$97:$D$105", relation:=1, formulatext:="$F$97:$F$105"
solveradd cellref:="$D$108:$D$110", relation:=2, formulatext:="$F$108:$F$110"
solveradd cellref:="$D$86:$L$86", relation:=5, formulatext:="binary"
solveradd cellref:="$D$114:$D$119", relation:=3, formulatext:="$F$114:$F$119"

solversolve userfinish:=True

End Sub
```

6.1.9.7   Reports page

Only written values, no VBA code embedded in the page.

6.1.9.8   Tasks record/historic page

Only written values, no VBA code embedded in the page.

6.1.10 Remove skill feature

6.1.10.1 Remove skill

```
Private Sub CommandButton1_Click()
Dim n As String
' Remove from Employees & Skills - name, dept, data and colors
Sheet1.Activate
Range("C4").Activate

n = ComboBox1.Value

 Do Until ActiveCell = n

  ActiveCell.Offset(1, 0).Activate

 Loop

 ActiveCell = "-"

' Delete row
  Rows(ActiveCell.Row).Delete
Unload Me
```

```
Sheet6.Activate
MsgBox "Skill removed.", vbInformation

End Sub
Private Sub UserForm_Click()
End Sub
```

6.1.11 Remove employee feature

6.1.11.1 Remove employee

```
Private Sub CommandButton1_Click()
Dim n As String

' Remove ocupation log / write 0s

n = ComboBox1.Value

Sheet3.Activate
Range("C4").Activate

Do Until ActiveCell = n
    ActiveCell.Offset(1, 0).Activate
Loop

ActiveCell.Offset(0, 1).Activate

' Bring from bottom to top 1 cell

Do Until ActiveCell.Offset(0, -1) = 0

   For i = 0 To 51 Step 1

   ActiveCell.Offset(0, i) = ActiveCell.Offset(1, i)

    Next i

ActiveCell.Offset(1, 0).Activate

Loop

' Remove vaccation log / write 1s

n = ComboBox1.Value
```

```
Sheet4.Activate
Range("C4").Activate

Do Until ActiveCell = n
    ActiveCell.Offset(1, 0).Activate
Loop

ActiveCell.Offset(0, 5).Activate

' Bring from bottom to top 1 cell

Do Until ActiveCell.Offset(0, -5) = 0

   For i = 0 To 51 Step 1

   ActiveCell.Offset(0, i) = ActiveCell.Offset(1, i)

   Next i

ActiveCell.Offset(1, 0).Activate

Loop

' Remove from Employees & Skills - name, dept, data and colors

Sheet1.Activate
Range("C4").Activate

 Do Until ActiveCell = n

  ActiveCell.Offset(0, 1).Activate

 Loop

 ActiveCell = "-"

 Do Until ActiveCell.Offset(1, 0) = ""

  ActiveCell.Offset(1, 0).Activate
  ActiveCell.Interior.Color = xlNone

 Loop

' Delete column
```

```
  Columns(ActiveCell.Column).Delete


Unload Me

' Read current week

Dim w, sw, ew As Integer

Sheet7.Activate
Range("F4") = "=WEEKNUM(D4)"
w = Range("F4")

' Activity Log "moves" Preparation

Sheet2.Activate
Range("C3").Activate

Do Until ActiveCell = ""

  If ActiveCell = n Then

    sw = ActiveCell.Offset(0, 7)
    ew = ActiveCell.Offset(0, 9)

      If sw <= ew Then

        If (w >= sw And w <= ew) Or (w <= sw And w >= ew) Or (sw >= w And ew >= w) Then
        ActiveCell.Interior.ColorIndex = 40
        ActiveCell.Offset(0, 19) = "x"
        End If

      Else
        If (w <= ew And w >= sw) Or (w <= ew And w <= sw) Or (w >= ew And w >= sw) Or (w <=
sw And w >= ew) Then
        ActiveCell.Interior.ColorIndex = 40
        ActiveCell.Offset(0, 19) = "x"
        End If

      End If
  End If

ActiveCell.Offset(1, 0).Activate
Loop
```

```
Sheet6.Activate
MsgBox "Employee removed. Please use Smart Reassign tool to reassign future or current tasks
of the removed employee.", vbCritical
End Sub
```

6.1.12 Remove task feature

6.1.12.1 Load Task

```
Private Sub CommandButton4_Click()
 Dim n As Integer
 Dim o As Integer
 Dim ew, sw As Integer
 Dim time As Double

 Sheet7.Activate
 Range("F4") = "=WEEKNUM(D4)"
 w = Range("F4")

 Sheet2.Activate
 Range("D3").Activate

 Range("B3").Value = ComboBox2.Value
 n = ComboBox2.Value

 Do Until ActiveCell = n

 ActiveCell.Offset(1, 0).Activate

 Loop

 ActiveCell.Offset(0, -3) = ComboBox2.Value
 ActiveCell.Offset(0, -2) = ActiveCell.Offset(0, -1)
 ActiveCell.Offset(0, 12) = ActiveCell.Offset(0, 6)
 ActiveCell.Offset(0, 13) = ActiveCell.Offset(0, 8)
 ew = ActiveCell.Offset(0, 8)
 sw = ActiveCell.Offset(0, 6)

 If ew <> sw Then
   TextBox3.Value = "from week " & sw & " to " & ew
 Else
   TextBox3.Value = "on week " & sw
 End If

   TextBox4.Value = ActiveCell.Offset(0, -1)
```

End Sub

6.1.12.2 Remove Task

```
Private Sub CommandButton1_Click()

Dim s, e, ec, s1, e1, ec1, o As Integer
Dim u As String

  Sheet2.Activate
s = ActiveCell.Offset(0, 6) ' Start date
e = ActiveCell.Offset(0, 8) ' End date

  ' Start thinking about removing Ocupation

Sheet2.Activate
Range("D3").Activate

  Do Until ActiveCell = Range("B3")

  ActiveCell.Offset(1, 0).Activate

  Loop

u = ActiveCell.Offset(0, -2)
o = ActiveCell.Offset(0, 5)
s1 = ActiveCell.Offset(0, 12)
e1 = ActiveCell.Offset(0, 13)

  ' Delete/ clean string

  ActiveCell.Offset(0, 17).ClearContents
  ActiveCell.Offset(0, 16).ClearContents
  ActiveCell.Offset(0, 11).ClearContents
  ActiveCell.Offset(0, 10).ClearContents
  ActiveCell.Offset(0, 9).ClearContents
  ActiveCell.Offset(0, 8).ClearContents
  ActiveCell.Offset(0, 7).ClearContents
  ActiveCell.Offset(0, 6).ClearContents
  ActiveCell.Offset(0, 5).ClearContents
  ActiveCell.Offset(0, 4).ClearContents
  ActiveCell.Offset(0, 3).ClearContents
  ActiveCell.Offset(0, 2).ClearContents
```

```vba
 ActiveCell.Offset(0, 1).ClearContents
 ActiveCell.Offset(0, -1).ClearContents
 ActiveCell.ClearContents


 ' Write (remove) on Ocupation log


Sheet3.Activate
Range("C4").Activate
Do Until ActiveCell = u
     ActiveCell.Offset(1, 0).Activate
Loop


If s1 <= e1 Then

 Do While s1 <= e1

   ActiveCell.Offset(0, s1) = ActiveCell.Offset(0, s1).Value - o / 100
   s1 = s1 + 1

 Loop
Else
 Do Until s1 = 53

   ActiveCell.Offset(0, s1) = ActiveCell.Offset(0, s1).Value - o / 100
   s1 = s1 + 1

 Loop
 ec1 = 1

 Do Until ec1 = e1 + 1

   ActiveCell.Offset(0, ec1) = ActiveCell.Offset(0, ec1).Value - o / 100
   ec1 = ec1 + 1
 Loop

End If

Sheet2.Activate

' Delete row
 Rows(ActiveCell.Row).Delete

Unload Me

Sheet5.Activate
```

End Sub

6.1.12.3 Reset

Private Sub CommandButton2_Click()

TextBox4.Value = ""
TextBox3.Value = ""
ComboBox2.Value = ""
End Sub

6.1.12.4 Cancel

Private Sub CommandButton3_Click()

Unload Me
Sheet6.Activate
End
End Sub

6.1.13 Smart reassign feature

6.1.13.1 Reassign

Private Sub CommandButton1_Click()
Dim s, e, ec, s1, e1, ec1, o As Integer
Dim u As String

s = TextBox1.Value
e = TextBox2.Value

  Sheet2.Activate
  Range("A3") = TextBox1.Value
  ActiveCell.Offset(0, 15) = TextBox1.Value
  ActiveCell.Offset(0, 16) = TextBox2.Value
  ActiveCell.Offset(0, 7) = TextBox1.Value ' Start date
  ActiveCell.Offset(0, 9) = TextBox2.Value ' End date

    ' Lenght

 If ActiveCell.Offset(0, 9) > ActiveCell.Offset(0, 7) Then
   ActiveCell.Offset(0, 8) = ActiveCell.Offset(0, 9) - ActiveCell.Offset(0, 7) + 1
 ElseIf ActiveCell.Offset(0, 9) = ActiveCell.Offset(0, 7) Then
   ActiveCell.Offset(0, 8) = "1"

```vba
 Else
  ActiveCell.Offset(0, 8) = 52 - ActiveCell.Offset(0, 7) + ActiveCell.Offset(0, 9) + 1
 End If


 ActiveCell.Offset(0, 9) = TextBox2.Value ' End date
 ActiveCell = ""
 ActiveCell.Offset(0, 2) = ""

s = ActiveCell.Offset(0, 15)
e = ActiveCell.Offset(0, 16)

 Sheet5.Activate

 Range("C21").Activate
 Range("D21:BC21").ClearContents

 ' WRITE 1s

If s <= e Then

 Do While s <= e

  ActiveCell.Offset(0, s) = "1"
  s = s + 1

  Loop

Else

  Do Until s = 53

  ActiveCell.Offset(0, s) = "1"
  s = s + 1

  Loop

  ec = 1

  Do Until ec = e + 1

  ActiveCell.Offset(0, ec) = "1"
  ec = ec + 1

  Loop
```

End If

```
 ' WRITE 0s

 Range("C21").Activate

 ActiveCell.Offset(0, 1).Activate

   For i = 0 To 51 Step 1

    If ActiveCell = "1" Then

      ActiveCell = "1"

     Else

      ActiveCell = "0"

     End If

      ActiveCell.Offset(0, 1).Activate
   Next i
Unload Me

Sheet2.Activate
Unload Me
Sheet5.Activate
End Sub
```

6.1.13.2 No reassign

```
Private Sub CommandButton2_Click()

Sheet2.Activate

Range("C3").Activate

Do Until ActiveCell = ""
   ActiveCell.Offset(1, 0).Activate
Loop
ActiveCell.Interior.Color = xlNone
ActiveCell.Offset(0, 19) = ""
ActiveCell = ActiveCell.Offset(0, -1)
```

```
Range("A1:B1000").ClearContents
Range("A1:P2").ClearContents
Range("P1:S1000").ClearContents
Sheet6.Activate

Unload Me
End
End Sub
```

6.1.13.3 Cancel

```
Private Sub CommandButton3_Click()
Unload Me
Sheet2.Activate
ActiveCell = ActiveCell.Offset(0, -1)
Range("A1:B1000").ClearContents
Range("A1:P2").ClearContents
Range("P1:S1000").ClearContents

Sheet6.Activate
End
End Sub
```

6.2   Activities Flowchart for the IT Department