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Project Management Practices in innovation and new product development programs - the case of Vestas' Blades Technology Program

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Abstract

In the dynamic landscape of the wind energy sector, innovation is crucial, and Vestas, a leading player in this industry, has linked its potential to drive sustainability and growth. This thesis explores the relationship of innovation, New Product Development (NPD), and project management within Vestas and the broader wind industry. Amidst the global transition to renewable energy sources, organizations increased R&D spending by approximately 10%, with the bulk coming from manufacturers. However, the intense pursuit of innovation in NPD projects presents challenges, including a high failure rate. To mitigate these challenges, organizations are turning to project management strategies.

Through qualitative research, with the support of six semi-structured interviews to Project Managers working in the Vestas Blades Technology Program, this study investigates how project management enhances NPD success within this department, recognizing its critical role in controlling costs, timelines, and quality. The thesis also highlights the need for diverse research methods, expanded sample sizes, and industry diversification for a comprehensive analysis.

By delving into the unique context of Vestas and the wind industry, this investigation contributes to the broader dialogue on innovation, NPD, and project management in renewable energy, providing insights for sustainable energy transitions.

Keywords: Innovation, New Product Development, Project Management

Resumo

No dinâmico cenário do setor de energia eólica, a inovação é crucial, e a Vestas, uma das principais atuantes nessa indústria, reconhece o seu potencial para impulsionar a sustentabilidade e o crescimento. Esta tese explora a relação entre inovação, Desenvolvimento de Novos Produtos (NPD) e gestão de projetos dentro da Vestas e no setor eólico em geral. Em meio à transição global para fontes de energia renovável, as organizações aumentaram os investimentos em Investigação e Desenvolvimento (I&D) em cerca de 10%, com a maioria proveniente de fabricantes. No entanto, a busca intensa pela inovação em projetos de NPD apresenta desafios, incluindo uma alta taxa de fracasso. Para mitigar esses desafios, as organizações estão a recorrer a estratégias de gestão de projetos.

Através de pesquisa qualitativa, com o apoio de seis entrevistas semiestruturadas com Gestores de Projetos que atuam no Programa de Tecnologia de Pás da Vestas, este estudo investiga como a gestão de projetos aprimora o sucesso do NPD dentro deste departamento, reconhecendo o seu papel crucial no controlo de custos, prazos e qualidade. A tese também destaca a necessidade de métodos de pesquisa diversificados, tamanhos de amostra ampliados e diversificação da indústria para uma análise abrangente.

Ao explorar o contexto único da Vestas e da indústria eólica, esta investigação contribui para o diálogo mais amplo sobre inovação, NPD e gestão de projetos em energia renovável, fornecendo perspectivas para transições sustentáveis de energia.

Palavras-chave: Desenvolvimento de Novos Produtos, Gestão de Projetos, Inovação

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List of Abbreviations and Acronyms

IT – Information Technology

KPI – Key Performance Indicators

NPD – New Product Development

PM – Project Manager

R&D – Research and Development

1. Introduction

In today's fast-paced and competitive business landscape, organizations across industries are continually seeking innovative ways to maintain a competitive edge. One of the most critical avenues for achieving this edge is the successful development and introduction of new products or services (Kahn, 2018).

Due to this need for innovation and the development of new products and in order to maintain their competitiveness, organizations have been investing a lot in investigation. As per the executive summary released by WIPO (World Intellectual Property Organization) in 2020, organizations demonstrated admirable resilience by increasing their investment in Research and Development (R&D) by approximately 10%, even in the economic challenges brought by the Covid-19 pandemic. Remarkably, the majority of this investment originated from the industrial sector, with a particular emphasis on product manufacturers. While organizations in the service and software sectors also contributed to R&D, the biggest share was attributed to manufacturers. In the context of the United States, it was observed that a substantial 70% of R&D investments hailed from the industrial sector, underscoring its fundamental role in driving innovation and the creation of new products within society.

However, the intensity and competitiveness associated with the development of new products present multifaceted challenges for organizations, which can, in some cases, even jeopardize their existence. Statistically, an estimated 40% of newly introduced products face failure, despite undergoing rigorous testing and validation processes. Moreover, among those products that do manage to reach the market, only a modest 13% attain their initially projected profit margins (Cooper, 2011). According to Herroelen & Leus (2005), given the elevated levels of uncertainty and the inherent risks of potential setbacks, organizations are diligently attempting to recalibrate their strategies for New Product Development (NPD). They are also exploring tools that effectively mitigate the risks associated with failure and substantial financial losses (Herroelen & Leus, 2005).

Consequently, to enhance the success of new product development initiatives, the field of project management has experienced remarkable growth in recent years and is increasingly recognized as an indispensable component (Berssaneti & Carvalho, 2015). This strategic tool empowers companies to navigate the uncertainties associated with innovation by providing a structured framework that enables meticulous control over costs, timelines, and project

quality (Herroelen & Leus, 2005). Therefore, deviations are minimized, project objectives become more manageable, and team efforts are adeptly aligned with organizational goals, as well as the evolving demands of the market and customers (PMI, 2017).

In the dynamic world of the wind industry, where sustainable energy sources are not just a choice but an imperative, the pursuit of innovation becomes critical. Vestas, a leading player in the wind energy sector, stands at the forefront of this renewable energy revolution. As the world increasingly pivots towards clean and sustainable energy solutions, Vestas has recognized the fundamental role of innovation, particularly within the context of New Product Development (NPD) related to Blades, in not only shaping its own future but also the trajectory of the entire wind energy sector. The confluence of innovation and NPD, facilitated by effective project management, holds the key to connecting the power of the wind to its fullest potential. However, this incorporation is not without its complexities and challenges.

Therefore, the aim of this study is to analyze the Project Management practices currently implemented in the Vestas, particularly in the Blades Project Management Technology Program where there is a high need to catch-up with other areas of the business. In more detail, the focus is to identify what are the best practices and the critical factors for the success of these types of projects perceived by the Project Managers who work in the program. Afterward, the goal is to contribute to a future proposal of standardized framework/set of practices for the critical processes in NPD in order to reduce the variability of outcomes and execution times of each project.

This dissertation is organized into seven chapters, each serving a specific purpose. The introduction (Chapter 1) sets the stage by introducing the topic of innovation and new product development (NPD), providing context, and outlining the research's scope. Chapter 2, the literature review, delves into the critical concepts of innovation, NPD, and project management, examining their importance, types, and methodologies, along with the role and challenges faced by project managers. Chapter 3 presents the methodology, detailing data collection and the sample selection process. The empirical study, explored in Chapter 4, analyzes sample characteristics and discusses results across several dimensions, including innovation and NPD, project managers, critical success factors, project methodologies, and

potential improvements. Chapter 5 contains conclusions, contributions, limitations, and suggestions for future studies.

2. Literature Review

2.1. Innovation and New Product Development (NPD) Process

Innovation and the New Product Development (NPD) process stand at the forefront of modern business strategies, shaping the success and sustainability of companies in today's dynamic markets. This dissertation explores the importance of innovation within organizations, diving into its multifaceted dimensions and highlighting its transformative impact. Throughout this study, we will analyze the diverse types of innovation that companies employ to adapt, grow, and remain competitive in an ever-evolving landscape.

2.1.1. Importance of Innovation

Innovation is of high relevance for companies since it serves as a key driver for their growth, sustainability, and competitive advantage. Consequently, Fagerberg et al. (2010), state it as a critical factor for the long-term survival of the companies (Fagerberg et al., 2010). In today's rapidly evolving business landscape, companies that fail to innovate risk falling behind their competitors and becoming obsolete. This fast-paced growth also leads to a constant creation of new markets, for example the streaming industry that completely changed with Netflix (Sundararajan, 2016).

However, according to Christensen (2013), the constant innovation has the potential of changing the customers habits, making it easy for a product or technology to become obsolete. The author illustrates this with examples like Nokia who was a dominant force in the mobile phone industry. Yet, the company failed to foresee the rise of smartphones and the shift towards touch-screen devices and app ecosystems. As a result, Nokia's market share declined significantly, and it eventually sold its mobile phone business to Microsoft (Christensen, 2013).

Therefore, by creating specific projects related to the development of new projects, continuously improving their current portfolio and embracing innovation, the companies can differentiate themselves in the market, create unique value propositions, and address changing customer needs effectively. Moreover, innovation attracts top talent and promotes employee engagement (Hamel, 2006). So, by investing in research and development, fostering partnerships, and embracing emerging technologies, companies can proactively navigate challenges and position themselves for long-term success in an ever-changing world.

Further in this report, critical success factors of an NPD project will be presented in more detail.

RP1: Innovation projects play a significant role in a company

2.1.2. Types of Innovation

Within the topic of innovation, this topic will delve into the different types that range from incremental improvement to groundbreaking disruptions.

Christensen (2013), in his work "The Innovator's Dillema", focus in one type of innovation, known as "Disruptive Innovation". The innovations generated from this type tend to be simple, afforadable, and less advanced when compared to the already existing products. But, over time their performance improves and eventually disrupt the existing market by attracting mainstream customers and replacing the dominant products or services (Christensen, 2013).

In his work, Kahn (2018), defends the importance of another type of innovation, the "Incremental Innovation", stating that the biggest mistake companies make is to consider the innovation as a result, leading to lower Returns on Investiment. The author defends that innovation should be recognized as three different elements: innovation is an outcome, innovation is a process, and innovation is a mindset (Kahn, 2018).

Innovation, when viewed as an outcome, centers on the outpu, on what are the desired results. Innovation as an outcome can be associated with (Kahn, 2018):

- **Product Innovation**: involves the development of new or improved products, services, or technologies, aiming to better meet customer needs, offer unique features, or address existing market gaps (eg.: iPhone).

- **Process Innovation**: focuses on optimizing and enhancing the methods, systems, and workflows within an organization (eg.: Toyota's implementation of "just in time").

- **Marketing Innovation**: relates to the introduction of new strategies, techniques, or campaigns to promote products or services and engage customers. It aims to create

unique and compelling ways to reach the target audience, increase brand awareness, and drive customer loyalty (eg: "Share a Coke" Coca-colas's campaign).

- **Business Model Innovation:** involves rethinking the fundamental structure and operations of a business to gain a competitive advantage. Companies might explore new revenue streams, distribution channels, partnerships, cost structures, or customer segments. (eg: Airbnb).

- **Supply Chain Innovation:** involves optimizing and improving the processes and activities related to the flow of goods, services, and information from suppliers to consumers (eg: Amazon's implementation of robotic fulfillment centers)

- **Organizational Innovation:** focuses on introducing changes to the internal structure, culture, and management practices of a company to foster a more innovative and adaptive environment (eg: remote work).

The second element is "Innovation is a Process", focuses on the organization and coordination of innovation to ensure the realization of these outcomes. The innovation process can be divided into three distinct phases: discover, develop, and deliver (Kahn, 2018). The current dissertation focuses in the development phase, which involves the creation of new products and the involvement of project management to increase the chances of the new product implementation is a success.

Finally, the last element Kahn (2018) presents is "Innovation is a Mindset". This is a crucial element in the innovation process, as it entails the incorporation of innovation within individual members of the organization and the cultivation of a supportive culture throughout the organization. When employees and the organization as a whole adopt and integrate innovation, it fosters a favorable environment for the development of positive innovation characteristics (Kahn, 2018).

Each element described is associated with key aspects as shown in Table 1.

Table 1 – Innovation Elements (Kahn, 2018)

Element	Strategic focus	Strategic question	Consideration
Innovation is an outcome	Ends	What do you want to happen?	– Product innovation – Process innovation – Marketing innovation – Business model innovation – Supply chain innovation – Organizational innovation
Innovation is a process	Ways and Means	How will you make it happen?	– Innovation process – Product development process
Innovation is a mindset	State	What should be instilled and ingrained to prepare for the what and the how?	– Individual mindset – Organization culture

2.2. Project Management and NPD Projects

According to the Project Management Institute, a project can be defined as a temporary effort, with well-defined beginning and end and involving the coordination of several resources, in order to produce a unique result, product or service (PMI, 2017). Projects may aim, for example, at the production of a physical or tangible product or to improve the logistical process in which the success measurement is tangible. In this sense, the concept of innovation can be associated with project management since it consists in the development of new products (NPD) (Lester, 1998).

The high uncertainty and probability of deviations makes the existence of the project management role crucial for the success of the projects. However, the criteria that establish the meaning of "success" is subjective (Berssaneti & Carvalho, 2015). The most used method for evaluating results is through Key Performance Indicator (KPI), which considers evaluation metrics that involve Quality, Cost & Delivery (QCD) (Ogunlana, 2010). Moreover, there are areas of expertise and knowledge (Project Integration, Scope, Time, Cost, Quality, Human Resources, Communication, Risk & Procurement) that represent critical factors for the success of an NPD project (Cooper, 2019).

2.2.1. The role of Project Management

As previously stated, nowadays more organizations are recognizing the importance of introducing Project Managers. Therefore, the role of the PM varies according to the organization and the type of projects that are assigned (Atkinson et al., 2006).

According to Browning et al. (2002), in NPD projects the PM is responsible for leading a cross-functional team, manage the stakeholders' expectations and ensure that the project goals are aligned with the ones from the organization, such as profits, quality standards and R&D costs (Browning et al., 2002).

Additionally, there are areas of expertise and knowledge that the PM needs to plan, manage, and control throughout the project development. As per Meredith et al. (2017), this are: Project Integration Management, Scope Management, Time Management, Cost Management, Quality Management, Human Resources Management, Communication Management, Risk Management and Procurement Management (Meredith et al., 2017).
Since these areas play an important role in the success of projects, it is relevant to analyze each one and what they represent in terms of NPD projects, as shown in Table 2 (Pons, 2008).

Table 2 - Processes and Output per Knowledge Area

Knowledge Area	Processes	Output
Project Integration Management	Incudes an analysis on the efforts needed in the project, which stakeholders are relevant, what strategy fits best and a plan of the activities	• Project Charter • Project Management plan • Lessons Learnt
Scope Management	Division and definition of the Project Work Packages	• Scope Management Plan • Requirements List • WBS
Time Management	Definition of the project's execution time, including the sequence and duration estimation of the tasks	• Master Schedule
Cost Management	Estimation of costs, investments, and potential sales. Also, helps in optimizing the resources allocation, avoiding over-investments.	• Budget

Quality Management	Planning of quality metrics, control, and continuous improvement activities.	• Quality KPI's; • Project/Product Control Plan
Human Resources Management	Planning, acquisition, and management of the resource's allocation for the project. Includes an evaluation of the team competency profile and their skills development.	• Project Organization Chart • Competencies Profile • Resource Management Plan
Communication Management	Documentation creation and communication strategy definition.	• Communication Tools
Risk Management	Risk analysis of anything that might affect the time, cost, or quality, compromising the project's success. The probability and severity are evaluated, and an action plan is elaborated.	• Risk Management File
Procurement Management	Product and/or services acquisition, to be incorporated in the project (either components or final product)	• Memoranda of agreements (MOAs) • Internal service level agreements (SLAs)

According to Sońta-Drączkowska & Mrożewski (2019), due to the fact that NPD projects involve the creation and introduction of new products or services to the market it is expected that a specific set of skills and expertise, that are not needed in other types of projects, are required (Sońta-Drączkowska & Mrożewski, 2019). In this way, a deep understanding of the product development process and about the market in which the product will be introduced is crucial to an NPD project manager. They must also be able to manage the uncertainty and risk associated with developing new products and be able to adapt quickly to changing market conditions. Additionally, to ensure the product is developed and launched successfully, the PM must be keen on coordinating cross-functional teams, such as product design, marketing, and manufacturing (Meredith et al., 2017).

In summary, Project Managers in NPD projects are required to have a unique set of skills and competencies to be successful in this role and might need to apply tools and techniques to manage the challenges and complexities of this type of projects. The next chapter will explore some of the challenges faced by an NPD Project Manager.

RP2: NPD Project Managers need to have a unique set of skills.

2.2.2. Project Manager Challenges

Given that NPD (New Product Development) projects are highly volatile and complex, it is expected that the challenges faced by the Project Manager are even more recurrent (Cooper & Sommer, 2020). Therefore, identifying these challenges allows Project Management to minimize or eliminate risks that may affect the achievement of objectives.

As mentioned earlier, choosing the appropriate methods and processes for the type of project and its life cycle is of great advantage to project success and project management effectiveness. With this in consideration, it is important for the PM to combine organizational and individual factors with the projects characteristics to choose the methodology that better suits the development and uncertainty of the project. This allows the constant validation of the project through client's feedback and reduces the time it takes for the product to be in the market (time-to-market) (Thesing et al., 2021).

Moreover, during the project's scope definition, the Project Manager should set objectives in a broader manner, avoiding limiting product development and increase associated flexibility (Barczak & Wilemon, 2003).

In highly competitive industries as the Wind Industry, speed to market is crucial for gaining competitive advantage. Project Managers in NPD face the challenge of accelerating the development process without compromising quality or introducing risks. Balancing the need for speed with effective planning and execution is a constant challenge (Araújo et al., 2017). This time-to-market pressure leads to the PM having to navigate aggressive timelines while maintaining product quality. They must optimize project schedules, identify critical paths, employ agile methodologies, manage resources efficiently, mitigate risks, and foster a culture of continuous improvement.

In a study conducted by Atkinson et al., another major challenge lies in the correct allocation of resources and competencies levels. This refers to the process of effectively assigning and utilizing the available resources and skills within a project to accomplish its objectives (Atkinson, Crawford, & Ward, 2006). This represents a great challenge since an inadequate resource allocation can lead to bottlenecks, delays, and inefficiencies, as well as potential risks and project failures. While ensuring the allocation of the right resources at the right time can help optimize efficiency, productivity, and performance throughout the project lifecycle.

Research made by Royer (2000), presents that the biggest challenges faced in NPD projects are related to recognizing, managing, and mitigating risks (Royer, 2000). Since NPD projects require more R&D efforts there is a higher need of investment from the company, which means that any deviation in the time, cost or scope can result in big losses for the organization. Therefore, it is important that the PM with the cross-functional teams, is capable of periodically assess what are the risks of the projects. Also, the Project team should be given enough freedom in order to develop more robust mitigation plans (Mu & MacLachlan, 2009).

In summary, considering that information is scarcer in NPD projects, it becomes crucial for the Project Manager to systematically evaluate the project's needs throughout its duration and communicate them to the executive team (Cooper, 2019). Furthermore, by effectively managing time-to-market pressures, project managers contribute to the competitive advantage of the organization by ensuring timely delivery of innovative products or services to the market. By having all this challenges in mind, the PM will then be capable of successfully managing a NPD project.

RP3: The main challenges that NPD Project Managers face are the methodology to choose, objectives definition, time-to-market, resources competencies and risk identification.

2.2.3. Key success factors for Project Managers

When it comes to NPD projects, the success of the execution from the conception to the launch is highly dependent on the role of the Project Manager. This type of project, as stated before, is typically complex, involves various stakeholders, multiple tasks, and strict timelines. In consequence, to effectively manage NPD projects, the PM needs to be aware of certain key success factors.

According to Cooper (2019), there are three distinct categories that can define what drives the success of the project. The first category relates to the individual factors, associated with the project or product characteristics. Second, are the business factors, such as business's innovation strategy, how the company makes its R&D investment decisions and culture. The last and third category is associated with the system and methods followed by the company, for example the agile development approaches and gating systems (Cooper, 2019).

In his study, Cooper (2019), then identifies the twenty critical success factors fitting each of them in one of the three categories. The Table 3 presents these results (Cooper, 2019):

Table 3 – Critical Success Factors (Cooper, 2019)

Number	Category	Critical Success Factor
1	Individual	Unique superior product: a differentiated product that delivers unique benefits and a compelling value proposition to the customer or user
2	Individual	VoC: market-driven and customer-focused NPD
3	Individual	Pre-work: Doing the homework and front-end loading
4	Individual	Definition: Sharp and early product definition
5	Individual	Iterations: Iterative or spiral development and putting something in front of the customer early and often, to get the product right
6	Individual	Global orientation: The world product – a global or "glocal" product concept targeted at international markets
7	Individual	Launch: A well-conceived, properly executed launch
8	Business	Innovation strategy: A product innovation and technology strategy to focus the business on the best strategic arenas and provide direction for ideation, product roadmaps, and resource allocation
9	Business	Focus: Doing fewer development projects, better projects, and getting the right mix of projects by adopting systematic portfolio management
10	Business	Leveraging core competencies: Step-out development projects, which take the business into new and unfamiliar markets and technologies, lead to higher failure rates

11	Business	Targeting attractive markets: use selection elements like market size, growth, and the competitive situation
12	Business	Resources available: Innovation resources, both quantity, and quality in place
13	Business	Teams: Effective cross-functional teams to reduce time-to-market
14	Business	Climate: The right climate and culture – one that supports and fosters innovation activities
15	Business	Leadership: Top management supporting and leading the innovation effector at every opportunity
16	Process	Gating systems: A multistage, gated disciplined idea-to-launch system, such as Stage-Gate
17	Process	Accelerating development: Many effective ways to accelerate development projects, but not at the expense of quality of execution.
18	Process	Agile: Agile methods from the software development world built into traditional gating systems to yield agility, adaptive response to changing requirements, and faster to market
19	Process	Generating breakthrough ideas: Effective ideation to feed the innovation funnel
20	Process	Execution: Quality of execution of key tasks in the innovation process

These key success factors help project managers navigate the complexities of NPD projects, drive collaboration, mitigate risks, and deliver successful outcomes. By effectively applying these factors, project managers increase their chances of achieving project objectives, meeting stakeholder expectations, and delivering innovative products to the market.

RP4: Identifying and prioritizing the key success factors in project management enhances project performance and the achievement of organizational goals.

2.3. Project Management Tools and Techniques

New Product Development (NPD) project management encompasses a range of tools and techniques that enable organizations to effectively navigate the complex process of bringing innovative products or services to market. These tools and techniques provide structure, organization, and control throughout the various stages of the NPD lifecycle, from idea

generation to commercialization. By adopting robust project management practices, businesses can optimize resource allocation, streamline communication and collaboration, mitigate risks, and enhance the overall success rate of their NPD initiatives. From well-known methodologies like the Stage-Gate model and Agile development to other techniques as Blue Ocean Strategy, NPD project management tools and techniques empower organizations to drive innovation, meet customer demands, and gain a competitive edge in today's rapidly evolving markets.

- **Project Management Methodologies**

According to the existing literature, the Stage-Gate Model is the most used method and the one with the highest probability of success in Innovation Projects by organizations (Cooper & Edgett, 2012).

In this system, as stated in Figure 1, the new product development process is divided in six phases, ranging from the creation of the idea to the moment of reviewing the product after its implementation. To ensure that the project continues to meet the conditions and results defined by the executive team, an assessment is conducted at the end of each Gate. Thus, this allows to evaluate the continuity of the project and the need for adjustments (Mullaly & Thomas, 2008).

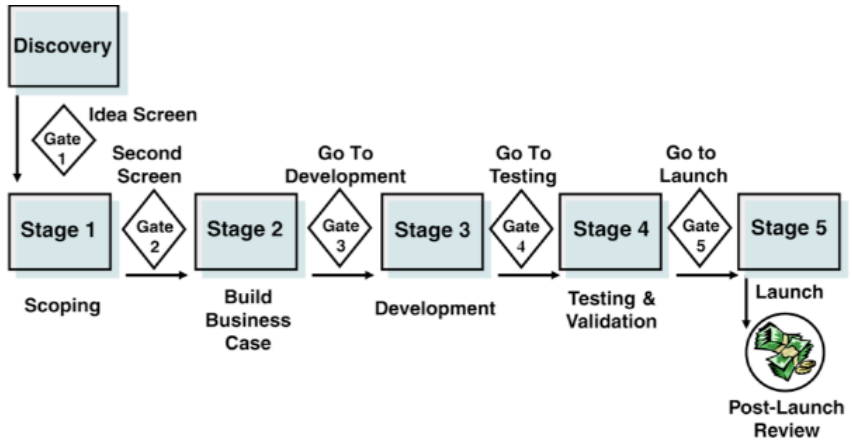

Figure 1 – Stage-Gate Model for NPD projects (Johansson, Larsson, & Parida, 2009)

The Stage-Gate Model can also be complemented with other project management methodologies which are distinguished by the way the activities are planned. The most used are Waterfall, Agile e Hybrid (Thesing et al., 2021).

- **Waterfall**

According to Thesing et al., of the three Project Management methodologies, the most traditional is the Waterfall Stage-Gate. In this, activities are planned in a way that for an activity to start it is necessary for its precedent to finish, this is called cascade planning. During the development of projects that follow this methodology, iterations are not carried out, nor are pre-tests of the product performed together with the customer and, therefore, it is not possible to obtain constant feedback (Thesing et al., 2021).

The advantages of using the Waterfall Stage-Gate system are the stability it generates in the team, since everyone knows what the next activity is, and the reduction of the likelihood of budget deviations. Furthermore, by allowing better documentation of the project phases, the allocation of lean resources to the project is also more efficient. Nevertheless, the process is slower leading to longer results, it is not flexible in case of increments or changes and requires the establishment of technical requirements from the beginning of the project. This rigidity implies that any error when analyzing the requirements can be critical for the project (PMI, 2017). The necessary investments by the organization are also considerably higher and profits are only obtained when products start to be sold, which means that these projects are not self-sustaining (Thesing et al., 2021).

- **Agile**

When it comes to the Agile Stage-Gate, system often found in the area of software development, it differentiates each phase of the project and there is closer contact with the client, through the various iterations of development, testing and feedback. The proximity to the customer during the various iterations allows the team to be able to constantly adapt the product to their needs by improving or adding new features, benefits and/or functionalities (Sommer et al., 2015).

In this context, the Agile methodology makes it possible to make faster decisions regarding the continuation of the project and the commercialization of the product earlier, leading to the financing of product maturation activities (Boehm & Turner, 2005). Compared to the Waterfall system, in which the project is evaluated according to the percentage of what is already completed, in this system it is evaluated according to the value created. Some of the disadvantages of Agile, are the need for quick reaction to change and uncertainty, even when

the customer's requirements are not fully known, as it is a much more dynamic environment and involves the consumption of more resources between iterations, whether of material or human resources (Sommer et al., 2015). The success of projects that follow this methodology is also conditioned by the freedom given to the team, since there are times when it is not possible to plan according to expectations or to evaluate the business plan in financial terms (Cooper & Sommer, 2020).

Finally, the combination of these two described approaches is called Hybrid Stage-Gate. According to Lalmi et al., the main objective of this system is for the Project Manager to understand what the needs of the project are, at each moment and, together with the project team, to adapt the most suitable methodology for those moments: Waterfall or Agile (Lalmi et al., 2021).

- **Hybrid**

The use of the hybrid methodology makes the Project Manager able to maintain the predictability characteristic of Waterfall and, simultaneously, the speed of execution of Agile. As a rule, when there is more stability and the requirements are known, the Waterfall method is more indicated, in case of greater uncertainty, the Agile method is preferable. However, as the Project Manager is responsible for evaluating the available documentation, the requirements, and objectives of the project, in each phase, and deciding whether the application of this approach is adjusted or not, the success of projects with hybrid methodology depends a lot on experience and knowledge. In addition, to maximize the advantages of both methodologies, it is important that the multidisciplinary team has knowledge about them as well (Pons, 2008).

Regarding NPD projects, the Stage-Gate system is always integrated with the development phases of a project, with the aim of aligning objectives, as can be seen in Figure 2. In this respect, there is no ideal methodology, but rather a combination of NPD approaches, project management and organizational context. On the other hand, it is crucial to take in consideration some decisive factors when choosing the methodology, such as (Thesing et al., 2021):

- Characteristics of the Project;
- Availability of information and customer requirements;

- Organizational context (hierarchical structure, team autonomy, executive team support).

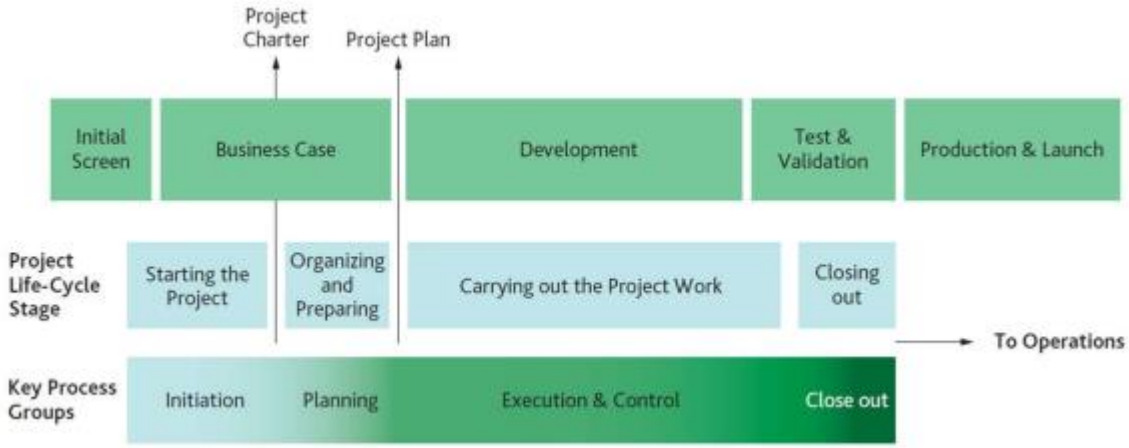

Figure 2 – Combination between the Project Management phases and the NPD process (Jetter et al., 2016)

While Stage-Gate methodologies are widely recognized, various alternative approaches in Project Management have demonstrated their effectiveness and success.

Brown (2009), in his book "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", explores design thinking as a human-centered approach to problem-solving and innovation. The author emphasizes that design thinking is not just a process but a mindset that focuses on empathizing with users, understanding their needs, and iteratively developing and testing solutions. The design thinking process is highly dependent on collaboration, experimentation, and risk-taking, and a culture of continuous learning and adaptation is crucial for achieving meaningful and transformative outcomes (Brown, 2009). Regarding NPD projects, this method, when combined with a Stage-Gate approach, can provide better and more efficient solutions by taking in consideration the most customer needs and without investing many resources too early in the project (Luchs, Swan, & Griffin, 2016).

Another framework, presented by Ries (2011), is the "Lean Startup". This methodology promotes continuous experimentation and validated learning to accelerate the development of successful products or services. It involves building a minimum viable product (MVP) quickly, measuring its performance through customer feedback and relevant metrics, and learning from the data to make iterative improvements. The Lean Startup approach encourages a scientific and customer-centric mindset, emphasizing the importance of

engaging with customers early on and being open to pivoting or persevering based on the learning. As described previously, in NPD projects there is a high uncertainty, continuous iterations, and data-driven decisions so, when this is embraced and combined with the Lean Startup method, entrepreneurs can increase their chances of creating innovative products that meet market needs and achieve long-term success (Ries, 2011).

According to Chesbrough (2003), a methodology that needs to be applied when it comes to NPD projects is the "Open Innovation". This framework encourages organizations to collaborate with external partners, share knowledge, and embrace a more user-centric approach. According to the author, innovation is not confined to internal R&D but extends to external sources, including customers, suppliers, and other organizations. By actively seeking external knowledge and ideas, organizations can accelerate the innovation process, access a broader pool of resources, and gain a competitive advantage. The open innovation framework emphasizes continuous learning, flexibility, and co-creation, enabling organizations to develop innovative products and solutions that better meet customer needs and adapt to an ever-changing business landscape (Chesbrough, 2003).

Kim & Mauborgne (2004) introduced the concept of "Blue Ocean Strategy", describing it as a strategic framework that focuses on creating uncontested market spaces and making the competition irrelevant. Although the Blue Ocean Strategy method is not directly associated with NPD in the traditional sense, its principles and methodologies can be highly relevant and applied to the NPD process. The concept suggests that businesses can achieve significant growth and success by creating new market spaces, called "blue oceans", rather than competing in existing, highly competitive market spaces, referred to as "red oceans". By applying this method organizations seek to look beyond competing with rivals and instead focus on creating new markets, often by redefining industry boundaries, rethinking the value chain, and challenging conventional assumptions about the industry. The benefits of the Blue Ocean Strategy, are related to the ability of companies unlocking new sources of growth, expand their market reach, and achieve sustainable competitive advantage by innovating in ways that make them stand out (Kim & Mauborgne, 2004).

RP5: There is a common understand of PM methodologies and it determines the project's success and organizational performance.

3. Methodology

The methodology chosen constitutes a broad approach guiding how research inquiries are formulated and addressed by the investigator, taking into consideration the research objectives.

Given that the aims of this study involve the identification of best practices and critical factors, the research's purpose is thus to determine the techniques utilized by Project Managers in NPD projects to achieve favorable outcomes and to unveil the primary challenges they encounter. In this specific instance, a favorable outcome is reflected in the reduction of costs and time compared to the planned benchmarks.

Therefore, the methodology adopted will be qualitative research, with the data collection done by interviews. Qualitative research constitutes an unstructured exploratory methodology that provides insights and comprehension regarding the defined issue, by the utilization of small sample sizes (Njie & Asimiran, 2014). Also, the use of an open conversation with clear objectives allows the interviewer to get "pure information" and to better understand the knowledge of the individuals (Amado, 2014)

As previously stated, the data collection was made through qualitative interviews. Since there were several themes to be covered and relevant questions that could arise, it was important to have a high level of flexibility, so the choice was to develop a semi-structured script for the interviews (Aires, 2011).

3.1. Research propositions and Script development

In this study we are analysing the PM practices for innovation and NPD programs focusing in the case of Vestas. In the last chapter, after reviewing the literatue we suggested the following research propostions:

Table 4 – Research Propositions

Research Proposition
RP1: Innovation projects play a significant role in a company
RP2: NPD Project Managers need to have a unique set of skills.

RP3: The main challenges that NPD Project Managers face are the methodology to choose, objectives definition, time-to-market, resources competencies and risk identification.
RP4: Identifying and prioritizing the key success factors in project management enhances project performance and the achievement of organizational goals.
RP5: There is a common understand of PM methodologies and it determines the project's success and organizational performance.

Based on the literature review and in order with these research propositions, the following script was developed. The script was developed having in consideration the categories that were found during the secondary research previously conducted and allowing space for other categories to be found and new information to be added:

Table 5– Interview Script and respective authors

Category	Question	Authors
Innovation and NPD (RP1)	Q1. What do you consider to be an innovation?	Fagerberg et al. (2010); Christensen (2013); Hamel (2006)
	Q2. How important are New Product Development projects in a company? Do you think they should be prioritized or created according to the needs?	
PM in NPD (RP2)	Q3. What are your strongest skills as a PM?	Sońta-Drączkowska & Mrożewski (2019); Meredith et al. (2017)
Critical Success Factors (RP3)	Q4. In your opinion and experience, which factors have most influence in the execution of your NPD project management activities?	Cooper (2019)
	Q5. What is the significance of company culture in the creation of NPD projects? Do you feel that the organizational culture drives certain types of projects?	
	Q6. From your experience, does the leadership style and organizational culture affects the methodology choice? Or is it more affected by the product type and/or resources competencies?	
	Q7. Do you feel the methodology is a critical factor for the project's success? What do you think happens when the method applied does not fit?	
	Q8. In your experience as a Project Manager, is it a common practice for organizations to filter which projects should actually materialize as projects, as opposed to remaining as ideas? Do you believe this makes a difference in the project's success?	
Project Management	Q9. What type of methodologies do you have experience with?	Cooper & Edgett (2012); Mullaly & Thomas (2008); Thesing et al. (2021); PMI
	Q10. What are the requirements, challenges, and advantages you see in each?	

Methodologies (RP4)	Q11. From your experience/knowledge which one do you feel works best?	(2017); Sommer et al. (2015);
	Q12. When it comes to NPD projects do you have a preferable methodology to use? Do you feel the methodology changes over the course of the project?	
NPD vs Normal (RP5)	Q13. In your other types of projects what were your main challenges?	Cooper & Sommer (2020); Thesing et al. (2021); Barczak & Wilemon (2003); Araújo et al. (2017); Atkinson, Crawford, & Ward (2006); Royer (2000); Mu & MacLachlan (2009) ; Cooper (2019)
	Q14. What challenges have you faced in NPD projects that you haven't in others?	
Further Improvements	Q15. Which of the following do you consider to need more development? a. planning b. Scope management c. Cost Management d. Time Management e. Communication Management f. Quality Mangement g. Stakeholder Management h. Risk & Issue Management i. Knowledge Sharing j. Leadership k. standardization	NA

3.2. Sample

As some of the participants were based outside Portugal, some of the interviews were carried out online, supported by the Microsoft Teams tool, and others in the workplace of the interviewed.

The study was conducted in the Project Management department of Vestas. Vestas is composed of various subsidiaries spread across the globe, engaging in the renewable energy market through the design, construction, installation, and maintenance of wind turbines. This company aspires to become a global leader in renewable energy solutions, channeling all its efforts into the development and implementation of increasingly sustainable ideas. Currently, it boasts more than 145 GW of wind turbines installed in 85 countries, already preventing emissions of 1.5 billion tons of CO_2 since the inception of its operations. Vestas' mode of operation is driven by its desire to make the world a better place and contribute to a more sustainable future.

The idea was to conduct this study with individuals working in Project Management in this company. However, Vestas has currently 58 Project Management departments totaling approximately 700 employees, spread across the globe. Therefore, it was not manageable to study all these elements, making it necessary to select a sample out of this population.

To select the sample, it was used a non-probabilistic sample technique where the researcher decides what will be the elements of the sample and, in this case in specific, it was chosen a convenience technique (Baker, et al., 2013). The choice of this method was to facilitate the contact and the interviews – individuals working in the same department as the researcher and that are currently working in New Product Development projects.

With this in mind, the 6 employees currently working in the NPD program were contacted and all of them accepted to be interviewed.

4. Empirical Study

4.1. Sample Characterization

The sample of participants who agreed to be part of the study consists of 2 females and 4 males and with half of the sample being Portuguese and the other half from different areas of the world. The age ranges from 26 to 54 years old.

When it comes to their educational background the entire sample has an engineer degree, either bachelor or master. Also, only half of the sample has a PM Certification. The participants were also asked about how many years they have been working, translating in half of the sample having worked between 5 to 7 years and the other half between 20 to 37 years. However, only two of them have been in the Project Manager role from more than 13 years and the other 4 for only 3 years. The years spent in unrelated roles to Project Management were associated with engineering, management, sales, business analysis, consultancy and entrepreneurial.

Regarding the interviewers' project management experience all of them have worked with projects in the Renewable Energy Sector. The IT Sector is also standing out with half of the sample having experience with these projects. One of the participants adds to his experience the manufacturing and food industry and another the automotive industry.

Finally, the last question related to their characterization involved their experience with NPD projects, with only two participants answering "No", as shown in Figure 3.

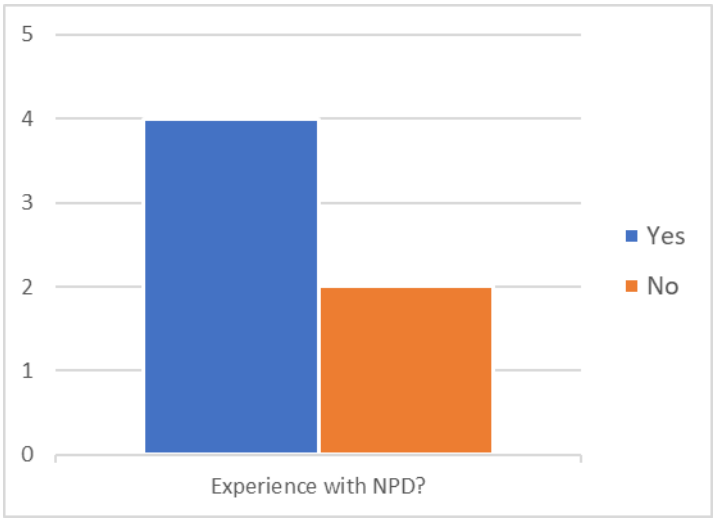

Figure 3 - Number of participants with NPD Experience

In order to keep the confidentiality and to be easier to reference the quotes from each interview, the names were replaced with a code. All of the information can be found in Table 6.

Table 6 - Interviewers characterization

Code	Genre	Age	Nationality	Role	Academic Education	PM Certifications	Job-Experience Years	Years in PM Role	Time in Vestas	Projects Business Area	NPD Experience	Previous Roles not PM Related
I1	F	30	Portuguese	Project Manager	MSc Biomedical Engineer PgD Management	Vestas Project Leadership	7	3	1 -3 years	IT sector Renewable Energy	Yes	Business Development Manager
I2	M	30	Portuguese	Project Manager	MSc Mechanical Engineering	NA	7	4	< 1 year	Renewable Energy	No	Product Engineer
I3	M	54	Canadian	Senior Project Manager	Electrical Mechanical Engineering	NA	37	18	9 - 11 years	Renewable Energy Manufacturing Food Industry	No	Engineering Manager Sales Entrepreneur
I4	F	26	Portuguese	Lead Professional Project Manager	MSc Industrial Engineering and Management	NA	5	3	1 - 3 years	Automotive Renewable Energy	Yes	Business Analyst
I5	M	42	Indian	Associate Project Manager	BSc Mechanical Engineering	PRINCE 2	20	3	9 - 11 years	IT sector Renewable Energy	Yes	Consultant Engineer Lead NPI Engineer
I6	M	43	Indian	Senior Project Manager	MSc Mechanical Engineering	PRINCE 2 Foundation PMP (PMI) Vestas Project Leadership	28	13	13 -15 years	IT sector Renewable Energy	Yes	Design Engineer Tooling Engineer

4.2. Result Analysis

The data collected was analyzed through the transcriptions of the six interviews made and divided by each category identified. Each transcription can be found in the appendixes, organized by themes.

4.2.1. Innovation and NPD

In order to first understand the point of view of the interviewees in terms of the concept of innovation the first question asked was "What do you consider to be an innovation?".

Therefore, the Table 7 presents the main aspects mentioned and some relevant quotes from the interview.

Table 7 – Mentioned Aspects of Innovation in each interview

I	Aspects of Innovation	Quotes from the interview
1	✓ Does not exist; ✓ Something that is not yet defined; ✓ Change to what already exists; ✓ Independent of the area; ✓ Different types: o Product; o Process; o How the project is assessed.	*"For me, innovation would be something new that does not currently exist. In other words, it doesn't necessarily have to be product innovation, it can be a process innovation or innovation in terms of how a project is assessed. So, I would say that anything involving the creation of something that is not already defined or will produce a change in what exists fall under innovation. This applies regardless of the specific area (…)."*
2	✓ Not been used before; ✓ Different types: o Process; o Product.	*"Innovation in a practical sense in a project would be a process or some material that has never been used before."*
3	✓ New concept not considered before; ✓ Not publicly known.	*"A new concept that has not been considered (…). That's not publicly known, and it literally goes from*

		blue sky thinking to development of some form or another."
4	✓ Does not exist; ✓ Different stages: o Completely new; o Upgrade something that already exists.	*"I think innovation is something that doesn't exist, and with something that doesn't exist, it can be created entirely from scratch or as an upgrade to something already existing."*
5	✓ Small or big change; ✓ Implement a new solution; ✓ Adds value to customer or product; ✓ Can create a completely new product.	*"(…) addressing a problem by implementing a new solution I would call it innovative solution. Whether it's a small one or larger one (…). So, it adds value to the customer or product. Sometimes you will come up with completely new product which doesn't exist in the market."*
6	✓ Different types: o Process; o Product; o Tools.	*"(…) make the process simplified (…) it's more about the process side trying to keep things very simple and to the point. (…), see what you can do and if you can make some tools, innovate some tools that could help."*

By analyzing the table above, it's possible to see that most of the participants described an innovation as something that it's completely new or a change to something that already exists and can appear in different types.

I2: *"Innovation in a practical sense in a project would be a process or some material that has never been used before."*

I3: *"A new concept that has not been considered (…). That's not publicly known, and it literally goes from blue sky thinking to development of some form or another."*

I4: *"I think innovation is something that doesn't exist, and with something that doesn't exist, it can be created entirely from scratch or as an upgrade to something already existing."*

I6: *"(…) make the process simplified (…) it's more about the process side trying to keep things very simple and to the point. (…), see what you can do and if you can make some tools, innovate some tools that could help."*

However, there was also a mention to the scale of the innovation, where it was referred that it can either be big or small depending on what it's being done and, that it brings value added to what it will be applied in. One of them even stated that it's independent of the area we are working on.

I5: *"(…) addressing a problem by implementing a new solution I would call it innovative solution. Whether it's a small one or larger one (…). So, it adds value to the customer or product. Sometimes you will come up with completely new product which doesn't exist in the market."*

I1: "*This applies regardless of the specific area (…).*"

To summarize, Table 8, shows the aspects mentioned by the interviewees of what is definition of innovation.

Table 8 – Summary of Aspects of Innovation mentioned

Aspects that define an innovation	Number of Mentions
New concept	5
Change to what already exists	2
Has different types	4
Independent of the area	1
Brings value added to product or costumer	1

Combining the results from both table 6 and 7, it's possible to understand that five of the participants (interview 1, 2, 3, 4 and 5) define innovation as a totally new concept being implemented and the aspect that it might exist in different types is presented in interview 1, 2, 4 and 6. The consideration that it can represent a change to something that already exists in mentioned only twice by participant 1 and . Finally, the least mentioned concepts were related to the value it adds and the application in any area.

Regarding the importance of NPD projects for a company, uniformly, the interviewees consider that it these types of projects play a major role in a company. To quote some of the participants:

I1: *"Because there are many companies in this industry, and it's these new ideas that, if well guided and delivered, I believe can set us apart."*

I4: *"I believe that companies must have an innovation and development area because if you don't keep up with the market, you fall behind. You can have a very good product, and in a year or two, or even in a few months, something new comes out, and your product can become outdated, and you're left behind."*

I6: *"Innovation is a must. Allows for our company to reduce costs and to become even more sustainable (…)."*

When questioned about if they should be prioritized or created according to the needs, there was some discrepancies. While some considered that these projects should be created according to the needs of the company:

I2: *"Everything depends on what the group's current priority is, but I think these development projects should be prioritized because they can improve what currently exists in the company."*

I4: *"As for prioritization, it's a bit tricky to say. On one hand, I think it's crucial because it allows you to continue evolving and maturing your products, positioning your company competitively in the market. On the other hand, you can be excellent at innovation but not so strong in operations, which isn't good in the long run. So, I believe it needs to take in consideration the needs."*

I5: *"They should be created according to the needs of the company. What is needed after a couple of years, so I think there are some sort of long course and then based on that the corporate strategy or the business strategy must be set up."*

Others considered they should be prioritized when compared to other types of projects:

I6: *"They should be prioritized since it's big for business and good news for the ecosystem."*

And two of the answers were even more distinct stating they should have the same importance as other projects and even that first the company should assess the resources they have and then prioritize the projects.

I1: *"I wouldn't necessarily say prioritized, because they might take years to have any returns, but I believe they should have the same level of importance as production projects."*

I3: *"They are important, but I think it should be created according to the resources that the company has and then prioritized accordingly."*

Significance of NPD projects in a company

The entirety of the interviewees considered that NPD projects are highly important in a company, they believe this type of projects permits the company to continuously develop their products and processes and, that it allows them to keep up with the market and differentiate themselves. Concerning the topic of the prioritization the answers were not unanimous, with three considering they should be prioritized according to the needs of the company and one stating that they play a big role in the business so they should be prioritized. The participants 1 and 3 declared they share the same priority as other projects and that the company must take in consideration their own resources and then decide on what the prioritization should be, respectively.

4.2.2. Project Managers in NPD

Regarding the skills of the Project Managers, it was important to understand if they felt they had an ability out of what is the considered normal. For that, they were asked "What are your strongest skills?".

The answers were as shown in Table 9:

Table 9 – Skills mentioned by each PM and quotes

I	Skills Mentioned	Quotes
1	✓ Interpersonal relationships ✓ Organization	*"I would say the ability to relate to others and to organize my work according to the challenges and projects that arise."*
2	✓ Adaptability ✓ Organization	*"The ability to adopt new methodologies and to organize myself during high-pressure moments."*

3	✓ Initiative	*"My strongest skills are breaking through the wall first."*
4	✓ Empathetic	*"I believe that I'm a very empathetic person and that can easily put myself in other people's shoes."*
5	✓ Knowledge	*"I can easily follow and understand processes."*
6	✓ Communication	*"Communication. I'm very meticulous in my in my writing as well."*

NPD Project Managers skills

By analyzing the table above is possible to understand that the PMs didn't refer to any outstanding characteristics that could make a difference in a NPD project. Skills like communication, process knowledge, empathy, organization and initiative are common across all types of projects.

4.2.3. NPD vs "Normal" projects

When it comes to the difference between NPD and Normal Projects the first goal was to assess what were the main challenges that the PMs faced in a "Normal" project.

In this case, it was referred challenges like the resources' availability and competency, since the team working in a project is at the same time allocated to a different number of projects. Also, because in some development projects there is a high need for technical understanding and if the team is not matured enough, it will not be possible to have the right level of knowledge.

I1: *"Resource availability is a significant factor. In this field, there are many blade development projects, so a resource isn't exclusively allocated to one project. I tried, in a way, to verify the planning, see which resources were allocated to each project, understand how many hours they were actually working and whether they had the capacity for more."*

I3: "*My worst nightmare is having to switch project managers (…) And the only person who understands it is the person who wrote it. So, for me, a lack of competencies within project execution is the worst nightmare I have."*

I4: *"My main challenge was keeping the team motivation, in my experience with a large project it was really hard to keep the team aligned and make them understand the vision of the project. Also, it was a technical difficult project."*

Other aspects stated were the constant scope changes and the collaboration between the team and suppliers.

I5: *"Collaboration between the suppliers. The stakeholders' management and communication is very much important to bring or keep everyone in the same page."*

I6: *"The dynamic nature of scope changes and the resource challenges, it's important to be vigilant on when you have weekly shared calls to see if you are on track with us with the scope. It is not my job as a project manager to do a result level the resources because we have line manager doing that, but it's your report and they're falling short or, you know, overcommitting."*

Participant two, showed a different point of view and explained that the main struggle was with prioritization. Since resources had many tasks happening simultaneously it is hard to point them what they should complete first.

I2: *"Essentially the lack of prioritization. No one knows what should be done first or what has more priority, there is a lack in that sense. To overcome that what I do is communicate with the team members and do a task list and together with them put them according to the needs in the moment."*

For comparison purposes, the interviewees who had experience with NPD were then asked what were the challenges they have faced in these projects that they have not faced in the others.

In spite of the different work experience, the four PMs that had worked NPD projects presented the same reason as a challenge: lack of clarity on what are the requirements. All faced problems with ensuring the expectations were aligned or that the scope didn't suffer many changes through the course of the project.

I1: *"Manage the expectations and be aligned with what is expected to be delivered."*

I4: *"Everything being very structured and organized, but in NPD, I didn't know what the requirements were, I didn't know what we had to do, and there was no standard documentation to use."*

I5: *"I think that the stakeholder management, when they are reviewing the project, everyone will have a different understanding depending upon what their specialization, how they are interpreting the results."*

I6: *"So innovation can always be a challenge in terms of keeping the scope the same, because one thing is scope cannot be crystal clear, defined in an innovation project because as we evolve in the concept, there might be something new popping up which will push the timeline to the right. Innovation project is always full of unknowns, unlike are the projects. So, there is lots of uncertainty there, it's important to keep this in mind and a good balance."*

Table 10 presents the comparison between the challenges PMs pointed for "normal" projects versus NPD Projects.

Table 10 – Comparison between challenges in Normal vs NPD projects according to the interviews

Normal Projects	NPD Projects
Resources availability and competency	Lack of clarity in the requirements
Scope Changes	
Inefficient Collaboration	
Lack of Prioritization	

Challenges faced by NPD Project Managers

After gathering all the answers and analyzing them it's possible to understand the main challenges faced by PMs in what is considered a "normal" project is the lack of availability and competency by the resources, the constant scope changes, the inefficient collaboration and the fact that there is no prioritization. When it comes to NPD projects, the answers were very uniform showing that the main challenge relies on the lack of clarity in the requirements, not allowing the PM to successfully deliver the project.

4.2.4. Critical Success Factors

In order to address what was the opinion of the Project Managers regarding the critical success factors in a NPD project, they were first asked "In your opinion and experience,

which factors have most influence in the execution of your NPD project management activities?".

Out of the five people that had enough experience to answer this question, all answered that the project team was the main factor that influenced their project activities:

I1: *"I would say that what influenced the most was resource allocation, without a doubt, because most of the resources are allocated to regular projects, not these ones."*

I3: *"Project team, having the correct competency profile."*

I4: *"I would say, perhaps the project teams, because as it's an innovation project, if they don't have enough knowledge, they won't be able to bring good results."*

I5: *"(…) At the same time, if you don't have a strong project team, then it is also challenged to meet the deliverables, or the qualities as expected."*

I6: *"To be fair I think that the project team and the utilization of the tools play a big part in the execution of these projects."*

Besides this, some of the participants also referred the leadership as a factor that is crucial for the successful execution of NPD projects.

I1: *"Leadership support, which is what I mentioned earlier, I believe there is still insufficient support for this type of projects."*

I4: *"Another aspect is leadership support and the market. Projects with high visibility receive a lot of support from leaders but also face a lot of pressure."*

I5: *"t's a bit complex because as a PM you are running the project, but you need a strong leadership team to guide the project in case of unexpected situation."*

Another aspect also mentioned during one of the interviews was the tools utilized during the project execution.

I6: *"To be fair I think that the project team and the utilization of the tools play a big part in the execution of these projects."*

Table 11, displays the critical factors that the interviewees find that have more influence in the successful execution of their NPD projects activities:

Table 11 – Number of mentions of each critical success factor referred

Critical Success Factor Mentioned	Number of Mentions
Project Team	5
Leadership	3
Tools	1

Following on the topic, the participants were then asked what they thought was the importance of the company culture in the creation of the NPD projects and if they felt that this culture drive a determined project type.

Once again, besides having different experiences, the answers were very similar to each other, with everyone saying that to have NPD projects the company needs to practice a culture of openness to innovation. Also, that the company must allow their employees to take risks and be flexible. Regarding the second part, there was consensus again, and the six agreed that the projects developed by a company were influenced by the culture adopted:

I1: *"Yes, I think there has to be an openness within the culture to create these new projects. I don't believe that convenience and the fact that there are already new blades or new concepts, which are easier to produce and deliver than technology or innovation, should hold us back."*

I2: *"The company is quite important because it's the company's culture that sets the boundaries for innovation and the development of a new product. If the company has a culture of wanting to innovate, it will allow you to work more in that area. So, I think culture has a significant influence and leads to a tendency in the type of projects."*

I3: *"Without the right company culture, then you're going to have nothing but frustration and poor performance. Culture is everything in this environment you have."*

I4: *"Culture has a significant impact on how the project is managed. Projects are managed differently depending on the company. I think we are a more flexible company and take more risks in innovation. People feel they have more freedom. So yes, a more open culture also leads to more freedom and better projects."*

I5: *"So I think that the company culture is really important in how the project has to be executed. It also helps since with this freedom to operate we feel safe to share new ideas and that will lead to projects more interesting."*

I6: *"It's very important the company considers very important for you to express your thoughts and express yourself as an engineer or project manager in your planning. So, it's very important that you feel comfortable in a company's corporate culture."*

After collecting information on the significance of the culture for NPD projects, the participants were questioned if the methodology chosen by the company was affected by the leadership style and organizational culture or by the type of product/resources competencies.

The answers now had some discrepancy, while some defended the methodology was dictated by the type of product others said it was more dependent on the culture. However, there was also one that stated the methodology of choice was influenced by both aspects, so the culture and the type of product. Table 12 below summarizes each point of view and quotes from the interviews:

Table 12 – Aspects of Influence according to each PM interviewed

Aspects of Influence	Number of Mentions	Quotes from the Interview
Leadership and culture	3	I4: *"I believe that the methodology is dictated by the organizational culture. As leaders, we may want to work differently, but if the organizational culture doesn't allow it, it's not possible to change the methodology."* I5: *"You have the freedom to play, so there is always a room for improvement and when you're driving for an improvement, no one stops in the organization."* I6: *"When you have a strong matrix organization project, then the PM decides how to drive the project. If it is weak matrix, then the line manager takes the precedence."*

Type of Product and Resources	2	I2: *"I think the project is more affected by the type of product and the resources that are used. If the resources aren't accustomed to working with a particular methodology, it can lead to a lack of understanding of what's being done."* I3: *"It's more affected by the product; if I'm doing a service project, then the ways of working in that methodology is going to be siloed into that type of project. If I'm building a new factory, it's going to have its own type of siloed thinking as well, because those two project types of projects are completely different from each other."*
Both	1	I1: *"Yes, I think upper management and the people involved in stakeholder evaluations do influence the choice of methodology. Once certain stakeholder leaders are accustomed to a particular methodology, it's a bit challenging to introduce a different one. However, I also believe it depends on the type of product. Perhaps for the development of a new product, the waterfall method makes more sense, but for innovation and technology, I think the Agile method makes much more sense. So, yes, the methodology can be influenced by the type of product or project itself, but I wouldn't necessarily say it's related to the skills of the resources."*

Continuing on the topic regarding methodology, the participants were asked if it was critical for the project's success and what they thought happened when it was wrongly applied.

This time, they all showed a need for having a project methodology instead of the opposite and agreed that it was a very important factor. As consequences for having the wrong methodology it was appointed confusion, longer delivery times, delays, communication problems and lack of traceability:

I2: *"Yes, the methodology does create some order and helps in the development stages of each project, which ultimately influences the outcome and the time it takes to reach that final result. If the method is chosen poorly, I believe the project can experience significant delays and even lead to failure."*

I3: *"Yes. Tension. Frustration. Mental shortcuts. People not understanding how to make things work. Confusion. Organizational noise and confusion."*

I4: *"Yes, I think it's a very important factor. If the team isn't almost in tune with the way the project is structured, they won't work that way. In other words, they may not follow how the project is developing, and this can lead to delays in projects. There can also be communication problems because if people can't understand how the project is being conducted, it can create issues."*

I5: *"I would say yes. You can find a solution even without setting the project, but the thing is how much you are taking to finish it. So yes, it's important that we are executing the project with a methodology to have structure and that also gives simplicity, traceability and the transparency."*

I6: *"Without methodology you are lost. You can have plenty of ideas unless you put them in a structured way of working, then you can't even say whether what it did was success or not. How would you even manage a project without having a tools and process? How will you know the requirements are satisfied or not? Traceability in a project is very important, so these are methodologies we are talking about."*

One of the interviewees mentioned it could also be beneficial for projects if from time to time, the company tried different approaches. This would provide support on understanding if the current way of executing was providing the best results or not.

I1: "*It's critical, but it doesn't have to be followed "by the book." What I often see in project management, especially when following the waterfall method, I don't know if it's the method itself, but there's a rigidity in terms of quality assessment and metrics. It might actually be beneficial to occasionally test different methodologies to understand their impact and whether they yield better results."*

To summarize some of the consequences mentioned and the frequency in which they were mentioned Table 13 was created.

Table 13 – Number of mentions of each consequence

Consequence Mentioned	Number of Mentions
Delays	2
Failure	1

Frustration	1
Confusion	3
Lack of understanding	1
Communication issues	1
Traceability	2

When it comes to critical factors related to Business, one of the topics is related to "Focus" so, if the company is putting efforts in doing fewer development projects, better projects, and getting the right mix of projects by adopting systematic portfolio management. To address the question asked was: "In your experience as a Project Manager, is it a common practice for organizations to filter which projects should actually materialize as projects, as opposed to remaining as ideas? Do you believe this makes a difference in the project's success?".

The answers denote that there is a filter no matter the experience of the Project Manager and that the filter produces an important impact in the way the company operates. The participants mentioned that this filtering supports the business strategy and allows the company to only focus on what will bring value instead of spending resources in everything.

I1: *"I believe that within organizations, it's definitely easier for projects that go through a filter. For example, in IT software, I can say it's entirely different, there's less openness to new ideas, introducing new features, and different things that I don't think are as restricted in that industry. However, in an industry that's more production-oriented, there may be more filtering. As for success, I think it has an impact since stakeholders are very closed off to other options and end up only doing what's expected without considering the impact."*

I2: *"I believe that filter exists even though it's not very transparent. Because without it we would be spending too many resources doing things that are not needed and that would lead the company to failure."*

I4: *"Yes, I think so, because if you don't do an initial filter and understand whether this is worthwhile or not, it's not worth expending resources on things that won't ultimately bring value, in terms of profit to the company and new ideas to the market, which is what matters."*

I5: *"The market demands and then there is a business strategy that gives the indication of what project has to be prioritized, materialized or when has to be implemented. Maybe some of them you can develop, but you have to wait for the right time to launch it. So yes, the filter exists and it's important."*

I6: *"Totally, innovations make the business better. If you're just a pouring money into something, you don't even know what is going to be the outcome or what is going to bring value to the to the organization. So it's very important to see what is the dependency, what, how this innovation, is going to drive companies business forward. So, it's important that technical heads put their brains together and find out what is the need. And so, it does make a difference in the project's success."*

Key success factors in project management enhances project performance and the achievement of organizational goals

Taking into consideration all the answers provided, there is a common opinion that the project team is currently playing a crucial role in the success of the project and that without the correct resources it's hard to manage. Then, regarding the factors that influence the methodology he answers were not very uniform but there was a tendency that it was more affected by the culture that the company adopts. Finally, analyzing in terms of the consequences of a bad methodology, the participants were very diverse, mentioning more often confusion, delays and traceability.

4.2.5. Project Management Methodologies

Next, to assess the knowledge in Project Management methodologies, there was first some questions regarding what approaches PMs had experience with and the understanding on the same.

Out of the six people interviewed, five have experience with the waterfall PRINCE 2 methodology. Of these five, three added Agile to their knowledge and one the PMI method. The participant two stated he has not been involved in projects that follow a structure, but either more task management activities. Participant six also referred the V-model as another technology he had experience with. Figure 4 shows the interpretation of this.

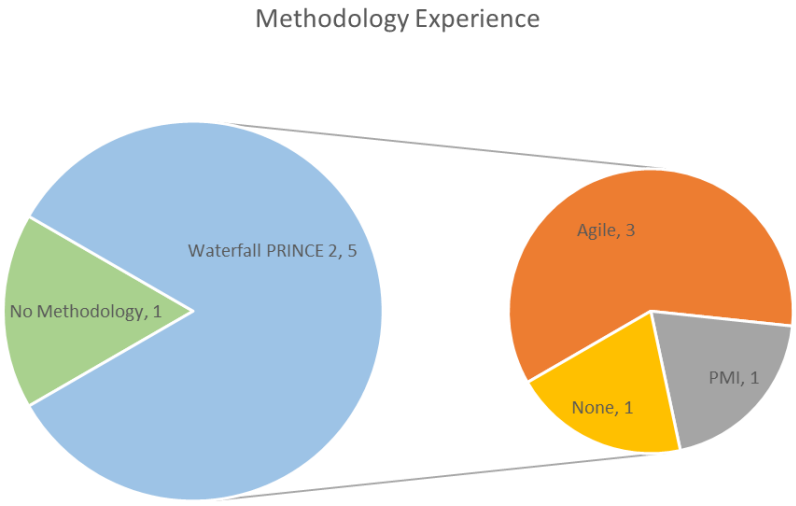

Figure 4 – Methodology Experience from each PM

Afterwards, it was important to clarify what was the level of understanding they had in the methodologies they have worked with so, for that, they were asked "How would you describe each methodology?".

The table below, Table 14, presents the aspects mentioned by the interviewees and the relevant quotes.

Table 14 - Aspects mentioned for each methodology of experience

I	Aspects mentioned for each methodology of experience	Quotes from the interview
1	Waterfall PRINCE2: ✓ Large project ✓ Sequential steps ✓ Rigidity Agile: ✓ Tasks breakdown ✓ Several resources ✓ Sprints with specific timeframe ✓ Less deadlines ✓ Flexible	*"In Agile, I think it's really about the concept itself. They sort of break tasks down, and various resources work on them. There are also multiple allocated resources that carry out various, let's say, sprints, with a specific timeframe to complete them. There isn't as much interdependence between these tasks. There aren't as many deadlines at least not in the way I think there are in the waterfall method. I consider waterfall to be like a very large project, as the name itself suggests, in*

		small, sequential steps where each task has almost a tight deadline, and only then does the next task begin. Maybe for larger projects, as is the case at Vestas, it makes sense to use the waterfall method because there's more process rigidity. It's not as flexible as Agile in my view, but perhaps it makes sense for monitoring and risk management."
3	Waterfall PRINCE2: ✓ Higher PM competency ✓ Large projects Agile: ✓ Sprints ✓ Bulky ✓ Requires high level of governance	*"PRINCE2 requires a much higher PM competency profile, and a company needs to be willing to invest in that competency profile; It's intended for, and it's designed for large infrastructure projects, so if I'm building a factory then it's the methodology that I want to use. If I'm developing a new material or qualifying a new material, I don't want to use sprints. It's too big, too bulky, too much governance"*
4	Waterfall PRINCE2: ✓ Need to plan too far ahead ✓ Lack of knowledge on the distant future Agile: ✓ Easier to plan ✓ More freedom	*"In Agile, at least I don't feel much difficulty in planning too far ahead. This can be challenging because teams often struggle to look too far into the future. In the waterfall approach, it's challenging because resources aren't always aware of the time they will need for tasks planned so far in advance, and they often end up taking longer in reality. Additionally, planning in a Waterfall approach offers less freedom."*
5	Waterfall PRINCE2: ✓ Clear scope definition	*"I think it's important that you are defining the scope and everything documented. Then you have a clear plan to meet that goes with the*

	✓ Helps understand the timeline in the long run	*scope or deliverables (…) The advantage of waterfall is that it helps with understanding the timeline in the long run."*
6	Waterfall PRINCE2: ✓ Plan in advance Agile: ✓ Fast pace	*"The methodologies are very well defined so it's hard to state all of the requirements but there is always the need to plan in advance in waterfall, in agile there are fast-paced environments."*

Even though the interviews differed in the terms used, it is possible to easily find some common points between each other. In the Waterfall PRINCE2 approach the participants referred to the need of planning ahead for the longer future and that it was more suited for large projects. The flexibility and freedom were attributes used to describe the Agile methodology.

For a better overview, Table 15 shows each approach and the aspects mentioned.

Table 15 – Summary of aspects mentioned for each approach

Approach	Aspects	Number of Mentions
Waterfall PRINCE2	Plan in advance	3
	Large projects	2
	Clear Scope	1
	Resources Competency	1
	Rigidity	1
	Sequential	1
Agile	Flexible	1
	Freedom	1

	Sprints	3
	Governance	1

With the participants that have experience with more than one Project Management methodology, the next question was related to which they thought worked better. In this case, the answers were also very similar to each other.

The three interviewees with experience in Agile and Waterfall, all considered there was not a methodology they could choose since it depended on the type of product:

I1: *"Having knowledge in different methodologies I would say it depends on the type of product, so it's hard to pick one."*

I4: *"I believe it depends on the industry. If it's more related to a software product it might make more sense to have an agile approach, on our case maybe it makes sense a waterfall because we have really large projects. Waterfall provides a bit more structure to our projects, we are able to plan ahead."*

I6*: "Totally depends. If you know the product very well and the projects requirements are very clearly defined, and if this requirement is not a technology project innovation, a waterfall where you can do things in sequence. If it's an innovation, then agile model is a more stable one. It all depends on what kind of product you are trying to develop with the project you are working on."*

The other participant with the PMI and PRINCE2 experience stated that for the NPD projects, it would be preferred to use the former:

I3: "*So, for me the projects that we're doing related to NPD, PMI would be much better suited; I do believe that in the state in this environment stage gate is appropriate which comes from PRINCE2, but all of the other tools and everything else that PMI uses are a lot better than what I'm seeing at a PRINCE2."*

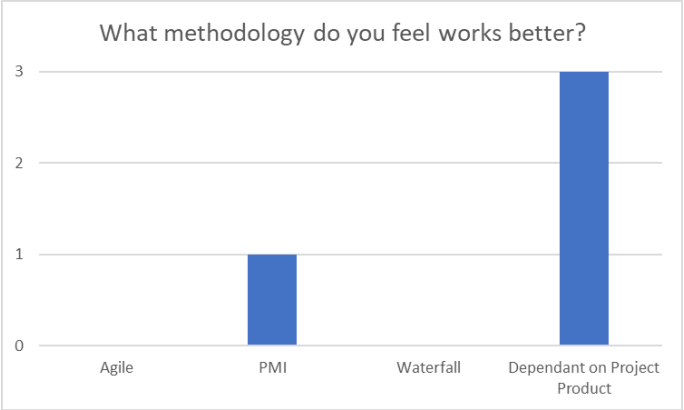

Figure 5 – Number of mentions for each methodology

Finally, the last question on this category was more specific to the NPD projects and it intended to evaluate the methodology that PMs more associate with these types of projects and if it could change over the course of the project.

Since only four of the participants had experience in NPD the answers diverged between Agile and that it would not change as the project progressed due to the fact that the project's requirements are not well defined, and it would allow to breakdown the big projects to be sized down into smaller pieces:

I1: *"I honestly believe that the Agile system would work better (…) It's a less restrictive methodology that allows for flexibility, with resources that are adaptable to execute certain tasks. The timeline isn't as rigid because there aren't as well-defined metrics for projects like this."*

I4: *"Perhaps if we worked with Agile, it would be much easier, and we wouldn't be tied to that structure. I think the organization has to look at innovation projects in a slightly different way. Also, I think if we change the methodology, it will cause a lot of stress and a big negative impact."*

Another participant pointed waterfall as the best and that it would not change due to the number of updates it would require:

I5: *"Waterfall. Don't believe it changes over time since it would mean lots of things to change and that would not be good for the project."*

The last one said it was not possible to appoint a methodology as best fit due to innovation having not specific requirements and the need to continuously revise them:

I6: *"I don't think you can. You can draw boundaries where innovation project because first of all you don't know the requirements well set and you can't have a timeline either. So, you can't just go about saying it*

will be waterfall model because there will be an iteration as well or the requirements you have to go back and revisit your requirements. It's hard to say which one it best."

Understanding of PM methodologies and its impact in the project's success

By analyzing the tables above and the images, there is a certain level of knowledge across the PMs since all have provided key words from each methodology, they have experience with. Moreover, the answers were very similar to each other.

Regarding the impact it has on the project's success the interviewees didn't show a consensus, since the majority answered saying it depends on the type of product not picking any specific methodology.

4.2.6. Further Improvements

Finally for the closure of the interview, the topic centered in the current area the PMs are working on, the Technology Project Management Program. The aim was to understand what were areas that needed more improvement. For that, they were given the following list of options to pick from:

a. Planning
b. Scope management
c. Cost Management
d. Time Management
e. Communication Management
f. Quality Management
g. Stakeholder Management
h. Risk & Issue Management
i. Knowledge Sharing
j. Leadership
k. Standardization

In spite of having or not experience with NPD projects, the answers present a consensus, all have mentioned that standardization is an area that needs improvement. Here are some quotes:

I2: *"Standardization. We have been putting a lot of effort in developing that and I have seen the progress, but it's still not fully aligned."*

I4: *"Tools standardization. There is not a common way of working and it would be very beneficial and scope."*

I5: *"I would say (…) standardization. We are now struggling with the multiple tools and maybe it's still a transition phase, but when it comes to the project execution, you still need to deliver the project on time, on budget."*

Other option that was mentioned several times was the scope, reaffirming what was stated before in the challenges they face:

I1: *"Scope management is also important because having new ideas is great, but there needs to be rationality to determine whether it is feasible or not."*

The participant three also added competency development to his options and risk management was referred by participant six.

To summarize this, Figure 6 shows each option and number of times it was referred.

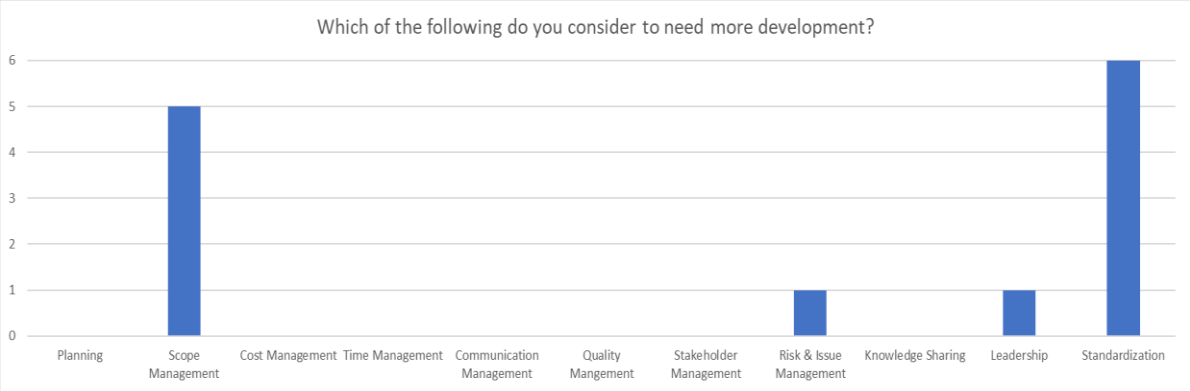

Figure 6 – Summary of the number of times each option was mentioned

4.3. Research Propositions

The data analysis allows us to assess the validity of the propositions presented earlier. Subsequently, it's shown the summary table with the corresponding results:

Table 16 – Validity of each Research Proposition

Research Proposition	Validity
RP1: Innovation projects play a significant role in a company	Validated
RP2: NPD Project Managers need to have a unique set of skills.	Not Validated
RP3: The main challenges that NPD Project Managers face are the methodology to choose, objectives definition, time-to-market, resources competencies and risk identification.	Not Validated
RP4: Identifying and prioritizing the key success factors in project management enhances project performance and the achievement of organizational goals.	Validated
RP5: There is a common understand of PM methodologies and it determines the project's success and organizational performance.	Partially Validated

5. Conclusions

5.1. Main conclusions

Nowadays, the fast-paced and competitive business landscape, the need for innovation and New Product Development (NPD) projects is more imperative than ever before. Innovation is the lifeblood of progress, and organizations that fail to innovate risk stagnation and obsolescence. NPD projects, as the instruments for translating innovative ideas into tangible products or services, are the engines of growth and relevance. They enable companies to respond to evolving market demands, stay ahead of the competition, and address pressing societal and environmental challenges. In essence, innovation and NPD projects are not merely strategic choices but survival imperatives in a world where change is constant. They represent the proactive pursuit of new opportunities and the means to continually reinvent and revitalize an organization's offerings, ensuring its longevity and continued impact in an ever-evolving global landscape (Kahn, 2018).

Therefore, the aim of this thesis is to analyze the Project Management practices currently implemented at Vestas, with a particular focus on the Blades Project Management Technology Program. This program, crucial for catching up with other areas of the business, requires an in-depth examination to identify best practices and critical success factors, as perceived by the Project Managers operating within it. Subsequently, the objective is to propose a standardized framework/set of practicesfor critical processes in NPD to reduce project variability and execution times. In this concluding section, we consolidate the key findings and contributions of this thesis within the domains of innovation, project management, New Product Development (NPD), and, ultimately, in alignment with Vestas' overarching objectives in the wind energy sector.

In order to answer the main goal of this study, the literature review intended to identify what is the importance of innovation, which types of innovation can be found in the industry and the role of project managers in NPD. Then, it was investigated some of the Project Management techniques that are currently being considered by companies. This way, it was understood that: innovation plays a very important role and it’s critical for a company to succeed; in NPD projects the Project Managers need to have a certain level of competency; the main challenges faced by PMs in NPD are the methodology to choose, objectives definition, time-to-market, resources competencies and risk identification; identifying and prioritizing the key success factors in project management enhances project performance

and the achievement of organizational goals; there is a common understand of PM methodologies and it determines the project's success and organizational performance.

Through a qualitative analysis of six Project Managers working for the Vestas' Blades Project Management Technology Program, it was possible to conclude that innovation does play a significant role to whether a company will be successful in the long-run or not, that by identifying and prioritizing key success factors in Project Management it's likely that the project performance is enhanced, and the achievement of organizational goals are achieved and that there is a common understand of PM methodologies and it doesn't determine the project's success and organizational performance. However, it was noted that NPD Project Managers don't need to have such unique skills, and that the main challenges they face is not related to the methodology to chosen, objectives, time-to-market, resources competencies or risk identification.

This study then concludes that, in this specific department, it would be important to improve the way scopes are being created in order to provide the Project Managers clear guidelines to what they have to delivery. Also, it would be important to implement a system to keep track of the continuous changes in the scope. Another focus could be to try to apply different methodologies to the projects with the aim to understand which provides better results. Additionally, as the Project Managers showed consensus, it would be crucial for the program to start standardizing its processes and ways of working.

Finally, to answer the last objective of this paper related to the standardization of critical factors Vestas could create competency profiles to each of its resources in order to ensure that each project is attributed to the right set of skills.

5.2. Limitations

Due to time constraints, this study exclusively employed the method of semi-structured interviews for data collection. Nonetheless, the literature recommends that, for a more comprehensive analysis of intricate subjects, it is advisable to integrate qualitative methodologies with quantitative ones (DiCicco-Bloom & Crabtree, 2006).

Furthermore, it is imperative to acknowledge that the study's sample size was limited to six interviewees, all working in the same department and for the same company. Since they are working in the same department there is also some limitations regarding to the type of

practices they are used to in NPD, to the tools and to what they consider to be "best". Also, even though the sample showed experience in Agile and Waterfall, the latter still prevailed since it is widely adopted within the majority of companies, leading to some bias.

5.3. Suggestions for future studies

Since this is a topic with some significance, it is recommended that more studies are made on the matter. For instance, the inclusion of questionnaires could facilitate a more quantitative exploration of the subject, thereby potentially reducing susceptibility to biases.

In subsequent research efforts, it would be relevant to expand the sample to a larger and more diverse group of Project Managers, either by picking other Technology Programs from other areas or go even further and include participants from a different company. This new sample should ideally include individuals with a greater level of experience in NPD projects, either corroborating the response patterns registered in this research or unveiling new perspectives and, therefore, expand the objectives of the study.

Finally, it may be worthwhile to contemplate an exploration of the perceptions of NPD project challenges held by project managers in the Information Technology (IT) sector, which might have more experience with Agile approaches. A focused group discussion amongst project managers across various industry domains could not only strengthen dialogue but also offer supplementary dimensions to the ongoing research inquiry.

5.4. Main contributions

From a contribution perspective to the literature, this study has allowed for the inclusion of viewpoints from project management professionals in the wind sector to a topic that has been relatively underexplored yet is gaining increasing relevance. The study allows space for the confrontation between the current NPD Project Management theories and what PMs have been facing during their daily work.

For the organizations, the results provide more knowledge to what actually are the PMs challenges and what it's needed in order to ensure that NPD projects are successful, consequently allowing for the products to be developed faster and reduce the time-to-market.

Finally, project managers can recognize the importance of tailoring methodologies to suit the specific project, the organization, and notably, the project's stage. However, they should also

swiftly transition to agile methodologies, aligning with the prevailing trend in various sectors, including the automotive industry.

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Annexes

Annex 1: Innovation and NPD

		1	2	3	4	5	6
Innovation and NPD	Q1. What do you consider to be an innovation?	For me, innovation would be something new that does not currently exist. In other words, it doesn't necessarily have to be product innovation, it can be a process innovation or innovation in terms of how a project is assessed. So, I would say that anything involving the creation of something that is not already defined or will produce a change in what exists fall under innovation. This applies regardless of the specific area, whether it's related to products, technology, or any other field. I believe that, for me, that is what innovation is all about.	Innovation in a practical sense in a project would be a process or some material that has never been used before. For example, in manufacturing or developing a blade, innovation for me would be a material, technology, or process that has never been used in the manufacturing of a particular component.	A new concept that has not been considered or put on the on the table before. That's not publicly known and it literally goes from blue sky thinking to developmen t of some form or another.	I think innovation is something that doesn't exist, and with something that doesn't exist, it can be created entirely from scratch or as an upgrade to something already existing. In other words, the product may already exist, and we're simply producing a different component to enhance the final product.	Can be a small one or the big one. When you are addressing a problem by implementing a new solution I would call it innovative solution. Whether it's a small one or larger one, that's what I see it here as an innovation. So, it adds value to the customer or product. Sometimes you will come up with completely new product which doesn't exist in the market.	Anything that I could do to make the process simplified is what I'll focus on. I'm not in the technical details, so I wouldn't talk about technical innovation, but it's more about the process side trying to keep things very simple and to the point. Just follow the project when principles, see what you can do and if you can make some tools, innovate some tools that could help.

	Q2. How important are New Product Development projects in a company? Do you think they should be prioritized or created according to the needs?	Because there are many companies in this industry, and it's these new ideas that, if well guided and delivered, I believe can set us apart. I wouldn't necessarily say prioritized, because they might take years to have any returns, but I believe they should have the same level of importance as production projects.	Everything depends on what the group's current priority is, but I think these development projects should be prioritized because they can improve what currently exists in the company. Even if it's not about developing an entirely new product from scratch, sometimes it's important to always prioritize the development of current products so that the company can evolve, even if it's in the direction of optimizing existing products.	They are important but I think it should be created according to the resources that the company has and then prioritized accordingly.	I believe that companies must have an innovation and development area because if you don't keep up with the market, you fall behind. You can have a very good product, and in a year or two, or even in a few months, something new comes out, and your product can become outdated, and you're left behind. You have to keep evolving as a company, in any industry. As for prioritization, it's a bit tricky to say. On one hand, I think it's crucial because it allows you to continue evolving and maturing your products, positioning your company competitively in the market. On the other hand, you can be excellent at innovation but not so strong in operations, which isn't good in the long run. So, I believe it needs to take in consideration the needs.	Yes, they are very important. They should be created according to the needs of the company. What is needed after a couple of years, so I think there are some sort of long course and then based on that the corporate strategy or the business strategy has to be set up. And according to that, the project must be mapped out. The project prioritization should be done according to the business strategy. It's also important that the products comes out at the right time to the right market.	Innovation is a must. Allows for our company to reduce costs and to become even more sustainable, according to the project that is developed. They should be prioritized since it's big for business and good news for the ecosystem.

Annex 2: Project Managers in NPD

Project Managers in NPD	What are your strongest skills as a PM?	1	2	3	4	5	6
		I would say the ability to relate to others and to organize my work according to the challenges and projects that arise.	The ability to adopt new methodologies and to organize myself during high-pressure moments.	My strongest skills are breaking through the wall first.	I believe that I'm a very empathetic person and that can easily put myself in other people's shoes.	I can easily follow and understand processes.	Communication. I'm very meticulous in my in my writing as well.

Annex 3: Critical Success Factors

Critical Success Factors	Q3. In your opinion and experience, which factors have most influence in the execution of your NPD project management activities?	1	2	3	4	5	6
		I would say that what influenced the most was resource allocation, without a doubt, because most of the resources are allocated to regular projects, not these ones. So, in a way, there is always some level of lower priority. Leadership support, which is what I mentioned earlier, I believe there is still insufficient support for this type of projects.	NA	Project team, having the correct competency profile	I would say, perhaps the project teams, because as it's an innovation project, if they don't have enough knowledge, they won't be able to bring good results. Another aspect is leadership support and also the market. Projects with high visibility receive a lot of support from leaders but also face a lot of pressure.	It's a bit complex because as a PM you are running the project but you you need a a strong leadership team to guide the project in case of unexpected situation. At the same time, if you don't have a strong project team, then it is also challenged to meet the deliverables, or the qualities as expected.	To be fair I think that the project team and the utilization of the tools play a big part in the execution of these projects

	Q4.What is the significance of company culture in the creation of NPD projects? Do you feel that the organizational culture drives certain types of projects?	Yes, I think there has to be an openness within the culture to create these new projects. I don't believe that convenience and the fact that there are already new blades or new concepts, which are easier to produce and deliver than technology or innovation, should hold us back. Of course, it's much simpler. The process is already defined. It's just a matter of aligning the resources or the profile. But when it comes to technology or innovation, a new process, a new product, we enter a bit of uncertainty.	The company is quite important because it's the company's culture that sets the boundaries for innovation and the development of a new product. If the company has a culture of wanting to innovate, it will allow you to work more in that area. So, I think culture has a significant influence and leads to a tendency in the type of projects.	Without the right company culture, then you're going to have nothing but frustration and poor performance Culture is everything in this environment you have. You have high skill sets you have. Pressure, high demand and then less the culture is such that it it facilitates a safe, a psychologically safe environment. Then you're not going to get the best out of people.	Culture has a significant impact on how the project is managed. Projects are managed differently depending on the company. I think we are a more flexible company and take more risks in innovation. People feel they have more freedom. So yes, a more open culture also leads to more freedom and better projects.	You have an entire value chain starting from technology, design, supply chain and transportation, and a lot of other things. So I think that the company culture is really important in how the project has to be executed. It also helps since with this freedom to operate we feel safe to share new ideas and that will lead to more interesting projects.	It's very important the company considers very important for you to express your thoughts and express yourself as an engineer or project manager in your planning. So it's very important that you feel comfortable in a company's corporate culture.

	Q5. From your experience, does the leadership style and organizational culture affects the methodology choice? Or is it more affected by the product type and/or resources competencies?	Yes, I think upper management and the people involved in stakeholder evaluations do influence the choice of methodology. Once certain stakeholder leaders are accustomed to a particular methodology, it's a bit challenging to introduce a different one. However, I also believe it depends on the type of product. Perhaps for the development of a new product, the waterfall method makes more sense, but for innovation and technology, I think the Agile method makes much more sense. So, yes, the methodology can be influenced by the type of product or project itself, but I wouldn't necessarily say it's related to the skills of the resources.	I think the project is more affected by the type of product and the resources that are used. If the resources aren't accustomed to working with a particular methodology, it can lead to a lack of understanding of what's being done.	It's more affected by the product; if I'm doing a service project, then the ways of working in that methodology is gonna be siloed into that type of project. If I'm building a new factory, it's gonna have its own type of siloed thinking as well, because those two project types of projects are completely different from each other.	I believe that the methodology is dictated by the organizational culture. As leaders, we may want to work differently, but if the organizational culture doesn't allow it, it's not possible to change the methodology.	Not really. You have the freedom to play, so there is always a room for improvement and when you're driving for an improvement, no one stops in the organization.	Totally yes. When you have a strong matrix organization project, then the PM decides how to drive the project. If it is weak matrix then the line manager takes the precedence. We are more of facilitators. At least in Vestas what I've seen it's a good balance where we are counterparts, Line Management and PMs, in controlling the projects scope and timeline.

	Q6. Do you feel the methodology is a critical factor for the project' s success? What do you think happens when the method applied does not fit?	It's critical, but it doesn't have to be followed "by the book." What I often see in project management, especially when following the waterfall method, I don't know if it's the method itself, but there's a rigidity in terms of quality assessment and metrics. It might actually be beneficial to occasionally test different methodologies to understand their impact and whether they yield better results.	Yes, the methodology does create some order and helps in the development stages of each project, which ultimately influences the outcome and the time it takes to reach that final result. If the method is chosen poorly, I believe the project can experience significant delays and even lead to failure.	Yes. Tension. Frustration. Mental shortcuts. People not understanding how to make things work. Confusion. Organizational noise and confusion.	Yes, I think it's a very important factor. If the team isn't almost in tune with the way the project is structured, they won't work that way. In other words, they may not follow how the project is developing, and this can lead to delays in projects. There can also be communication problems because if people can't understand how the project is being conducted, it can create issues.	I would say yes. You can find a solution even without setting the project, but the thing is how much you are taking to finish it. So yes, it's important that we are executing the project with a methodology to have structure and that also gives simplicity, traceability and the transparency.	Without methodology you are lost. You can have plenty of ideas unless you put them in a structured way of working, then you can't even say whether what it did was success or not. How would you even manage a project without having a tools and process? How will you know the requirements are satisfied or not? Traceability in a project is very important, so these are methodologies we are talking about.

	Q7. In your experience as a Project Manager, is it a common practice for organizations to filter which projects should actually materialize as projects, as opposed to remaining as ideas? Do you believe this makes a difference in the project's success?	I believe that within organizations, it's definitely easier for projects that go through a filter. For example, in IT software, I can say it's entirely different; there's less openness to new ideas, introducing new features, and different things that I don't think are as restricted in that industry. However, in an industry that's more production-oriented, there may be more filtering. As for success, I think it has an impact since stakeholders are very closed off to other options and end up only doing what's expected without considering the impact.	I believe that filter exists even though it's not very transparent. Because without it we would be spending too many resources doing things that are not needed and that would lead the company to failure.	Yes and no	Yes, I think so, because if you don't do an initial filter and understand whether this is worthwhile or not, it's not worth expending resources on things that won't ultimately bring value, in terms of profit to the company and new ideas to the market, which is what matters.	The market demands and then there is a business strategy that gives the indication of what project has to be prioritized, materialized or when has to be implemented. Maybe some of them you can develop, but you have to wait for the right time to launch it. So yes, the filter exists and it's important.	Totally, innovations make the business better. If you're just a pouring money into something, you don't even know what is going to be the outcome or what is going to bring value to the to the organization. So it's very important to see what is the dependency, what, how this innovation, is going to drive companies business forward. So it's important that technical heads put their brains together and find out what is the need. And so, it does make a difference in the project's success

Annex 4: Project Management Methodologies

Project Management Methodologies		1	2	3	4	5	6
	Q8. What type of methodologies do you have experience with?	Waterfall PRINCE2 and Agile	The projects I have been involved in didn't follow any official structure, they were more tasks manageme nt than projects.	Waterfall: PMI and Prince 2	Waterfall PRINCE 2 and Agile	PRINCE 2 waterfall	When I started my project management career, like I said, the first one it's software and the company I was mostly working on V model and what and what we see in vestas' project is Agile and waterfall

	Q9. What are the requirements, challenges, and advantages you see in each?	In Agile, I think it's really about the concept itself. They sort of break tasks down, and various resources work on them. There are also multiple allocated resources that carry out various, let's say, sprints, with a specific timeframe to complete them. There isn't as much interdependence between these tasks. There aren't as many deadlines, at least not in the way I think there are in the waterfall method. I consider waterfall to be like a very large project, as the name itself suggests, in small, sequential steps where each task has almost a tight deadline, and only then does the next task begin. Maybe for larger projects, as is the case at Vestas, it makes sense to use the waterfall method because there's more process rigidity. It's not as flexible as Agile in my view, but perhaps it makes sense for monitoring and risk management.	NA	Prince 2 requires a much higher PM competency profile, and a company needs to be willing to invest in that competency profile; It's intended for, and it's designed for large infrastructure projects, so if I'm building a factory then it's the methodology that I want to use. If I'm developing a new material or qualifying a new material, I don't want to use sprints. It's too big, too bulky, too much governance	In Agile, at least I don't feel much difficulty in planning too far ahead. This can be challenging because teams often struggle to look too far into the future. In the waterfall approach, it's challenging because resources aren't always aware of the time they will need for tasks planned so far in advance, and they often end up taking longer in reality. Additionally, planning in a Waterfall approach offers less freedom.	I think it's important that you are defining the scope and everything documented. Then you have a clear plan to meet that goes with the scope or deliverables. Also, you have a good change management system in case because in a complex environment you do not expect everything to be like a straight line. That is always a challenge or some bottlenecks. The advantage of waterfall is that it helps with understanding the timeline in the long run.	The methodologies are very well defined so it's hard to state all of the requirements but there is always the need to plan in advance in waterfall, in agile there are fast-paced environments. These are requirements and a challenge at the same time because it's a learning curve. The V-model was easier for me because of it's flexibility and it allowed to go back and forth during the development of the project.

	Q10. From your experience/knowledge which one do you feel works best?	Having knowledge in different methodologies I would say it depends on the type of product, so it's hard to pick one.	NA	So for me the projects that we're doing, PMI would be much better suited; I do believe that in the state in this environment stage gate is appropriate which comes from Prince 2, but all of the other tools and everything else that PMI uses are are a lot better than what I'm seeing at a Prince 2.	I believe it depends on the industry. If it's more related to a software product it might make more sense to have an agile approach, on our case maybe it makes sense a waterfall because we have really large projects. Waterfall provides a bit more structure to our projects, we are able to plan ahead.	NA	Totally depends. If you know the product very well and the projects requirements are very clearly defined, and if this requirement is not a technology project innovation, a waterfall where you can do things in sequence. If it's an innovation, then agile model is a more stable one. I. It all depends on what kind of product you are trying to develop with the project you are working on.

	Q11. When it comes to NPD projects do you have a preferable methodology to use? Do you feel the methodology changes over the course of the project?	I honestly believe that the Agile system would work better. In this type of project, which can be quite large and complex in its conceptual stage, you don't necessarily need to have all the details defined. Based on my experience, you start with your concept or idea and define a small package of tasks to be developed initially. Depending on the project's size, a package can consist of one or several tasks. It's a less restrictive methodology that allows for flexibility, with resources that are adaptable to execute certain tasks. The timeline isn't as rigid because there aren't as well-defined metrics for projects like this.	NA	NA	It depends a lot on the type of product we are developing. I feel that there has to be some flexibility in innovation projects, but at the same time, there needs to be structure. Often in innovation projects, what happens is that they plan the tests they need to conduct, but as they progress with the project, they discover other things they want to test. So, it almost forces us to be constantly planning. Perhaps if we worked with Agile, it would be easier, and we wouldn't be tied to that structure. I think the organization has to look at innovation projects in a slightly different way. Also, I think if we change the methodology, it will cause a lot of stress.	Waterfall. Don't believe it changes over time since it would mean lots of things to change and that would not be good for the project	I don't think you can. You can draw boundaries where innovation project because first of all you don't know the requirements well set and you can't have a timeline either. So you can't just go about saying it will be waterfall model because there will be a iteration as well or the requirements you have to go back and revisit your requirements. So it’s hard to say which one it best.

Annex 5: NPD vs Normal

		1	2	3	4	5	6
NPD vs Normal	Q12. In your other types of projects what were your main challenges?	Resource availability is a significant factor. In this field, there are many blade development projects, so a resource isn't exclusively allocated to one project. I tried, in a way, to verify the planning, see which resources were allocated to each project, understand how many hours they were actually working and whether they had the capacity for more. I also spoke directly with the managers of these resources to determine whether it made sense or not to have the same resource in another project.	Essentially the lack of prioritization. No one knows what should be done first or what has more priority, there is a lack in that sense. To overcome that what I do is communicate with the team members and do a task list and together with them put them according to the needs in the moment.	My worst nightmare is having to switch project managers so by not establishing a well-considered plan, the worst nightmares that I've had are taking over projects that everything is in a entrepreneurial toolbox. And the only person who understands it is the person who wrote it. So for me, a lack of competencies within project execution is the worst nightmare I have.	My main challenge was keeping the team motivation, in my experience with a large project it was really hard to keep the team aligned and make them understand the vision of the project. Also, it was a technical difficult project. So what I did was to keep the communication with them and tried to ensure they always knew what was expected from them.	Collaboration between the suppliers. The stakeholder's management and communication is very much important to bring or keep everyone in the same page.	The dynamic nature of scope changes and the resource challenges, it's important to be vigilant on when you have weekly shared calls to see if you are on track with us with the scope. It is not my job as a project manager to do a result level the resources because we have line manager doing that, but it's your report and they're falling short or, you know, overcommitting.

	Q13. What challenges have you faced in NPD projects that you haven’ t in others?	Manage the expectations and be aligned with what is expected to be delivered.	NA	NA	Everything being very structured and organized, but in NPD, I didn't know what the requirements were, I didn't know what we had to do, and there was no standard documentation to use.	I think that the stakeholder management, when they are reviewing the project, everyone will have a different understanding depending upon what their specialization, how they are interpreting the results.	So innovation can always be a challenge in terms of keeping the scope the same, because one thing is scope cannot be crystal clear, defined in an innovation project because as we evolve in the concept, there might be something new popping up which will push the timeline to the right. Innovation project is always full of unknowns, unlike are the projects. So there is lots of uncertainty there, it's important to keep this in mind and a good balance.

Annex 6: Further Improvements

		1	2	3	4	5	6
Further Improvements	Q14. Which of the following do you consider to need more development?	Here, I would mention standardization and leadership, more in the sense of developing tools that fit all the different product projects. Scope management is also important because having new ideas is great, but there needs to be rationality to determine whether it is feasible or not.	Standardization. We have been putting a lot of effort in developing that and I have seen the progress, but it's still not fully aligned.	Standardization, competency development and scope	Tools standardization. There is not a common way of working and it would be very beneficial and scope	I would say scope and standardization. We are now struggling with the multiple tools and maybe it's still a transition phase, but when it comes to the project execution, you still need to deliver the project on time, on budget. At the same time, you are also testing or experiencing some unmatured tools, how do you say that they fit into our environment? It's a bit challenge and I think those kinds of things can be taken with the small projects.	Standardization, risk management and scope management