



**Politecnico  
di Torino**

## **POLITECNICO DI TORINO**

Master's Degree Course in Engineering and Management (DIGEP) LM-31

A.a. 2023/2024

Graduation Session Settembre-2024

# **Prioritization of projects in Project Portfolio Management (PPM)**

Supervisor:

Alberto De Marco  
Full Professor, DIGEP – PoliTO

Co. Supervisor:

Francesca Saba

Candidate:

Carlos Benito Calviño  
s313308

# ACKNOWLEDGMENTS

I am truly grateful to all the people who have lend me a hand and provided support through the realization of this thesis. This journey has been challenging and fulfilling at the same time, but it wouldn't have been possible without the guidance and advice that many have given to me.

Firstly, I would like to thank my thesis advisor, Professor Alberto De Marco. His expertise on this subject, and his continuous encouragement and assistance have been vital throughout the research process. His knowledge and sharp feedback have made possible not only the fulfilment of this thesis, but the deepening of my knowledge in project management and similar subjects.

Lastly, but not less important, I want to appreciate the support of my family and friends, especially my parents, whose constant support, comfort, and reassurance have been essential. They have believed in my capabilities from the first moment and have motivated me to continue in the most difficult times.

To everyone I have previously mentioned and the rest who have contributed in a way, I want to let you know that your involvement has been fundamental to my thesis and my academic journey, and I am immensely thankful for all the support you have given me.

# ABSTRACT

This thesis with the title “Prioritization of projects in Project Portfolio Management” mainly focuses on different methods and tools that are commonly used to select and prioritize the different project opportunities inside a companies’ portfolio. This work is primarily bibliographical, where we have performed an extensive and systematic literature review. However, we have also studied and analysed PPM softwares that are generally used.

Firstly, we have carried out a general literature review on Project Portfolio Management (PPM), where we have studied its importance for enterprises and the challenges it faces nowadays. Furthermore, we have reviewed distinct techniques that companies use to prioritize their projects.

After this first research, we have discovered that the two main used methods are financial planning and visualization tools. So, we have later decided to narrow-focus our investigation to these two topics. We will cover its main functionalities and in which situations they are principally used. Furthermore, we will be describing how these two techniques are integrated with PPM and with project portfolio selection and prioritization. In addition to the impact of financial constraints on portfolio performance and methods to align financial planning with strategic goals.

Lastly, we will also be studying and analysing different softwares which are generally utilized in Project Portfolio Management. In here there will be a general description of each of them with their main functionalities, advantages and disadvantages. Moreover, we will include a table in where it will be shown clearly the differences and characteristics of all of them.

**Main keywords:** Project Portfolio Management, project prioritization and selection, financial planning, rolling wave method, data visualization tools, PPM softwares, strategic alignment.

# TABLE OF CONTENTS

ACKNOWLEDGMENTS .....	2
ABSTRACT .....	3
1. INTRODUCTION .....	7
2. LITERATURE REVIEW .....	8
2.1. PRIORITIZATION IN PROJECT PORTFOLIO MANAGEMENT.....	10
3. RESEARCH METHODOLOGY .....	15
4. FINANCIAL PLANNING.....	18
4.1. INTEGRATION WITH PPM.....	19
4.2. CHALLENGES WITHIN PPM.....	20
4.3. TECHNIQUES AND METHODS USED .....	21
4.4. ROLLING WAVE METHOD FOR BUDGETING .....	22
5. FINANCIAL PLANNING AND PROJECT PORTFOLIO PRIORITIZATION .....	24
5.1. IMPACT OF FINACIAL CONSTRAINTS ON PORTFOLIO PERFORMANCE .....	25
5.2. METHODS TO ALIGN FINANCIAL PLANNING WITH STRATEGIC GOALS .....	25
6. DATA VISUALIZATION IN PPM .....	27
6.1. TOOLS AND TECHNIQUES.....	28
7. PPM SOFTWARES AVAILABLE FOR FINACIAL PLANNING.....	31
7.1. INTEGRATION OF FINANCIAL PLANNING TOOLS WITHIN PPM SOFTWARE	32
8. RESULTS .....	34
8.1. MICROSOFT PROJECT.....	34
8.2. ECOSYS .....	36
8.3. SMARTSHEET .....	37
8.4. WRIKE .....	39
8.5. PLANVIEW .....	40
8.6. PLANISWARE.....	42
8.7. COMPARISON .....	44
9. CONCLUSIONS .....	47
REFERENCES .....	49

# LIST OF FIGURES

Figure 1: Multiple-Criteria Weighted Ranking (PMI, 2014) .....	12
Figure 2: Bubble chart (PMI, 2014) .....	12
Figure 3: Thesis project tasks .....	15
Figure 4: Thesis project Gantt Chart .....	16
Figure 5: NPV Formula .....	21
Figure 6: IRR Formula .....	21
Figure 7: Dependency matrix .....	28
Figure 8: Portion of a portfolio network map .....	29
Figure 9: Project Gantt Chart .....	29
Figure 10: Screenshot of Microsoft Project .....	35
Figure 11: Screenshot of EcoSys .....	37
Figure 12: Screenshot of Smartsheet .....	38
Figure 13: Screenshot of Wrike .....	40
Figure 14: Screenshot of Planview .....	41
Figure 15: Screenshot of Planisware .....	43

# LIST OF TABLES

Table 1: Comparison between softwares.....	46
--	----

# 1. INTRODUCTION

Project and portfolio management have gained in the last years importance in companies and many authors have written about it. And some of them talk specifically about the prioritization of projects inside a portfolio. However, the methods and processes they offer are not very flexible and adaptable to all types of companies and are usually based on complex mathematical models that are difficult to implement in smaller companies.

Furthermore, methods used for prioritization such as financial planning or visualization tools are of vital importance. However, it is more crucial to integrate these methods properly with Project Portfolio Management (PPM) to get the most out of them. Allowing managers to align financial plans with strategic objectives, so they can maximize the portfolio value and achieve the firm's goals.

Nowadays, there exist numerous softwares that are useful for PPM, each one of them with their unique characteristics and features. Some of them even help with the integration of financial plans with portfolio management. So, it is of vital importance to know them to be able to use the one that will fit your companies' requirements.

The main objective of this thesis is to carry out a detailed study of financial planning and visualization tools in PPM and analyse how they integrate with portfolio and project management. We also want to cover these topics from the point of view of prioritization and selection of projects, discussing how these two commonly used techniques can be beneficial for it.

Furthermore, another primary objective is to perform a research on the different PPM softwares that are used to manage projects and portfolios. Analysing how each one of them integrate financial planning with PPM and how they can be helpful to its users when the selection and the prioritization of projects is being executed.

## 2. LITERATURE REVIEW

Projects are temporary endeavours undertaken to create a unique product, service, or result. Those outcomes might be tangible or intangible. And they also have a temporary nature which indicates they have a definite beginning and end (Rose, 2013). In the last years, organizations have been shifting towards an approach that focuses on projects, to be able to reduce costs and improve competitiveness. It also helps adapt to the rapid changing demand in the market, which is really important in a world with increasing global competition (Padovani, 2008).

Traditionally, organizations have focused only on single projects success. Nevertheless, they have started managing groups of projects as an interconnected portfolio, rather than in isolation. But which it is also more complex. (Levine, 2005). Due to these reasons project portfolio management has been gaining a remarkable importance in the last decades.

Project portfolio management (also known as PPM) is a process through which companies select the right projects, prioritize the work, and provide the resources needed in order to be aligned with their organizational strategies and long-term goals (Rose, 2013). Other authors such as (Iyyuni, 2015), consider project portfolio management as a critical tool for firms to deal with the dynamic global market and their uncertainties to accomplish their financial and strategic objectives. He also highlights the need for flexibility and strategic planning in project portfolio management to deal with the shifts in market trends and consumption patterns across the world over time, which calls them “spatio-temporal uncertainties”. What all authors have in common is that they use it to deal and manage the different projects an enterprise has to maximize their overall welfare and success (Levine, 2005).

However, managing multiple projects simultaneously is challenging because of different reasons (Purnus, 2014):

- **Volatile economic climate:** Financial crises can cause payments to stop temporarily which would force companies to take additional risk they wouldn't normally take.



- **Unstable cash flows:** Delays in payments cause companies to use internal resources. Which can trigger cash shortages, missed deadlines and budget overruns.
- **Fierce competition:** Due to the decrease in projects every year, companies participate in unsustainable bidding practices. They even assign to projects values the 50% of the initial budget, which causes an erosion on the margin profits and reduces the quality of the services.

Apart from the external competition we have just mentioned, there also exist internal competition in companies due to limited resources like funding and senior management attention. This is why project teams experience pressure and feel demotivated or undervalued within an organization when they have less access to resources (Iyyuni, 2015).

Project portfolio management has different task which are vital for companies to achieve their short and long-term goals. One of the main tasks within PPM is risk management, that has to deal with uncertainties which influence portfolio outcomes. Other sources of uncertainty apart from the ones previously mentioned are market (PESTLE), technological, customer relationship, and people uncertainties. Analysing and understanding these sources can help companies develop specific strategies (Iyyuni, 2015)

However, in this literature review we will focus on another main task of PPM, which is the selection and prioritization of projects. An effective project categorization and prioritization can give rise to a successful project portfolio management and maximize the value creation potential for an organization by increasing the output and being more cost-effective (El Hannach, 2019). Other benefits are they ensure the support on organization's goals and the optimization of the resources based on their strategic priorities. It can also help reduce the overall portfolio risk thanks to the diversification of projects and selecting those with uncorrelated risks (Purnus, 2014).

On the other hand, selection, and prioritization of projects in companies are currently facing some challenges (Chatterjee, 2018):

- **Limited funding and resources:** Organizations generally have limited budgets and resources, which forces them to prioritize projects that will offer the highest benefit.

- **Outdated technology:** Obsolete technology can limit the success of a project and impact negatively on cost.
- **Subjective expert judgments:** The process of decision-making in a company can often suffer from experience-based judgement and subjectivity which could lead to cognitive bias. These problems often come from high-level management.
- **Financial risk minimization:** Enterprises look for projects that will maximize the possibility of success while minimizing financial risks.

Furthermore, companies usually have multiple project proposals which will lead them take timely decisions to avoid delays. This selection of projects will also lead to trade-offs between different objectives.

Traditionally, this selection and prioritization has been done focusing only on individual project evaluation and financial metrics, like profit or return on investment (ROI). While these factors are important, they can lead to suboptimal portfolio decisions. One clear example could be the case where a project with the highest potential profit margin requires significant resources, limiting the execution of other valuable projects (El Hannach, 2016). Moreover, this often leads to a selection of projects that may not be fully aligned with a company's overall business strategy and long-term vision (El Hannach, 2019).

(Padovani, 2008) points out that an effective portfolio management should not only focus on meeting the strategic requirements, but also give the company a competitive advantage. And to achieve this effectiveness they should choose the right projects. But like (Elbok, 2020) says, there aren't "one-size-fits-all" approach to project portfolio selection since each organization has their unique needs.

## 2.1. PRIORITIZATION IN PROJECT PORTFOLIO MANAGEMENT

Throughout the lecture of the different articles, we have found different methods and processes to select and prioritize projects in a portfolio. One of the main steps that all the processes have in common is defining a set of criteria for the projects.

The method of **multiple criteria** consists in defining different key indicators to assess and compare the projects in a portfolio. As (Chatterjee, 2018) mentions, the criteria

chosen can either be tangible (like financial ratios) or intangible (like strategic alignment). There are many types, but the most common ones are (Purnus, 2014):

- Financial criteria (benefit-cost ratio, net present value, return on investments)
- Technical criteria (project complexity, technology capabilities and capacities)
- Strategic criteria (goals, objectives, market share and growth, competitive advantage)

However, there are many other types of criteria that can be also used depending on the type of project such as (PMI, 2014):

- Risk-related criteria (potential internal and external risks, mitigation strategies)
- Resource-related criteria (human resources capabilities, equipment needs)
- Legal criteria (legal/regulatory compliance)
- Qualitative factors (experience, team expertise, urgency)
- Quantitative factors (project size, people committed to the project, time available)

Nevertheless, there isn't a universally accepted set of criteria, and organizations should define the criteria that best suits their specific context and operating environment. Decision-makers usually prefer to consider both qualitative and quantitative criteria for better decision outcomes. However, choosing inappropriate criteria can negatively impact the company's ability to achieve their goals and objectives (Elbok, 2020).

This method uses different decision-making models (also known as MCDM) to rank the projects based on the different previously chosen. Some of the most common are ELECTRE, PROMETHEE, and AHP (Analytic Hierarchy Process) (Elbok, 2020). (Sari, 2023) mentions other models like MAUT (Multiple-Attribute Utility Technique) and decision trees, that use a hierarchical structure to evaluate project alternatives against objectives at different levels, like AHP does.

One of the disadvantages of using AHP, is that it doesn't take into account uncertainties. However, (Chatterjee, 2018) proposes the integration of a fuzzy approach to this model to help address decision-maker uncertainty.

The methods previously mentioned are more advanced and for companies which are seeking a more sophisticated approach to the decision making. And they require a minimum knowledge on the models to be able to use them. However, there are other methods that are simpler and easier to use (Levine, 2005):

- Weighted ranking/Balance scorecard:** Consists in assigning a weight to each of the criteria that has been previously selected depending on their importance to the company or to the project category. Projects are then evaluated and assessed according to the criteria to have a more comprehensive vision and be easier to compare. With the final values for each project, they can be ranked and prioritize inside the portfolio. In Figure 1, that has been extracted from (PMI, 2014) we can see an example of how this method can be used to rank projects based on their priority.

PROJECTS	Criterion 1		Criterion 2 * Probability of Success		Criterion 3		Criterion 4		PRIORITY	
	Measure	Rank	Result	Rank	Level of Importance	Rank	Measure	Rank	Score	Priority
Project 1	16.0	2	8.8 (\$11M X 80%)	2	5 (++)	1	\$2M	1	1.50	1
Project 3	14.0	4	18.9 (\$21M X 90%)	1	4	2	\$2.5M	2	2.25	2
Project 4	15.5	3	8.45 (\$13M X 65%)	3	2	4	\$3M	3	3.25	3
Project 2	19.0	1	5.95 (\$7M X 85%)	4	1 (-)	6	\$4.3M	4	3.75	4
Project 5	10.0	6	5.4 (\$6M X 90%)	5	3	3	\$5.2M	6	5.00	5
Project 6	12.0	5	2.1 (\$3M X 70%)	6	1.5	5	\$4.6M	5	5.25	6

Figure 1: Multiple-Criteria Weighted Ranking (PMI, 2014)

- Visualization/Graphical techniques:** Data visualization tools like grids and charts are powerful aids in presenting multidimensional data for analysis. These tools can be used to compare projects, allowing decision-makers to prioritize projects and to monitor portfolio balance according to the criteria previously selected. In the (PMI, 2014), different types of graphs are suggested such as: risk vs. return charts, histograms, pie charts, and bubble graphs. An example of a bubble chart can be found in Figure 2, where projects are evaluated on three different criteria, two of them in each of the axis, and the other represented by the size of the circles.

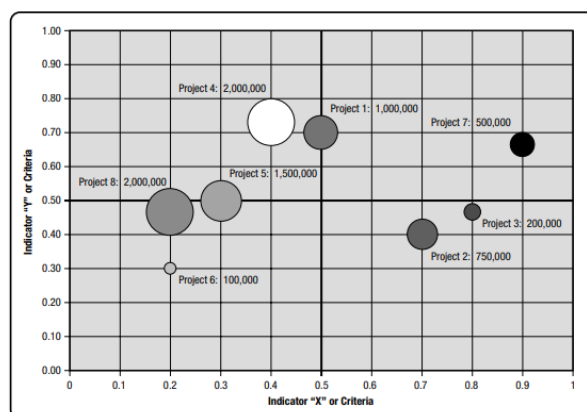


Figure 2: Bubble chart (PMI, 2014)

Another important step in the suggested processes is **categorization**, which consists in classifying the projects in the portfolio. This is essential since not all projects are alike, and we want to avoid unfair comparisons and “throwing everything in the same basket”. (Elbok, 2020). The different benefits associated to categorization mentioned in (PMI, 2014) are:

- **Standardized Comparisons:** Criteria and its importance can vary between projects, so by using categorization we allow a standardized and balance comparison of projects that addresses similar needs and strategic goals. In that way they ensure projects contribute to the desired outcomes.
- **Efficient Evaluation:** By grouping similar projects, categorization allows for a more efficient and easier scoring, ranking, and selection processes. Decision-makers can focus on comparing projects within relevant categories for their companies.

(Iyyunni, 2015) introduces the NTCP model (Novelty, Technology, Complexity, and Pace) as a tool to help organizations understand the characteristics of different project types.

Other important steps that some authors mention in their processes are the following:

- **Selection:** This would be the first step, where from a wide variety of projects, possible candidate projects for the portfolio are chosen. This selection is done in order to have a first filter, which is pretty useful in big companies since the complexity in the management of portfolios increases with the number of project proposals (Chatterjee, 2018).
- **Evaluation:** Projects previously selected are reviewed and analysed in order to get the most information out of them. This is helpful because they will have to be assessed, according to the criteria selected by the company, to prioritize the projects on the portfolio (El Hannach, 2019).
- **Adjustment:** Performance data, resource availability, and changes in the business environment (market shifts, economic fluctuations) need continuous monitoring. Project portfolios are not static, and projects may be added, removed, or re-prioritized to ensure optimal resource allocation and strategic alignment (El Hannach, 2016).

Lastly, we would like to mention (Purnus, 2014) probabilistic approach, which is really helpful to take into account risk and uncertainty in the assessment of project criteria. He highlights that a deterministic approach is commonly used to estimate project performance, which cannot be as accurate in making decisions. However, this type of approach can only be used with quantitative criteria. The two different methods that he introduces are:

- **Three-Scenario Approach (Pearson-Tukey Method):** A semi-probabilistic strategy of developing optimistic, most likely, and pessimistic project scenarios to build probability curves for target goals.
- **Monte Carlo Simulation:** Computer-based simulation of project risks and uncertainties, allowing analysis of thousands of potential outcomes to understand project behaviour.

### 3. RESEARCH METHODOLOGY

This thesis has been developed using a technique similar to waterfall project management methodology, in which each phase has been carried out in sequence, one after the other. Waterfall methodology is a linear process model which is characterized by clearly stated series of stages that flow downwards like a waterfall. As it can be seen in Figure 4, our thesis project also follows a sequential approach like the waterfall methodology.

We have decided to follow this type of approach since we need to finish each of the tasks before moving on to the next one. So, this characteristic of the waterfall methodology is suitable for our project.

#### ▸ Thesis Project

1. Initial discussion and statement of the first thesis hypothesis
2. Project Prioritization Literature Review
3. Analysis of reasearch gaps and re-design of thesis
4. Financial Planning Literature Review
5. Visualization Techniques Literature Review
6. PPM Softwares Literature Review
7. Analysis and discussion of the results found in the literature review
8. Conclusions of the thesis

*Figure 3: Thesis project tasks*

As it can be seen in Figure 1, our project is composed of 8 main tasks, where the majority of them are literature review of different topics, since we are doing a bibliographical thesis. To start off, we first stated the hypothesis of our thesis and about what we wanted to do the literature review.

In the beginning we did a general study on project portfolio management (PPM) and the different methods that exist. After analysing the results from this first part, we decided to narrow-focus on two of the main methods that are commonly used, which are financial planning and visualization tools.

Secondly, we did a broad study on different softwares that are used for PPM. With this we were able to extract the characteristics of each of them and their advantages and drawbacks. To capture

To conclude, we did a final analysis on all the literature review we had carried out to arrive to the final conclusions on our thesis.

In Figure 4, we can observe the Gantt Chart of all the task previously mentioned. This thesis' work has been performed through the period of seven months, starting in the month of March of 2023.

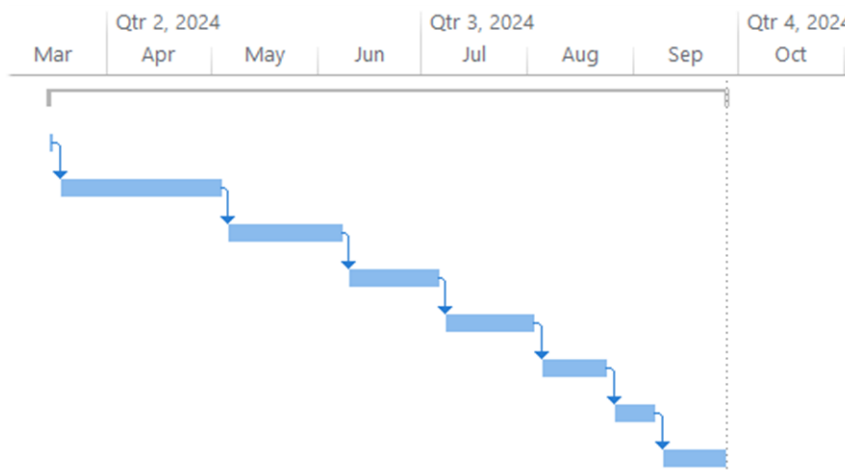


Figure 4: Thesis project Gantt Chart

The literature review of this thesis has been done using an extensive and systematic literature analysis, with both academic and professional articles. For the search process of this study, we have primarily used the online database of *Google Scholar*, and other websites such as *Elsevier*, *IEEE Xplore*, *Taylor & Francis*, and *Springer*. Although some of the books used have been downloaded from different websites such as *Academia.edu*. Moreover, for some topics like Rolling Wave Method or for the different softwares, we have extracted also information from some websites since we could not find that many articles on these matters.

To conduct the research for the literature review of this thesis, relevant keywords like “prioritization in a project portfolio”, “financial planning in PPM”, “visualization tools for projects and portfolios”, and “softwares for project management” have been used in order to find the right articles.

The first filter used in all the articles encountered, was done by reading the headlight and the abstract of each one of them, which in case of being the type of article we were looking for, it was stored for a posterior lecture. After certain articles were selected for each of



the different topics we cover in this thesis, an in-depth analysis was done to get all the ideas.

Afterwards, we did a synthesis/summary of all the articles and stated the main key points of each of them. Thanks to it, we could easily connect the ideas of the different authors and see what they had in common, and which parts were less developed so we could find the research gap that we will try to explore and expand in our thesis.

## 4. FINANCIAL PLANNING

Previously, in a general literature review, we have analysed different methods and tools commonly used on the selection and prioritization of projects in a portfolio, which is a crucial step in Project Management Portfolio (PPM). One of the most important methods that is used to execute the prioritization of a portfolio is financial planning.

Financial planning is a fundamental process that consists in allocating and managing the financial resources of a company across a portfolio of projects. This mechanism, essential to PPM, acts as support to ensure that projects are strategically aligned with an organization's long-term goals and their financial capabilities. This is achieved through meticulous budget management, optimal resource allocation, and continuous financial assessment, which allows organizations to prioritize the projects that will bring the maximum value while taking care of risks effectively (Kapoor, 2016).

It comprises critical activities such as budget allocation, cost estimation, and resource and risk management, all of which are crucial for a successful execution of the projects and the achievement of the firm's goals.

(Cooper, 2001) mentions that a well-structured financial plan helps in decision-making, because it provides a comprehensive insight into the financial viability and potential returns of projects. This process involves evaluating projects not just for their strategic fit but also for their economic feasibility, ensuring that resources are allocated to projects with the greatest potential for success. By using financial planning as a guiding reference, organizations can manage better their project portfolios and ensure that projects are aligned with the overall strategic vision.

Moreover, organizations gain the possibility to adapt to market changes if they have an effective financial plan. In today's dynamic business environment, where market conditions and strategic priorities can shift rapidly, having a robust financial planning framework is critical to adjust and re-align projects to new opportunities and threats (Müller, 2008).

Financial planning can also be used as a tool for accountability and performance measurement. Organizations can track the progress of the projects by setting financial targets and milestones, apart from assessing financial health and making adjustments whenever is needed. Thanks to this continuous monitoring process, firms can ensure that

projects are not only delivered on time and within budget but also that they provide the expected financial returns (Dooley, 2005).

#### 4.1. INTEGRATION WITH PPM

Integrating financial planning with PPM is vital to ensure that project portfolios are managed so that they support strategic objectives and maximize return on investment. This integration means lining up financial metrics with strategic priorities, allowing organizations the optimization of resource allocation and project selection processes (Dooley, 2005).

The integration's key aspect is the development of an extensive financial structure that covers strategic, tactical, and operational planning levels. At the strategic level, financial planning makes sure that portfolios are aligned with the vision of the firm and that resources are assigned to projects which strategic value offer is the greatest. This arrangement is vital to maintain a balanced portfolio that supports the organization's competitive positioning and long-term growth (Meskendahl, 2010).

At the tactical level, financial planning requires an optimal coordination of the resource's allocation across the portfolio, to ensure that all projects are properly supported, and their resources are efficiently used. A dynamic approach to resource management is essential, since financial plans need to be continuously updated to display changes in project scope, timelines, and priorities (Killen & Hunt, 2010). By including financial metrics into the portfolio management process, organizations can assess in a better way project performance and make informed decisions about project continuation or termination.

Lastly, at the operational level, financial planning is integrated into the daily management of projects. Project managers use financial data to manage costs, track progress, and ensure that projects do not exceed their budget. According to (Turner & Ledwith, 2012) this operational integration is crucial to maintain financial discipline and ensure that projects deliver the expected financial returns.

Furthermore, financial planning integration with PPM increases organizational agility and responsiveness. Organizations can quickly adapt their project portfolios to changes in the external environment, such as technological advancements, market shifts, or competitive pressures. All thanks to the alignment of financial and strategic planning. This ability to

adjust and pivot is one of the main advantages of integrating financial planning with PPM (Müller, 2008).

## 4.2. CHALLENGES WITHIN PPM

Even though financial planning has a crucial role in PPM, it is filled with challenges that firms must deal with to achieve successful outcomes. One of the main challenges is the intrinsic uncertainty and complexity of project environments, which can make it complicated to precisely forecast and budget (Müller, 2008).

Companies frequently face resource constraints, which entails complex decisions with respect to project prioritization and resource allocation. The highly competitive demands for limited resources, requires optimizing resource use with effective strategies and needs to make sure that projects receive adequate funding. As mentioned before, financial plans need to be aligned with the strategic priorities, which intensifies this challenge (Kapoor, 2016).

Moreover, the dynamic nature of project portfolios necessitates continuous monitoring and adjustment of financial plans to accommodate changes in the business environment and strategic priorities. This requires a flexible and adaptable approach to financial planning that enables organizations to respond quickly to new possibilities and problems. For instance, project plans and budgets may need to be quickly adjusted if there are changes in market conditions, regulatory environments, or technological advancements (Martinsuo, 2013).

According to (Dooley, 2005), there exists an essential need for effective communication and collaboration between project managers and stakeholders to overcome financial planning challenges. A continuous dialogue and arrangements among all parties involved, including project teams, financial analysts, and executive leaders helps to achieve this effective communication. Moreover, this cooperation is essential to maintain clarity, inspire confidence, and ensure that all stakeholders have the same financial goals and priorities as the firm.

Lastly, when integrating financial planning with other elements of PPM, such as risk management and performance evaluation, this process gets more complex. In addition, to

ensure that financial plans are complete and in line with managerial goals, enterprises must create a strong financial framework that includes risk assessments, performance metrics, and feedback mechanisms, (Killen & Hunt, 2010).

### 4.3. TECHNIQUES AND METHODS USED

Financial planning for PPM can be done using various methods or techniques, each one having their own advantages and limitations. Two of the most famous and common are the following ones:

- **Net Present Value (NPV) analysis:** it calculates the present value of the expected future cash flows to evaluate the project's profitability. It is especially effective when we compare projects with different cash flow patterns and timelines, allowing companies to make informed investment decisions. This method is useful to evaluate the financial viability of projects, to later prioritize those with the highest profit (Archer, 1999).

$$NPV = \sum_{t=0}^n \frac{Rt}{(1+i)^t}$$

Figure 5: NPV Formula

- **Internal Rate of Return (IRR):** it calculates the discount rate which will make zero the net present value of cash flows. This tool allows organizations to assess the financial attractiveness of projects and select the ones with the highest potential returns. It is a valuable method that can be useful to evaluate the relative profitability and compare projects with different durations and cash flow profiles. (Cooper, 2001).

$$0 = NPV = \sum_{n=0}^N \frac{CF_n}{(1+IRR)^n}$$

Figure 6: IRR Formula

According to (Müller, 2008), in PPM, financial scoring models are generally used to evaluate projects based on different financial criteria, such as cost savings, expected

revenue, and strategic impact. These models provide a structured approach to evaluate the projects, and to allow portfolio managers to prioritize projects based on their financial and strategic value. Financial scoring models can be adapted to an organization's specific needs and priorities, providing a flexible framework to assess projects.

Another known method is the strategic buckets approach, that assigns funds based on strategic priorities to different categories, also called "buckets". So, resources are distributed in a balanced way thanks to this approach that reflects the organization's strategic goals. By classifying projects into distinct "buckets", such as product lines, markets, or project types, companies can select and prioritize those projects that are in line with their strategic goals and provide the greatest financial returns (Meskendahl, 2010).

Organizations are increasingly using data-driven strategies and advanced analytics, in addition to these conventional methods, to improve financial planning in PPM. Some tools such as predictive analytics, scenario planning, and real-time data visualization enable companies to gain deeper view of the project performance, and to identify trends to make more informed financial decisions. These techniques allow businesses to optimize their project portfolios, maximize returns, and promote long-term value creation (Turner & Ledwith, 2012).

#### 4.4. ROLLING WAVE METHOD FOR BUDGETING

The rolling wave method in PPM is a budgeting technique that enables a detailed planification of actual tasks while leaving more flexibility on future tasks until they are close in time. This technique uses iterative planning, which means that the project will adapt as the project unfolds. Thanks to this approach, companies are able to adapt to changing circumstances and make informed-based decisions as new information becomes available (Shakir, 2023).

Projects with uncertain environments or that subject to change can benefit significantly from rolling wave method. By focusing on short-term goals and repeatedly adapting your plans based on project progress, firms that use this method make sure that they will react rapidly to dynamic market circumstances. Furthermore, project managers will be able to

effectively respond to new difficulties and opportunities thanks to the real-time adjustments and adaptations of this approach (Team, 2023).

Within rolling wave method there are several key steps, such as: identifying the requirements of the project, outlining the phases, planning immediate tasks, managing initial stages, and iterating plans for future ones. By dividing the project into small and manageable phases, and focusing on immediate priorities, the efficiency and effectiveness of organizations can increase greatly. This structured approach makes it easier to effectively allocate their resources, manage the risk, and improve the communications throughout the project lifecycle (Buma, 2022).

Moreover, rolling wave planning combines well with agile practices, since both of them use iterative and incremental development. The integration of rolling wave planning with agile methodologies enables companies to benefit from both approaches, improving project adaptability and responsiveness. Thanks to it, they can also increase cooperation, remain flexible, and accomplish projects that fit stakeholder's needs (ProjectManagementReport, 2023).

As stated in (The Rolling-wave Planning, 2022), this methodology also looks for continuous advancement and learning, which encouraging project teams to identify areas for improvement, and make changes that will bring better outcomes. By supporting a culture of innovation and adaptability, rolling wave planning helps organizations work in difficult and uncertain environments, ensuring success and sustainability in the long run.

## 5. FINANCIAL PLANNING AND PROJECT PORTFOLIO PRIORITIZATION

Financial planning is a crucial element in the selection and prioritization of projects within a portfolio. It ensures that resources are assigned to those which initiatives are in line with the strategic goals and offer the highest potential returns. As mentioned before, there are various financial metrics that are useful to evaluate the financial viability of project, such as: Economic Value Added (EVA), Internal Rate of Return (IRR), and Net Present Value (NPV). These measures offer a quantitative basis for decision-making, that ensures that selected projects will positively contribute to the firm's financial position and strategic goals (Cooper, 2001).

In the study (Cooper, 1997), the authors emphasize on the importance of combining financial planning with project selection processes. Dominant companies are using nowadays detailed financial analysis to ensure that the financial needs of the projects are in line with the long-term strategic goals. Therefore, resource allocation is optimal, portfolio performance is enhanced, and projects support a broader business objective.

There exist different qualitative analysis techniques such as the Balanced Scorecard, that complement the quantitative methods previously mentioned. They allow organizations to include other types of criteria, like strategic criteria, into their decision-making processes, to ensure a complete evaluation of projects. Companies can create a diversified project portfolio using this approach, to promote overall business success and sustainable growth (Baier, 2008).

In addition, methods like the Matrix for the Evaluation of Strategic Alternatives (MESA) creates a structure that allows aligning project selection with strategic goals. These techniques use a combination of financial and qualitative criteria that prioritize projects depending on their strategic and financial impact, which enhances the strategic coherence of the project portfolio (Laslo, 2010).



## 5.1. IMPACT OF FINACIAL CONSTRAINTS ON PORTFOLIO PERFORMANCE

Financial constraints can have a significant effect on the performance and configuration of project portfolios. In the case of firms with limited financial resources, they must prioritize projects which ensure that their investments will bring the maximum potential. Sometimes, this obliges the exclusion of projects that, even though they have strategic importance, they do not meet the needed financial criteria (Musso & Schiavo, 2008).

(Musso & Schiavo, 2008) discuss in his article how financial constraints can impact firm survival and growth. They highlight that constrained companies are bound to optimize resource allocation in order to sustain their activities and grow. In the short-term, this often leads to a higher efficiency and productivity, since firms attempt to maximize the use of their assets. However, in the long-term, growth can be significantly impacted since investments in innovation and strategic development will be little. Which might lead to a less diversified project portfolio.

To handle and manage these constraints in an effective way, organizations must adopt a dynamic approach. This approach needs effective communication among stakeholders and strong financial management standards to ensure that the portfolio will support the strategy of the organization despite having financial constraints. In addition, to respond adequately to the changes in the financial and strategical conditions, continuous monitoring and adjustment of financial plans are required. (Müller, 2008).

As mentioned in (Baier, 2008), the use of performance measurement techniques, such as the Balanced Scorecard, allows companies to record the financial data of their project and use it to make strategical decisions. Apart from the benefits of aligning financial metrics with strategic objectives previously discussed before, it also helps in mitigating the risks associated with financial constraints.

## 5.2. METHODS TO ALIGN FINANCIAL PLANNING WITH STRATEGIC GOALS

As we have learned, aligning financial planning with strategic goals is essential to optimize resource allocation and ensure that project portfolios will support long-term

business objectives. To achieve this alignment and get the most out of it there exist various methods. Now we will discuss the ones that are more commonly used:

- The Stage-Gate process is one effective method to achieve this. This approach consists in a process with different stages where financial evaluations and strategic reviews are included at each step of the project lifecycle. Thanks to the constant review of the project, we ensure continuous assessment of the financial viability and strategic alignment. This process makes it possible to have convenient adjustments and taking informed decisions, making it easier to have a more agile and responsive project management approach (Cooper, 2001).
- The strategic buckets approach is another method that helps with the alignment of financial planning with strategic goals. This approach consists in categorizing projects into different “buckets” based on strategic priorities, like product innovation, market expansion, or operational efficiency. So, organizations can ensure that their investments will support their strategic objectives if they allocate resources in these “buckets” or categories. This method encourages a balanced and strategically aligned project portfolio (Meskendahl, 2010).

Another vital method for this alignment is regular portfolio reviews. These reviews make it possible to assess the performance and make the required adjustments in the resources of the projects. Regular evaluations help ensure that the portfolio remains dynamic and responsive to changing business conditions. Portfolios remain responsive to changing conditions thanks to this process, which is critical to sustain long-term success and competitiveness in an unstable business environment (FasterCapital, 2023).

As stated in (Baier, 2008), advanced analytics and data-driven decision-making are also really important. Tools such as predictive analytics and real-time data visualization enables companies to gain a more profound insight in the performance and financials of their projects. These methods facilitate more accurate and informed decision-making, enhancing the overall effectiveness of financial planning processes.

## 6. DATA VISUALIZATION IN PPM

In addition to financial planning, there are other tools and methods that help in the selection and prioritization of projects in a project portfolio, such as data visualization ones. Data visualization, like financial planning, has a crucial role in Project Portfolio Management (PPM), since it supports decision-makers with the management and the interpretation of complex data sets. These types of methods can provide a clearer overview of the portfolio's condition, thanks to their ability to clarify the representation of complex project interdependencies, resource allocations, and risk estimation. This clarity is essential to align projects with the company's strategic goals and to make sure that decisions are taken well-informed (Kerr, 2023).

In the last years, project portfolio use has increased significantly, and so the complexity to manage them. This has triggered the need of tools that are able to transfer extensive amounts of data in an accessible format. Traditional methods, like table of contents and textual reports, are usually not enough to capture the varied and changing nature of modern project portfolios. As mentioned by (Killen, 2020), visualizations also make more complex relations of information and patterns more apparent to improve the decision-making process.

In addition, well-designed visualizations can grant companies and managers the ability to have a better understanding of the portfolio's overall structure and the strategic implication of each of the projects (Geraldi & Arlt, 2013).

Moreover, visual tools are necessary to have a more effective communication among stakeholders. They can initiate debates and discussions in management meetings, where quick and informed decisions are essential. Furthermore, these debates can lead to a more in-depth analysis of the possibilities and difficulties of the portfolio. Rapid visual interpretation of data can help companies improve the communication between the different levels of management and ensure the alignment with the strategic decisions and organization's goals (Kerr, 2023).

## 6.1. TOOLS AND TECHNIQUES

In PPM, there are different visualization tools that are commonly used to analyse and interpret project data effectively. These techniques are the following:

- Dependency Matrices:** are effective representations of the direct relationships between projects in a grid format, which makes it possible for managers to quickly identify dependencies and their impact on the portfolio. Network maps are similar to dependency matrices, since they both represent relationships. They are particularly useful when recognizing direct interdependencies between projects, since they provide a clear and organized view of how projects affect one another. However, they do not work as good when visualizing complex and multi-step dependencies (Killen, 2013). As can be seen in Figure 7, the relationship between the different task as represented in the matrix.

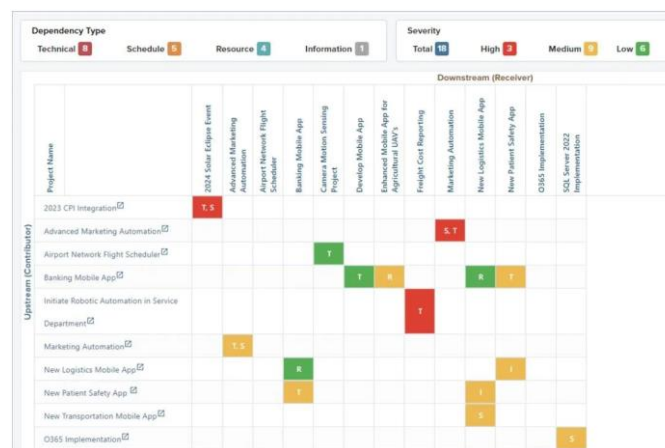


Figure 7: Dependency matrix

- Network maps:** offer a more extensive view of the portfolio's interdependencies, since they represent both direct and indirect dependencies as interconnected nodes. Their dynamic representation is especially useful to understand complex relationships and potential cascading effects within a portfolio. These tools are vital to manage interconnections and ensure that there is a complete understanding of the portfolio's structure at the time of taking decisions. Their characteristics make them more convenient for large and complex portfolios that need to understand the full scope of project interactions (Killen, 2013).

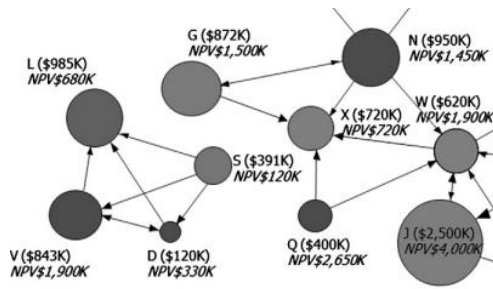


Figure 8: Portion of a portfolio network map

- Gantt Charts:** are visual representations of project timelines, with which you can track progress and ensure that the projects are advancing as expected. These types of visualization techniques are particularly convenient for projects where time scheduling and meeting the deadline are critical. They are ideal for projects with tight deadlines, since they provide a clear and intuitive view of the progress. However, they are less effective when compare projects based on different criteria (da Silva et al., 2016).
- Bubble charts:** on the other hand, give you the opportunity to be more flexible and visualize the project through different perspectives, such as risk, cost, and benefit. The use of these different factors is relevant and essential when optimizing portfolio performance and balancing the trade-offs between competing projects (da Silva et al., 2016).

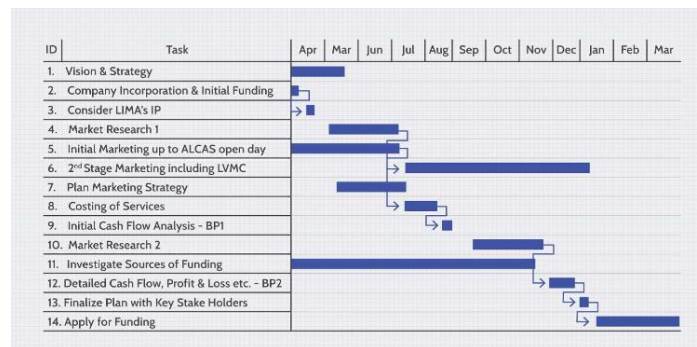


Figure 9: Project Gantt Chart

- Self-Organizing Maps (SOMs):** SOMs are an advanced machine learning technique used to reduce the dimension of a dataset. Thanks to this characteristic, they are especially useful in projects where you have to work with complex and large datasets. In the context of PPM, SOMs can bundle similar projects together based on diverse criteria. This technique allows managers identify patterns and trends, that otherwise would not be visible with other methods. However, this

technique requires a high degree of technical competences to exercise and interpret, which might be a limitation for some companies. (Naiem, 2016) demonstrates this method's effectiveness when dealing with project portfolios, since it enables decision-makers to gain a broader vision of all options.

In addition to traditional PPM framework, recent studies have proposed and studied different advanced visualization techniques. As mentioned in (Couto et al., 2021), the incorporation of data visualization tools into project management softwares provides a structured approach that improves the ability to manage and communicate complex data effectively. This is particularly useful in sectors where traditional PPM methods are insufficient to handle complex and dynamic projects. Similarly, (Rauch et al., 2013) promotes in his article the use visual approaches in project and portfolio monitoring. All because of the ability to track progress and identify potential early problems or difficulties in the project lifecycle before they escalate.

## 7. PPM SOFTWARES AVAILABLE FOR FINACIAL PLANNING

We have now reviewed the uses of financial planning and visualization in PPM and its importance. We have also mentioned how the integration of financial planning and budgeting tools is a critical element in ensuring that organizations manage their project portfolios effectively and line up with their strategic goals. Now we will focus on the different software tools that have become central to this process, each one with unique features that fit the different company needs. The most common and used softwares are:

- **Microsoft Project:** is one of the key programs used in the PPM industry, recognized for its portfolio planning capabilities that combine with financial management. The main strength of this tool is the ability to provide detailed budgeting, and the cost-tracking and forecast features all in the Microsoft 365 environment. This makes it appealing to companies that normally make use of other Microsoft programs, because of its familiarity and integration with the other tools. The powerful integration capabilities of Microsoft Project make it an optimal option for organizations that need large financial control over multiple projects (Nikitina et al, 2022).
- **EcoSys:** is highlighted for being an excellent choice for large-scale projects, especially in the engineering and construction field. This tool combines into the same platform, portfolio and project management with financial administration, while giving remarkable support to financial planning. As stated in (RETIEF, 2005), its ability to manage complex financial specifications makes it also ideal for sectors where precise financial control over large project portfolios is crucial.
- **Smartsheet:** has an interface similar to a spreadsheet, that is combined with different templates and automation features, which makes it the perfect option for companies that need flexible and dynamic financial planning solutions. It offers an adaptable and user-friendly approach to financial planning within PPM. In addition to these characteristics, this software is also optimal for teams that need to keep continuously updating and adjusting their plans in response to the changing project conditions, thanks to its capabilities to share and collaborate in real-time. In (Triskell Software, 2024), Smartsheet is complimented for its ease of use and adaptability to simple and complex financial tools.

- **Wrike:** provides an extensive project lifecycle management with a special attention on the financial aspects of PPM, such as budgeting and cost management. Its capabilities to personalize workflows and to track real-time makes it possible for firms to control carefully their financial performance and easier to take informed decisions. Furthermore, it has the capability to integrate the software with other business tools, which increases its utility. In addition, this characteristic makes it an effective tool for organizations that need to maintain a detailed financial control while making sure that the projects support business objectives (Hexagon, 2023).
- **Planview:** has different tools that help with portfolio visualization and structuring together financial plans and organizational goals. Conversely to the other reviewed softwares, this one has a particular focus on the strategic approach of PPM. This program has capabilities on resource allocation and financial planning, that make it possible to efficiently assign the resources to the projects that have highest potential outcome. (Nikitina et al., 2022) highlights that Planview's strong alignment features are their main and key advantage.
- **Planisware:** is designed to assist the strategic and financial facets of PPM. It includes diverse tools such as project planning, resource management, and financial analysis, which makes it perfect for big companies with complex portfolios. This software integrates strategic alignment with financial planning, which allows its users to prioritize projects based on their financial feasibility and possible impact. Furthermore, it has advanced features like scenario planning, budget tracking, and real-time portfolio performance monitoring. These characteristics make it possible for organizations to optimize resource allocation and maximize portfolio value (Hexagon, 2023).

## 7.1. INTEGRATION OF FINANCIAL PLANNING TOOLS WITHIN PPM SOFTWARE

We have now also reviewed the most common softwares for PPM, and like financial planning and visualization, the use of one of them is of vital importance to portfolio management. However, the software alone is not miraculous, it needs to be carefully integrated with the financial planning of the company.



Planview and Planisware are similar softwares that are designed to make sure that financial assets are assigned to projects that will promote business goals more. While maintaining a balanced portfolio that supports actual operational needs and long-term strategy (Triskell Software, 2024).

Moreover, Planisware also includes scenario planning and real-time information, enabling organizations to forecast financial data and adjust their plans accordingly. Because of these characteristics, it is ideal for companies operating in dynamic sectors where quick adjustments to changing circumstances is necessary. In addition, the integration of financial planning to other PPM systems, helps firms ensure that their strategies will be efficient, flexible and capable of adapting to new challenges (Hexagon, 2023).

Smartsheet and Wrike contribute to strategic alignment by providing immediate collaboration and communication across teams. These tools enable prompt updates and modifications to financial plans, which allow financial decisions to be taken with the most actual information. This real-time capability decreases the risk of financial planning not being aligned with strategic objectives. Which at the same time, helps companies accomplish their business objectives more effectively (Triskell Software, 2024).

## 8. RESULTS

In the extensive literature review we have just performed, we have analysed both financial planning and visualization tools, and how they can be used in Project Portfolio Management (PPM). Furthermore, we have mentioned some of the commonly used softwares in PPM and how they can be integrated with financial planning. However, we will now perform a deep study of each of them, where we will examine their main functionalities, advantages and disadvantages. Lastly, we will develop a table to be able to compare all of them easily.

### 8.1. MICROSOFT PROJECT

Previously, we have developed a general description of this software, in which it has been pointed out that one of its main strengths is being part of Microsoft, which allows the integration with other products. However, we will now cover in detail about all of its functionalities:

- The **task and resource management capabilities** enables users to allocate assets, develop detailed project schedules, and monitor the progress with respect to timelines.
- It incorporates **collaboration tools** which allow it to integrate with Microsoft Teams and SharePoint, which facilitates communication and document sharing among teams.
- It helps with **portfolio optimization** since it provides competencies for project selection and prioritization based on different criteria such as resource availability, risk, and strategic alignment.
- Microsoft Project also includes **budgeting and cost tracking tools**. In functions where you have to estimate costs, monitor expenses, or administrate project budgets, this platform can be really helpful.

Now, we will carry on with the advantages and disadvantages that this software can bring to its users. The main benefits of this software are:

- This program can be **easily integrated with other Microsoft products**, such as Excel or Teams. This enhances collaboration and data sharing between different project teams.
- This platform provides **comprehensive and powerful** features that help its user manager their portfolio. It allows monitoring the financial aspects of the project, scheduling different tasks, and managing the resources of a company.
- This software is **highly customizable**, and it can adapt perfectly to different project and company needs.

However, it also has some weaknesses, which are the following:

- Although it enables the integration with other Microsoft products, its **real-time collaboration features are quite limited and certainly not advanced**. Wrike or Smartsheet, other softwares that we have previously mentioned, have more sophisticated cooperation capabilities.
- It can be considered **quite expensive**, especially for small and medium businesses. This is because the pricing model is based on per-user licenses.
- This platform has a **high complexity of use**, due to the large range of features it has. New user can have difficulties managing it, particularly the one who have not gotten any previous training.

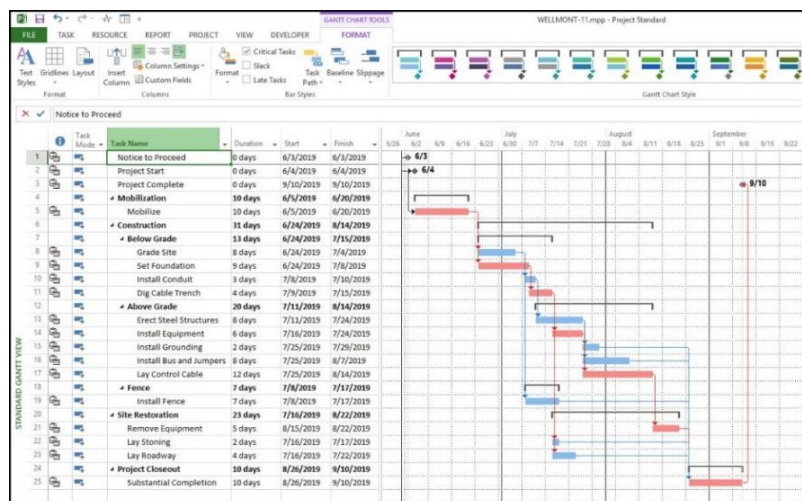


Figure 10: Screenshot of Microsoft Project

## 8.2. ECOSYS

As we have already stated in the general description of this software, EcoSys gives particular support to the financial planning of the projects. In addition to this characteristic, the other capabilities which provides to its user are:

- The **cost and resource management feature** provides support by tracking and monitoring costs and resources in real time, which allows users to handle budgets and expenses effectively.
- **Forecasting and reporting tools** enable users to prepare detailed forecasting, which allows to make predictions of project outcomes and adjusting the plans accordingly. It also supports customized reports for financial and performance metrics.
- It helps with **portfolio planning and optimization**, since the software offers advanced planning tools to prioritize and select projects based on financial feasibility, resource availability, and risk, ensuring the portfolio aligns with strategic goals.
- This program includes **dashboards features and visualizations tools**. This allows its users to develop personalized control panels which help envision project performance, financials, and risks.

Now, we will continue this analysis with the advantages and disadvantages that this software can bring its users. The major strengths that it has are:

- EcoSys has incorporated **advanced financial monitoring tools**, which enables for real-time tracking and performing detailed financial reports.
- This platform has an **industry-specific design**. Due to this characteristic, this software is particularly suitable for sectors like construction and engineering.
- This software enables a **high level of customization** of the platform. Which allows its users to adapt it to their specific project management needs.

On the other hand, it has some weaknesses such as:

- This platform has a **high complexity of use**. Due to its specific features, it can be difficult to manage at an expert level, in addition to requiring significant learning curve for new users.

- In comparison with other enterprise-level softwares, the **cost of EcoSys can be considered high**, especially for smaller organizations.
- While it is specifically suitable for project control and monitoring, EcoSys **lacks advanced real-time collaboration tools** that some competitors, like Microsoft Project or Smartsheet, offer.

ID	Description	WP Progress Method	Budgeted Hours	Budgeted Hours (Resource Spread)	Earned Hours	Budgeted Cost	Baseline Start Date	Baseline End Date
2	Electrical Equipment Spec	Milestone Credits	175	0	170.6	21,875		
3	Line Drawings	Milestone Credits	0	0	0.0	0		
3	Permitting	Manual % Complete	0	0	0.0	0	10/11/2009	10/27/2009
4	Construction	Schedule % Complete	201,225	75	35,701.2	156,000	10/27/2009	02/25/2010
01	Electrical		0	0	0.0	0		
4000	Cable Tray	Milestone Credits	0	0	0.0	0		
4100	Cable Pulls	Milestone Credits	0	0	0.0	0		
4200	Cable Terminations	Milestone Credits	0	0	0.0	0		
02	Mechanical		223	75	200.4	117,000		
5000	Hangers	Milestone Credits	0	0	0.0	0		
5100	Large Bore Piping	Milestone Credits	0	0	0.0	0		
5200	Small Bore Piping	Milestone Credits	223	75	200.4	78,000		
1	Piping Plan 1	Milestone Credits	115	0	97.8	20,000		
2	Piping Plan 2	Milestone Credits	108	0	102.6	19,000		
03	Structural		201,000	0	35,500.0	0		
6000	Duct Support Steel	Milestone Credits	1,000	0	500.0	0		

Step Number	Description	Weight	% Complete	Weighted % Complete	Earned Hours	Earned Cost	Budgeted ManHours	Budgeted Cost	Unit of Measure
1	Define Scope of Work	35%	100%	35	40	7,000	40.25	7,000	EACH
2	Review Client Standards	20%	100%	20	23	4,000	23.00	4,000	
3	Issue Draft for Comments	30%	100%	30	35	6,000	34.50	6,000	
4	Incorporate Comments	10%	0%	0	0	0	11.50	2,000	
5	Revise / reissue	5%	0%	0	0	0	5.75	1,000	

Figure 11: Screenshot of EcoSys

### 8.3. SMARTSHEET

In the general description we developed earlier, we pointed out that Smartsheet has real-time collaboration capabilities, in addition to an adaptable and user-friendly platform. Apart from these main characteristics, this software includes other functionalities such as:

- It includes **task and project tracking tools** like Gantt charts, calendars, and card views that help monitoring project timelines, tasks, and milestones.
- This platform allows **real-time collaboration between team members**. It also allows to put comments on tasks and sharing files within the software.
- It can be **integrated with other cloud storage services** like Google Drive and Microsoft OneDrive.
- Smartsheet provides **workflow automation tools**, which enable users arrange recurring tasks, approvals, and notifications without manual intervention.

- It also incorporates **customizable dashboards**, which allow its users to apprehend key metrics and monitor project performance. These reports provide a comprehensive view of project data across companies' portfolios.

Now, we will carry on with the advantages and disadvantages of this software. The primary benefits of this platform are:

- Its **intuitive interface and easy to use platform** are one of Smartsheet's main advantages. These characteristics make it suitable for all kind of users, especially those with limited experience.
- This software has incorporated different **real-time collaboration tools**, which permit a smooth communication between team members. It also improves the productivity and coordination of the project.
- Smartsheet is a **highly scalable platform**, which enables its users to adapt to all kind of different project management needs. It supports all types of groups, from small teams to large enterprises.

State	Task Description	Estimated Labor	Estimated Materials	Estimate Total	Actual Labor	Actual Materials
	Project Summary	\$2,500	\$3,750	\$6,250	\$1,800	\$2,450
	Phase 1	\$2,500	\$3,750	\$6,250	\$1,800	\$2,450
	Task 1	\$250	\$500	\$750	\$200	\$450
	Task 2	\$500	\$750	\$1,250	\$600	\$750
	Task 3	\$750	\$1,000	\$1,750	\$500	\$750
	Task 4	\$1,000	\$1,500	\$2,500	\$500	\$500
	Phase 2	\$0	\$0	\$0	\$0	\$0
	Task 1			\$0		
	Task 2			\$0		
	Task 3			\$0		
	Task 4			\$0		
	Phase 3	\$0	\$0	\$0	\$0	\$0
	Task 1			\$0		
	Task 2			\$0		
	Task 3			\$0		
	Task 4			\$0		

Figure 12: Screenshot of Smartsheet

However, it also has some drawbacks, which are the following:

- This platform has **limited advanced project features**, while some of its competitors offer tools such as deep resource management or financial planning. However, it includes professional tools in task management and collaboration.
- This software can be **quite expensive**, especially for large companies or teams. Since the platform charges for each user and not for the entire license.

- Smartsheet offers several templates. However, it has **limited customization options** in comparison with more complex PPM tools.

## 8.4. WRIKE

As we have mentioned before in the general description of this software, Wrike is known for its real-time tracking capabilities and the possibility to integrate with other business tools. Moreover, it has other functionalities that we will now cover in detail:

- The **task and resource management capabilities** enables its users to assign tasks to teams, to establish priorities, and to allocate resources efficiently.
- It includes **real-time collaboration tools** that allow communication within the same tasks, apart from integrating with cloud storage, and providing proofing tools for marketing and creative teams.
- Users are able to **customize their workflows and automate repetitive processes**, which increases the efficiency of the project across all teams.
- Wrike also incorporates **real-time dashboards and comprehensive reports**. Those enable its users to apprehend key metrics and monitor project performance and resource utilization.

We will now continue this analysis with the advantages and disadvantages of this software. The main strengths that it has are:

- This program offers **excellent collaboration tools**, including real-time updates and task-level communication, making it highly effective for team-based project work.
- It offers the possibility to **fully customize their workflows**. This allows its users to adapt the platform and project flows to their specific project needs.
- Wrike is a **highly scalable platform**, which make it adaptable for different kinds of industries and sectors. It supports projects of all sizes, from small teams to large enterprises.

However, this software also has some drawback which we will now discuss:

- This platform has a **high complexity of use**, particularly for new users. Its extensive features and customizability can make it difficult for beginners to navigate without proper training.
- Wrike's pricing structure can be considered **expensive** for large organizations, especially for teams that require advanced features.
- It has **limited financial tools**. While Wrike excels in task and workflow management, its financial planning and budgeting tools are less advanced in comparison with other specialized PPM softwares.

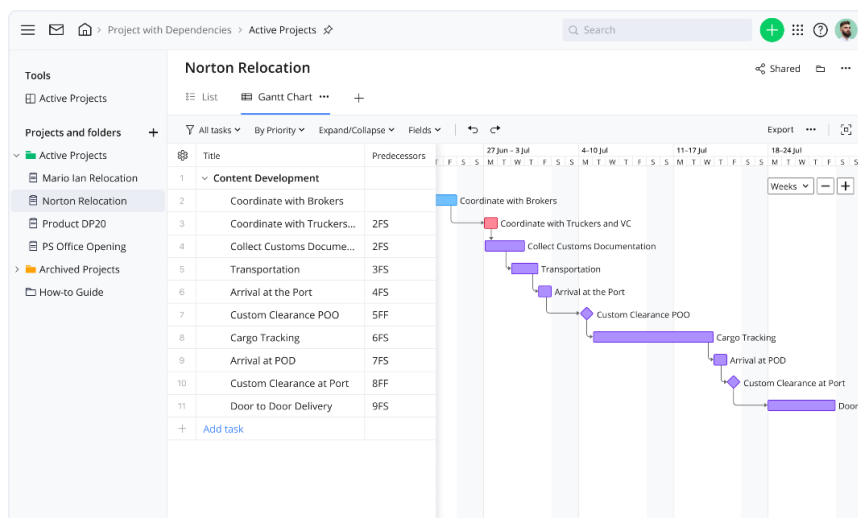


Figure 13: Screenshot of Wrike

## 8.5. PLANVIEW

Previously, we have developed a general description of this software, in which it has been pointed out that one of its main strengths are their strong alignment features and its focus on a strategic approach. However, we will now cover in detail about all of its functionalities:

- The **portfolio and resource management tools** that Planview offers, allows its users to manage project resources and optimize portfolio performance, making sure that projects are aligned with strategic priorities.
- It offers tools that help **integrating financial planning** into project management. Some of these tools provide aid in budgeting, cost tracking, and financial forecasting.



- This software provide supports with **scenario planning analysis**. It allows organizations to compare different portfolio configurations and select the best approach for meeting strategic objectives.
- Planview incorporates **customizable dashboards and reports**. This provides real-time visibility into project performance, financials, and resource utilization, enhancing decision-making processes.

We will now carry on this analysis with the advantages and disadvantages that this software can bring its users. The main strengths that it has are:

- Planview is one of the best softwares which **aligns strategically project portfolios with broader business goals**. Thanks to this, it is particularly effective for large enterprises focused on long-term planning and resource optimization.
- This program offers **comprehensive financial management tools**, helping organizations manage budgets, track expenditures, and forecast financial performance.
- It includes **scenario planning and analysis features**, which allows organizations to explore various portfolio configurations. This makes it easier for the users to assess risks and benefits before committing resources.

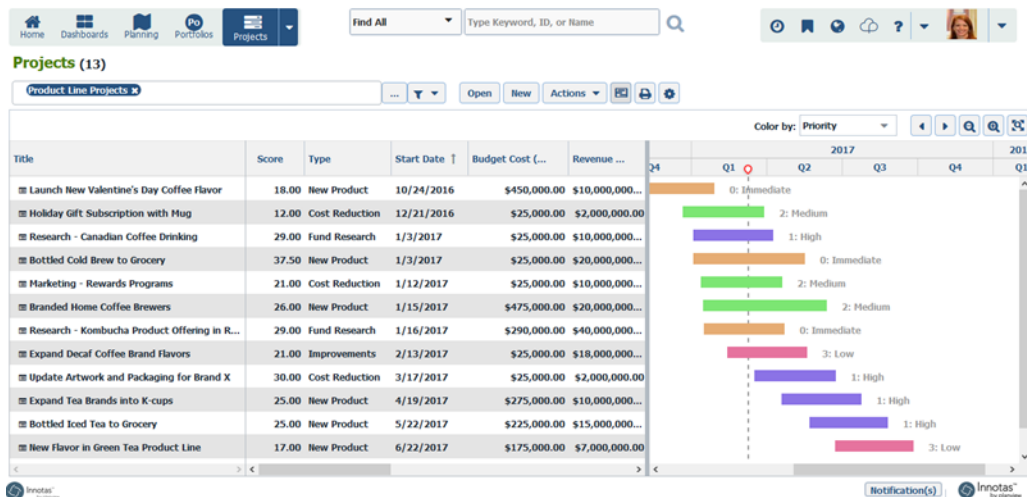


Figure 14: Screenshot of Planview

On the other hand, it has some weaknesses such as:

- Due to its comprehensive features, Planview can be **challenging for new users**, requiring significant training to fully leverage its capabilities.

- Like other enterprise-grade PPM tools, Planview can be **expensive**, particularly for smaller organizations.
- Even though it is highly functional, Planview's **customization options** are considered by some users to **be less flexible** compared to other PPM tools.

## 8.6. PLANISWARE

In the general description we have already developed, we mentioned that Planisware stands out for his strategic alignment features. Apart from these main characteristics, this software includes other functionalities such as:

- Planisware includes **tools to prioritize their project prioritization** based on strategic alignment, budget constraints, and resource availability. It also has the ability to evaluate project impact, risks, and benefits, which enables companies to optimize their portfolios.
- It also incorporates **financial management and forecasting tools**. It integrates financial management with project execution, allowing to do detailed cost tracking, budgeting, and financial forecasting across the project lifecycle.
- This platform supports **resource allocation and capacity planning**, which is helpful for optimizing resource usage, reducing bottlenecks and maximizing efficiency.
- It offers **scenario analysis and planning features**, that allow decision-makers to compare the impact of different situations in their resources and financials and choose the most optimal.
- The program accommodates both **agile and traditional project management methodologies**, enabling teams to switch between different approaches depending on the project needs.

We will now continue this analysis with the advantages and disadvantages of this software. The main strengths that it has are:

- It **integrates financial and resource management** to ensure that project budgets and resources are aligned with the firm's objectives and portfolio strategies.

- Planisware offers advanced features to **conduct scenario analysis**. It allows its users to prioritize projects based on their alignment with the company objectives and to evaluate different portfolio configurations.
- This software has a **high level of customization and scalability**, which makes it perfectly suitable for companies with diverse portfolio needs.

Despite all this advantages, it has some inconvenient which are:

- Since this platform has a **high complexity of use**, beginners can find it difficult to manage. It requires a deep understanding of some complex features and previous experience.
- This program can be considered **expensive for small organizations**, especially in terms of implementation and user licensing.
- It requires a **significant customization and setup time** before it is fully implemented. This can lead to a delay in the total time of integration of the software with the organization.

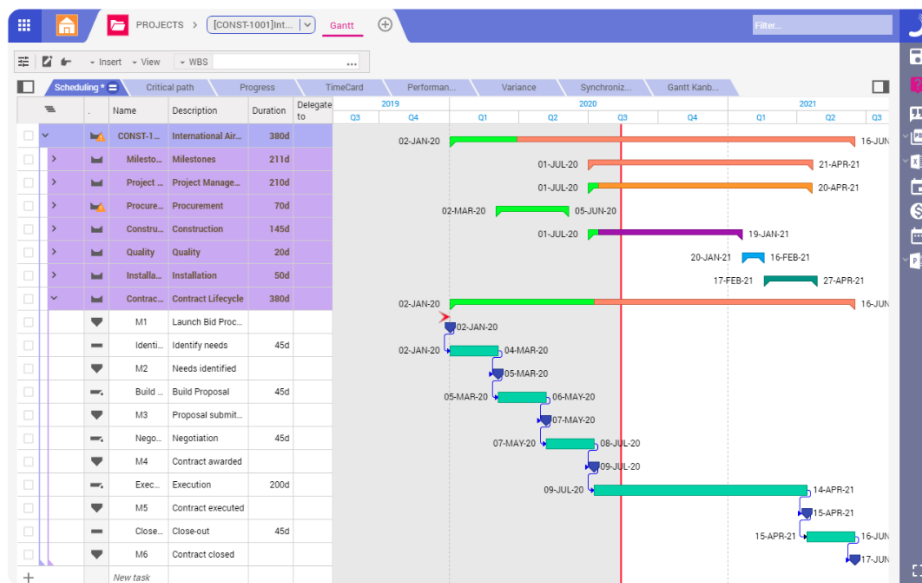


Figure 15: Screenshot of Planisware

## 8.7. COMPARISON

We have now performed a deep study and analysis on six of the most commonly used softwares in Project Portfolio Management, where we have described the main functionalities of each one of them and discussed their strengths and weaknesses.

Now we will develop a table in where the characteristics of each software and their differences will be clearly shown.

<b>SOFTWARE</b>	<b>FUNCTIONALITIES</b>	<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<b>Microsoft Project</b>	<ul style="list-style-type: none"> <li>Task and Resource Management</li> <li>Budgeting and Cost Tracking</li> <li>Portfolio optimization</li> <li>Collaboration tools</li> </ul>	<ul style="list-style-type: none"> <li>Microsoft integration</li> <li>Powerful features</li> <li>Customizability</li> </ul>	<ul style="list-style-type: none"> <li>Complexity for new users</li> <li>License cost (Expensive)</li> <li>Limited Real-Time Collaborations</li> </ul>
<b>EcoSys</b>	<ul style="list-style-type: none"> <li>Cost and Resource Management</li> <li>Forecasting and Reporting</li> <li>Portfolio Planning and Optimization</li> <li>Dashboards and Visualization tools</li> </ul>	<ul style="list-style-type: none"> <li>Advanced Financial control</li> <li>Industry-specific design</li> <li>Customizability</li> </ul>	<ul style="list-style-type: none"> <li>Complexity of use</li> <li>Elevated cost</li> <li>Limited collaboration tools</li> </ul>
<b>Smartsheet</b>	<ul style="list-style-type: none"> <li>Task and Project Tracking</li> <li>Collaboration and Sharing tools</li> <li>Reports and Dashboards</li> <li>Automation tools</li> </ul>	<ul style="list-style-type: none"> <li>Ease of use</li> <li>Collaboration features</li> <li>Scalability</li> </ul>	<ul style="list-style-type: none"> <li>Limited advanced project features</li> <li>Costly for large firms</li> <li>Customization limitations</li> </ul>
<b>Wrike</b>	<ul style="list-style-type: none"> <li>Task and Resource Management</li> <li>Collaboration tools</li> <li>Reports and Dashboards</li> <li>Custom Workflows and Automation tools</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration features</li> <li>Custom workflows</li> <li>Scalability</li> </ul>	<ul style="list-style-type: none"> <li>Complexity for new users</li> <li>Expensive for large firms</li> <li>Limited financial tools</li> </ul>

<b>Planview</b>	Portfolio and Resource Management Financial management Scenario planning Reports and Dashboards	Strategic alignment Comprehensive financial tools Scenario planning	Steep learning curve Elevated cost Customization limitations
<b>Planisware</b>	Strategic Planning and Prioritization Financial Management and Forecasting Resource management Agile and Waterfall Support Scenario planning	Comprehensive Financial and Resource Management Scenario Planning and Strategic Alignment Customization and Scalability	High complexity Elevated cost Lengthy setup time

*Table 1: Comparison between softwares*

## 9. CONCLUSIONS

Project prioritization within PPM remains a crucial and complex area of management science. While there exist different techniques, there's a clear trend towards adapting methods to handle uncertainty and using multi-criteria decision methods instead of using just one financial ratio like it has traditionally been done. The two main types of methods that are used nowadays are sophisticated methods like AHP or weighted rankings, that are easier to use. Nevertheless, there are other methods not that common such as graphical and visualization techniques.

Financial planning is intrinsic to the prioritization and successful accomplishment of projects within a portfolio. Thanks to its use, managers can ensure an optimal resource allocation and alignment with strategic goals. In addition to features such as budget assignment and cost management, it can also serve as a method for accountability and performance measurement. These characteristics will help companies control progress, meet financial objectives, and achieve desired outcomes.

Moreover, it is important to mention that financial planning alone is not miraculous, since it has to be carefully connected with PPM. In that way, we can ensure that the financial and strategical aspects of the projects will be aligned.

Another crucial element in PPM are visualization tools, which help in the process of taking decision because it transforms complex and large datasets into easy and fast to understand graphs. Tools such as dependency matrices, network maps, Gantt charts, and Self-Organizing Maps (SOMs) offer different perspectives on portfolio data, each one of them with their unique advantages. These visual aids not only simplify the communication among stakeholders, but also makes it easier for decisions to be taken with more information.

After the research and the analysis of different articles, we have arrived at the conclusion that there are few studies on the uses of rolling wave methods to interconnect project management with financial planning. This would be crucial for PPM, since the characteristics of this methodology would allow companies to continuously adapt their strategies and financial plans to the circumstances at each moment.

In addition, there are also hardly any articles that analyse and compare the different softwares that we have nowadays for project and portfolio administration. Which would also be optimal for firms to know so they can select the software that best fit their needs.

To conclude, financial planning and visualization are recognized as vital elements of effective PPM, further research is needed to fully understand their potential. If they continue with this research and exploration, PPM practices will advance and improve, while also ensuring that organizations will be able to achieve their goals even in dynamic environments with changing conditions.

It is also important to mention that there exist different kinds of software for PPM. Some of them are more focused on the financial aspects of project management, and others in the resources and task management. So, companies have a wide range of software to choose from depending on their particular need and projects.



## REFERENCES

Levine, H. A. (2005). *Project portfolio management: a practical guide to selecting projects, managing portfolios, and maximizing benefits*. John Wiley & Sons.

Institute, P. M. (2014). *The Standard for Portfolio Management - Third Edition (3rd ed)*. Project Management Institute.

Rad, P. F., & Levin, G. (2006). *Project portfolio management tools and techniques*.

Rose, K. H. (2013). A guide to the project management body of knowledge (PMBOK® Guide)—Fifth Edition. *Project management journal*, 3(44), e1-e1.

Purnus, A., & Bodea, C. N. (2014). Project prioritization and portfolio performance measurement in project oriented organizations. *Procedia-Social and Behavioral Sciences*, 119, 339-348.

El Hannach, D., Marghoubi, R., & Dahchour, M. (2016, March). Project portfolio management Towards a new project prioritization process. In *2016 International Conference on Information Technology for Organizations Development (IT4OD)* (pp. 1-8).

El Hannach, D., Marghoubi, R., El Akkaoui, Z., & Dahchour, M. (2019). Analysis and Design of a Project Portfolio Management System. *Comput. Inf. Sci.*, 12(3), 42-57.

Iyyunni, C. (2015, February). Project priority and pressures from portfolio management. In *PMI India Research & Academic Conference, Mumbai* (pp. 13-15).

Elbok, G., & Berrado, A. (2020). Project prioritization for portfolio selection using MCDA. In *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 2317-2326).

Sari, R., Sulistiyani, E., & Meutia, N. S. (2023). Prioritization Model for IT Project Portfolio Management in Private University: A Literature Review. *Journal of Information Systems and Informatics*, 5(1), 1-14.

Chatterjee, K., Hossain, S. A., & Kar, S. (2018). Prioritization of project proposals in portfolio management using fuzzy AHP. *Opsearch*, 55, 478-501.

Padovani, M., de Carvalho, M. M., & Muscat, A. R. N. (2008). Current project portfolio management practices: A case study. *Product: Management and Development*, 6(1), 19-28.

Kapoor, N. (2014). Financial portfolio management: Overview and decision making in investment process. *International Journal of Research (IJR)\**, 1\*(10), 1362-1369.

Cooper, R., Edgett, S., & Kleinschmidt, E. (2001). Portfolio management for new product development: results of an industry practices study. *R&D Management\**, 31\*(4), 361-380.

Müller, R., Martinsuo, M., & Blomquist, T. (2008). Project portfolio control and portfolio management performance in different contexts. *Project management journal*, *39*(3), 28-42.

Dooley, L., Lupton, G., & O'Sullivan, D. (2005). Multiple project management: a modern competitive necessity. *Journal of Manufacturing Technology Management*, *16*(5), 466-482.

Meskendahl, S. (2010). The influence of business strategy on project portfolio management and its success—A conceptual framework. *International Journal of Project Management*, *28*(8), 807-817.

Archer, N. P., & Ghasemzadeh, F. (1999). An integrated framework for project portfolio selection. *International Journal of Project Management*, *17*(4), 207-216.

Turner, R., Ledwith, A., & Kelly, J. (2012). Project management in small to medium-sized enterprises. *Management Decision*, *50*(5), 942–957.

Killen, C. P., & Hunt, R. A. (2010). Dynamic capability through project portfolio management in service and manufacturing industries. *International Journal of Managing Projects in Business*, *3*(1), 157-169.

Martinsuo, M. (2013). Project portfolio management in practice and in context. *International journal of project management*, *31*(6), 794-803. Shakir, Ahmed. (2024). Rolling wave planning, in planning phase.

The Rolling-wave Planning. (2022) -apppm. (n.d.). [http://wiki.doing-projects.org/index.php/The\\_Rolling-wave\\_Planning](http://wiki.doing-projects.org/index.php/The_Rolling-wave_Planning)

Buma, R. (2022, June 21). *What Is Rolling Wave Planning?* *ProjectManager*. <https://www.projectmanager.com/blog/rolling-wave-planning>

Teamcamp. (2023, October 16). Riding the Waves of Project Management: An Introduction to Rolling Wave Planning. *Medium*. <https://medium.com/@teamcamp/riding-the-waves-of-project-management-an-introduction-to-rolling-wave-planning-98b375479223>

Mastering Rolling Wave Planning in Project Management: Process, Benefits, and Examples *- Project Management Report*. (n.d.). <https://projectmanagementreport.com/blog/rolling-wave-planning>

Laslo, Z. (2010). Project portfolio management: An integrated method for resource planning and scheduling to minimize planning/scheduling-dependent expenses. *International journal of project management*, *28*(6), 609-618.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (1997). Portfolio management in new product development: Lessons from the leaders—I. *Research-Technology Management*, *40*(5), 16-28.

Musso, P., & Schiavo, S. (2008). The impact of financial constraints on firm survival and growth. *Journal of evolutionary economics*, *18*, 135-149.

Baier, C., Hartmann, E., & Moser, R. (2008). Strategic alignment and purchasing efficacy: an exploratory analysis of their impact on financial performance. *Journal of Supply Chain Management*, *44*(4), 36-52.

FasterCapital. (2024, March 20). Aligning Financial Goals with Business Objectives. <https://www.linkedin.com/pulse/aligning-financial-goals-business-objectives-fastercapital-kz52f/>

Nikitina, E. V., Nikitin, S. A., & Elkina, D. A. (2022, February). Comparative Analysis of Project Management Software Products. In *Proceedings of the International Scientific Conference "Smart Nations: Global Trends In The Digital Economy" Volume 1* (pp. 339-345). Cham: Springer International Publishing.

RETIEF, F. (2005). Modern project portfolio management software. *Management Planning Systems*.

Friedberg, B. A. (2024, July 26). *Best Portfolio Management Software Tools*. Investopedia. <https://www.investopedia.com/best-portfolio-management-software-tools-7552649>

*8 Top Project Portfolio Management (PPM) Tools and Software in 2023*. (n.d.). <https://aliresources.hexagon.com/knowledge-pages/ppm-tools-and-software>

*10 Best Project Portfolio Management (PPM) software for 2024: the ultimate guide*. (2024, July 29). Triskell Software. <https://triskellsoftware.com/blog/best-project-portfolio-management-software/>

Couto, J. M. C., Kroll, J., Ruiz, D. D., & Prikladnicki, R. (2021). A PMBoK Extension Proposal for Data Visualization in Software Project Management. In *ICEIS (2)* (pp. 54-65).

da Silva, C. G., Meidanis, J., Moura, A. V., Souza, M. A., Viadanna, P., Costa Lima, G. A., & de Barros, R. S. (2016). A visualization-based approach for project portfolio selection. In *New Advances in Information Systems and Technologies* (pp. 835-844). Springer International Publishing.

Killen, C. P., Geraldi, J., & Kock, A. (2020). The role of decision makers' use of visualizations in project portfolio decision making. *International Journal of Project Management*, *38*(5), 267-277.

Rauch, M., Kienreich, W., Aquila, G., & Sabol, V. (2013, July). A visual approach to project and portfolio monitoring. In *2013 17th International Conference on Information Visualisation* (pp. 313-318). IEEE.

da Silva, C. G., Meidanis, J., Moura, A. V., Souza, M. A., Viadanna Jr, P., de Oliveira, M. R., ... & de Barros, R. S. (2017). An improved visualization-based approach for project portfolio selection. *Computers in Human Behavior*, *73*, 685-696.

Naiem, A., El-Beltagy, M., & Seif, S. (2016, May). Project portfolio exploration and visualization using self-organizing maps. In *Proceedings of the 10th International Conference on Informatics and Systems\** (pp. 222-227).

Killen, C. P. (2013). Evaluation of project interdependency visualizations through decision scenario experimentation. *International Journal of Project Management\**, *31*(6), 804-816.

Geraldi, J., & Arlt, M. (2013). Can you see the forest for the trees? Supporting sense-making through the visualization of project portfolios. In *IRNOP 2013 Conference\**. Norwegian Business School.

Kerr, C. (2023). Visualizing Portfolios: Prompt Discussions and Provoke Debates in Management Meetings. *IEEE Engineering Management Review\**.