A Work Project, presented as part of the requirements for the Award of a

Master's degree in Innovation and Entrepreneurship - Executive from the

Nova School of Business and Economics.

STRATEGIES FOR RESOURCE ALLOCATION IN CORPORATE INNOVATION PORTFOLIO MANAGEMENT: AN EXPLORATORY ANALYSIS OF SELECTED PORTUGUESE COMPANIES

DANILO SANTOS RODRIGUES CRUZ

Work project carried out under the supervision of:

Maria João Rodrigues

30/10/2024

Abstract

This study investigates resource allocation strategies in innovation portfolio management within five Portuguese companies: BPI, Delta Cafés, Fidelidade, Galp, and NOS Inovação. Using a qualitative, exploratory approach, semi-structured interviews were conducted to explore how these organizations allocate resources between incremental and transformational projects, balance short and long-term objectives, and address external and internal pressures. Key findings highlight the influence of strategic alignment, ambidexterity approach, and innovation funding. The study contributes to understanding how Portuguese organizations navigate resource constraints, risk tolerance, and portfolio management to sustain innovation and long-term competitiveness.

Keywords

Innovation Portfolio Management (IPM), Resource Allocation, Organizational Ambidexterity, Innovation Strategy.

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

Acknowledgements

I would like to express my deepest gratitude to Professor Maria João Rodrigues, my advisor, whose insights and guidance have been crucial throughout this journey. Special thanks also go to all the professors who generously shared their knowledge and expertise.

Many thanks to all my classmates for making this experience unforgettable. I would like to recognize Alexandra Reis Stoffel, Carlos Martins, Márcio Lopes, Marco Rodrigues, and Sérgio Silvestre for their contributions to this work project. A special mention goes to Danielle Farias and Guilherme Michelini for their continuous support and friendship—they made it easier to persevere through every challenge.

I extend my gratitude to the companies and professionals who participated in the interviews for this project, openly sharing insights about their work. Their contributions were essential in enriching my understanding of this study.

I also wish to thank my dear friends Allan Sousa da Silva, Claiton Lovato Jr., Marcelo Lopes Daparte, and Saulo Eduardo Fernandes de Oliveira. Your words of encouragement and faith in me have been invaluable. To my parents, Judite and Valter, my heartfelt gratitude for always encouraging me to pursue my dreams and for teaching me the values that guided me throughout my life. To my parents-in-law, Silvia and Vanderlei, my sincere thanks for fostering in me the importance of knowledge and helping me to expand my horizons.

Finally, to my wife Barbara and daughter Alice, I am profoundly grateful for your endless patience, deeply support, and the inspiration you give me each day—I would not have reached this milestone without you.

Table of Contents

Table of Figures **4**

Introduction **5**

Literature Review **7**

Innovation Portfolio Management *7*

Innovation Resource Allocation *9*

Portfolio Balance and Overload *10*

Portfolio Selection: Criteria for Resource Allocation, Prioritization, and Termination *10*

Organizational Ambidexterity *12*

Strategies for Managing an Ambidextrous Portfolio: Different Types of Ambidexterity *13*

The Three Horizons of Growth Model *14*

Funding Sources and Authority *15*

Risk Tolerance & Uncertainty in Innovation *16*

Methodology **16**

Results and Findings **17**

Strategic Innovation Objectives *18*

Motivation and Approach to Innovation *18*

Organizational Ambidexterity and Resource Allocation *19*

Innovation Funding Strategies *21*

Criteria for Allocating Resources and Prioritizing Innovation Initiatives *23*

Kill Criteria: When to Discontinue Innovation Initiatives *23*

Risk Tolerance and Uncertainty Management *24*

Portfolio Overload *26*

Conclusions, Limitations and Future Work **27**

References **29**

Appendices **34**

Table of Figures

Figure 1: Portfolio management best practices performance (Cooper, Edgett, and Kleinschmidt 2004) *8*

Figure 2: Four types of ambidexterity (Mom, Van Den Bosch, and Volberda 2009; Constant, Calvi, and Johnsen 2020) *13*

Figure 3: Innovation resource allocation in the three growth horizons *20*

Figure 4: Key criteria to allocate resources in innovation initiatives *23*

Figure 5: Key criteria to kill innovation initiatives *24*

Introduction

In today's economic landscape, characterized by intense competition and rapid technological changes, companies face increasing pressure to continuously innovate and develop new products to remain competitive (Cooper and Edgett 2003; Cooper, Edgett, and Kleinschmidt 2004; Kavadias and Chao 2007; Si, Kavadias, and Loch 2022). Innovation has become a critical element for ensuring long-term growth and sustainability, as organizations seek to differentiate themselves in saturated and increasingly volatile markets (Lerch and Spieth 2012). According to Townsend (2010), the ability to innovate is one of the main determinants of corporate success, and companies that fail to keep pace risk losing relevance.

Despite the substantial increase in research and development (R&D) investments, the results have not always been satisfactory. In 2019, the global R&D investment reached an impressive US$2.3 trillion, representing about 2% of the world's GDP (Brennan et al. 2020). However, this massive investment has not translated into proportional returns, with many companies reporting that new and innovative products generate less revenue than expected (Cooper and Edgett 2003). This disparity between investment and results raises questions about the effectiveness of resource allocation strategies in innovation portfolios.

One of the reasons for this misalignment is the predominant focus on incremental improvements and short-term goals. As highlighted by O'Reilly and Tushman (2004) and Jugend et al. (2016), many companies focus their efforts on sustaining innovations that improve existing products but offer little disruptive potential. Burleson (2021), and Eckert and Hüsig (2021) confirm this trend, noting that a large part of the innovations launched represent only marginal improvements. This focus on short-term initiatives, however, can expose companies to a higher risk of disruption, as new technologies and business models can emerge and destabilize the market.

As a result, the longevity of organizations is in decline. A study by Foster and Kaplan (2001) on companies in the Standard & Poor's 500 (S&P 500) index shows that, in the 1930s, a company could expect to remain in the index for about 65 years. According to Viguerie, Calder, and Hindo (2021), by the 1990s, the average tenure in the S&P 500 had narrowed to 20 years and is now forecast to shrink to 15 years by 2026 (c.f. Annex 1). The disruption caused by new players and innovative technologies has made the business environment increasingly unstable, requiring companies to revisit their Innovation Portfolio Management (IPM) approaches and adopt more effective practices to ensure long-term survival (Lettice and Thomond 2008).

In this context, efficient and effective resource allocation and prioritization of innovation initiatives emerge as critical factors for the long-term success of organizations (Cooper, Edgett, and Kleinschmidt 2001; Chao and Kavadias 2008; Hunt and Killen 2008; Ernst and Lichtenthaler 2009). IPM has become a strategic tool, allowing companies to identify the most promising projects and direct resources in a way that maximizes the impact of these initiatives (Cooper, Edgett, and Kleinschmidt 2001; Killen, Hunt, and Kleinschmidt 2008; Lerch and Spieth 2012; Meifort 2016; Weinreich et al. 2021).

This study aims to explore how Portuguese companies address the challenges of resource allocation in their innovation portfolios. The literature review and exploratory analysis conducted seek to answer the main research question: "How do Portuguese companies define and allocate their resources in their innovation portfolios, and what are the main factors influencing these decisions?" In addition, a secondary research question will be addressed: "How do Portuguese companies manage their short and long-term tradeoffs in their innovation portfolios to ensure business sustainability?"

By investigating these questions, this study aims to contribute to understanding how companies can balance their investments between incremental and transformational projects,

ensuring that, while they remain competitive in the present, they are also prepared for the future. Efficient management of innovation resources, as emphasized by Ernst and Lichtenthaler (2009), is essential for addressing the challenges of a constantly evolving market. Therefore, companies must develop robust portfolio management strategies that position them for sustainable growth.

Literature Review

Innovation Portfolio Management

IPM refers to the process of selecting and managing a set of innovation projects with the goal of maximizing value, balancing high and low-risk projects, and aligning with short and long-term organizational strategic objectives (Cooper, Edgett, and Kleinschmidt 1999; Lerch and Spieth 2012). Essentially, IPM is a specialized form of portfolio management focused on innovation outcomes, where decisions are continuously revised to ensure that resources are allocated efficiently and effectively (Killen et al. 2023). This approach requires constant evaluation, prioritization, and, in some cases, discontinuation of projects (Cooper, Edgett, and Kleinschmidt 1999). Effective IPM is essential for product and service innovation success. It enables companies to make critical strategic choices, such as which markets, products, and technologies to invest in and how to allocate limited resources among various initiatives (Cooper, Edgett, and Kleinschmidt 1999).

However, managing an innovation portfolio presents several significant challenges (c.f. Annex 2 and Annex 3). Many companies struggle with overloaded portfolios, an excess of projects relative to available resources, a lack of solid information to make go/kill decisions, and ineffective prioritization, which often leads to poor performance and high failure rates (Cooper, Edgett, and Kleinschmidt 2000). One of the major challenges is ensuring the portfolio has a proper balance between incremental and transformational projects while maintaining

continuous alignment with the company's strategic goals (Cooper, Edgett, and Kleinschmidt 2004). This alignment is strongly correlated with portfolio success (Cooper and Edgett 2003) and it ensures that resources are directed toward initiatives that foster sustainable growth and strategic market positioning (Lerch and Spieth 2012).

Research has demonstrated that certain portfolio management practices significantly impact business performance, particularly in the context of resource allocation. Companies that align their resource breakdown with business strategy and maintain a good balance between the number of projects and available resources tend to achieve superior portfolio outcomes (Cooper, Edgett, and Kleinschmidt 2004). Furthermore, effective ranking and prioritization of projects, combined with a balanced portfolio of project types, are crucial for sustaining long-term innovation success, as illustrated below (Figure 1).

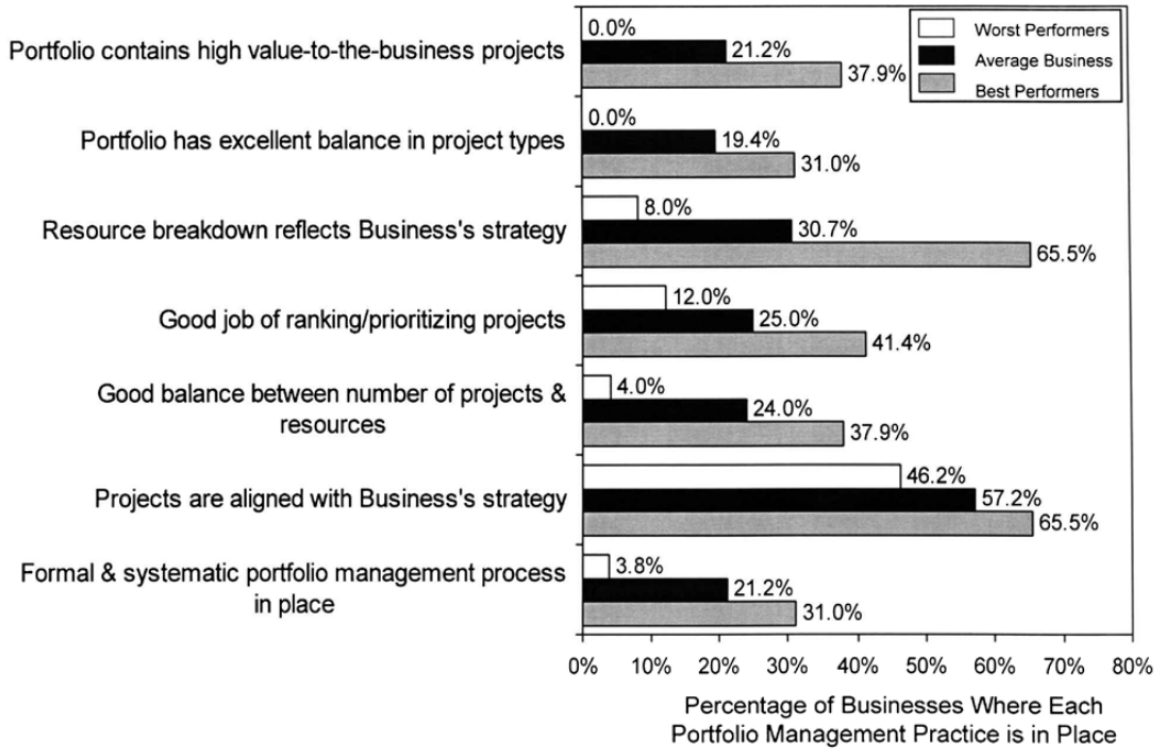


Figure 1: Portfolio management best practices performance (Cooper, Edgett, and Kleinschmidt 2004)

Innovation Resource Allocation

Innovation resource allocation is a fundamental aspect of portfolio management, involving the distribution of financial, human, and technological resources to ensure that a company's innovation projects align with its strategic goals (Cooper, Edgett, and Kleinschmidt 2000). Resource allocation for innovation is more than just budgeting; it is a dynamic process where resources are continuously redistributed based on project needs, market conditions, and strategic priorities (Hunt and Killen 2013). The ability to adapt and reallocate resources efficiently underpins an organization's agility, enabling it to respond to environmental changes and innovate effectively (Morcos 2008). In essence, innovation resource allocation is about making deliberate, data-driven decisions to invest in projects that promise future growth while managing uncertainties and risks inherent in innovation.

One of the most significant challenges in innovation resource allocation is the perennial shortage of resources (c.f. Annex 4). Most organizations face constraints that affect not only how much can be allocated but also how resources are distributed across competing projects (Cooper and Edgett 2003). Furthermore, the pressure to achieve short-term financial results often compromises the ability to focus on long-term, high-potential innovations (Laslo 2010). A reluctance to terminate underperforming projects, coupled with a lack of structured portfolio management processes, exacerbates these issues. Best practices in resource allocation emphasize the need for dedicated innovation teams and strategic resource planning, which align resources with long-term business goals. Regular reviews of the innovation portfolio significantly improve performance by ensuring that resource allocation adapts to evolving business needs (Lerch and Spieth 2012).

Organizations employ various strategies to allocate resources to innovation, with the most common being top-down, bottom-up, and strategic buckets. In top-down approaches, senior management dictates how resources are distributed, ensuring alignment with overall

corporate strategy. Conversely, in bottom-up strategies, decision-making authority is decentralized, allowing project managers to make resource allocation decisions based on their specific knowledge of the projects (Aghion and Tirole 1997). A hybrid approach, known as strategic buckets, combines elements of both top-down and bottom-up processes. Strategic buckets allocate resources to predefined categories, such as different innovation types or strategic goals, providing flexibility while maintaining control over the strategic direction (Cooper 2004). The strategic buckets decision process tends to outperform other methods, especially for more difficult and risky initiatives (Cooper 2004; Hutchison-Krupat and Kavadias 2015).

Portfolio Balance and Overload

Maintaining balance within an innovation portfolio is another critical aspect of resource allocation. A well-balanced portfolio should distribute resources between short-term, incremental innovations, and longer-term, transformational projects. However, many organizations struggle with portfolio overload, where too many projects are initiated without sufficient resources to support them adequately (Cooper, Edgett, and Kleinschmidt 1999). This imbalance can lead to extended project timelines, lower-quality outcomes, and the dilution of innovation efforts. Balancing the portfolio requires a continuous evaluation of project value, risk, and alignment with strategic goals to avoid resource strain and ensure optimal performance. The overload problem can be partly resolved by undertaking a resource capacity analysis (Cooper, Edgett, and Kleinschmidt 2000).

Portfolio Selection: Criteria for Resource Allocation, Prioritization, and Termination

Portfolio selection is the process of identifying, prioritizing, and occasionally terminating innovation projects to maximize the value of resource allocation. The earlier

portfolio selection models aimed to maximize objectives within resource constraints but required extensive data—such as financial results and success probabilities—which was often unavailable or unreliable. Managers found these methods too complex for practical use. Instead, techniques like scoring models (c.f. Annex 5), analytical hierarchy process and mapping tools (c.f. Annex 6) are now more commonly used. Cooper, Edgett, and Kleinschmidt (2001) identified strategic fit, value maximization (business value), and portfolio balance as key criteria in project evaluation. The ability to make "go/kill" decisions is crucial to maintaining an efficient portfolio. Studies show that organizations with well-structured go/kill processes achieve higher portfolio performance, as they can stop underperforming projects and reallocate resources to more promising initiatives (Killen, Hunt, and Kleinschmidt 2006).

External factors, such as economic cycles, regulatory changes, competition, and technological advancements, significantly influence how organizations allocate resources for innovation (Floricel and Ibanescu 2008). During periods of economic uncertainty, companies may shift resources away from risky projects towards safer, short-term investments, thereby limiting their capacity for transformational innovation (Voss and Kock 2013). Similarly, technological disruptions can prompt organizations to reallocate resources to ensure they remain competitive. Regulatory environments also play a crucial role, as compliance requirements can divert resources from innovation projects to meet legal standards, reducing available capacity for innovation (Teller, Kock, and Gemünden 2014). However, restrictive regulatory environments can stimulate innovation by prompting firms to seek alternative solutions, which can have both positive and negative impacts on innovation output (Park, Wu and Funk 2024).

Internally, organizational culture, leadership, and governance structures heavily influence resource allocation decisions. Companies with a strong innovation culture tend to be more flexible in resource allocation, allowing for greater experimentation and risk-taking

(Meskendahl 2010). Leadership involvement is another critical factor; visionary leaders are more likely to champion resource allocation towards transformative innovation, even in the face of uncertainty (Beringer, Jonas, and Gemünden 2012). Additionally, governance structures that support cross-functional collaboration and empower project teams tend to result in more effective resource allocation (Unger, Gemünden, and Aubry 2012).

Organizational Ambidexterity

According to ambidextrous innovation theory (Dewar and Dutton 1986; March 1991), firm technological innovation can be divided into exploitation and exploration. Exploitation focuses on improving existing knowledge and products, while exploration involves more transformational innovation, aiming to enter new, less familiar fields to achieve breakthroughs. Organizational ambidexterity is a concept that refers to an organization's ability to balance exploitation with exploration (Tushman and O'Reilly 1996). Ambidexterity is critical for organizations seeking sustainable competitive advantage (Martinsuo 2019).

The tension between these two modes of innovation has long been acknowledged, as both compete for resources and management attention (March 1991). Firms that invest heavily in exploitation risk falling into a "success trap," where short-term gains overshadow long-term innovation potential. Conversely, an excessive focus on exploration might lead to a "failure trap," where firms overextend themselves in uncertain ventures without yielding immediate returns (Stadler, Rajwani, and Karaba 2014).

Incremental innovation, often associated with exploitation, follows established processes and delivers more predictable outcomes, which makes it appealing to managers focused on short-term results (Benner and Tushman 2003). In contrast, transformational projects, often aligned with exploration, involve greater uncertainty and risk, requiring longer timeframes and less defined goals (Lenfle 2016). One of the key barriers is the natural tendency

for organizations to allocate more resources to exploitation projects, as they provide more frequent feedback and are perceived as less risky (March 1991). Cultural resistance also poses a significant barrier. Managers accustomed to the predictability of exploitative tasks may resist the uncertainty and perceived inefficiency of transformational projects (Killen et al. 2023).

Additionally, many organizations attempt to funnel all innovation projects through a unified portfolio management system, which inherently favors exploitative initiatives. This "one-size-fits-all" approach not only discourages transformational innovation but also undermines the potential for its breakthroughs (O'Connor et al. 2008).

Strategies for Managing an Ambidextrous Portfolio: Different Types of Ambidexterity

To address these challenges, according to Mom, Van Den Bosch, and Volberda (2009) and Constant, Calvi, and Johnsen (2020) we can distinguish between four different types of ambidexterity as strategic solutions (Figure 2). Each type provides a distinct approach to managing the conflicting demands of exploitation and exploration.

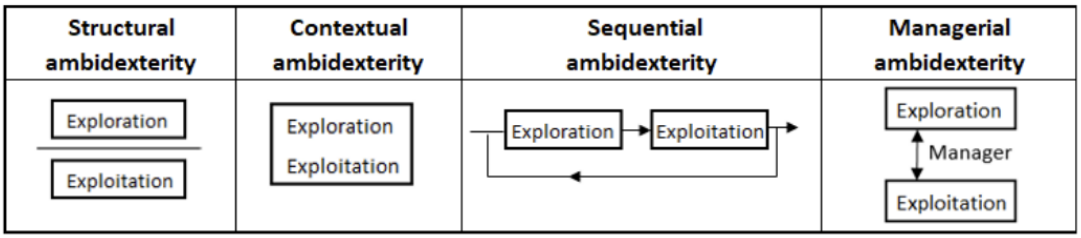


Figure 2: Four types of ambidexterity (Mom, Van Den Bosch, and Volberda 2009; Constant, Calvi, and Johnsen 2020)

Structural ambidexterity is one of the earliest forms discussed in the literature and involves the creation of separate organizational units, each focusing on either exploration or exploitation. This structural separation helps organizations manage the conflicting demands of

these activities by ensuring that each unit operates with distinct processes and cultures (Tushman and O'Reilly 1996; Boumgarden, Nickerson, and Zenger 2012; O'Reilly and Tushman 2013). **Contextual ambidexterity**, on the other hand, emphasizes the ability of individuals within the same organizational unit to switch between exploratory and exploitative tasks as needed (Gibson and Birkinshaw 2004). This type is less about structural differentiation and more about creating a supportive environment that encourages employees to manage these dual activities simultaneously (Turner, Swart, and Maylor 2013). **Sequential ambidexterity** suggests that organizations alternate between periods of exploitation and exploration over time, adapting to changes in the external environment by shifting focus as needed (Rothaermel and Deeds 2004). This approach is useful in industries experiencing cyclical changes. Lastly, **managerial ambidexterity** highlights the role of leaders in balancing these activities through strategic decision-making, ensuring resource and collaboration across the organization (Mom, Van Den Bosch, and Volberda 2009).

The Three Horizons of Growth Model

Another strategy is the use of the "Three Horizons of Growth" model, conceptualized by Baghai et al. (1996, 2000), and popularized through their work with McKinsey & Company. The researchers underscore the necessity of a resilient, forward-looking financial strategy to manage the tension between short-term and long-term innovation efforts. The tool offers a practical framework for distributing an organization's focus and resources across three temporal horizons simultaneously. **Horizon 1** is dedicated to optimizing the core business and is primarily exploitative in nature. **Horizon 2** focuses on emerging opportunities, bridging the gap between the current business and new areas of growth, often combining both exploration and exploitation. **Horizon 3** is concerned with transformational initiatives, which are highly exploratory and aim to create future market leadership.

This model emphasizes the need for strategic resource allocation across these horizons to ensure a balance between immediate performance and long-term innovation (Mittal 2024) and has been widely recognized for its effectiveness in strategic planning (Hadjinicolaou, Kader, and Abdallah 2021). High-performing companies typically allocate an average of 70% of their innovation resources to the core, 20% to adjacent, and 10% to transformational initiatives. However, the ideal distribution depends on factors such as the industry type, the company's competitive position within that industry, and the stage of the company's development (Nagji and Tuff 2012).

Funding Sources and Authority

Public funding sources play a critical role in driving corporate innovation by providing direct subsidies and tax incentives to stimulate private R&D investments (Beck, Junge, and Kaiser 2018). Many governments allocate significant resources to support innovation, often through targeted programs aimed at reducing market failures and encouraging firms to invest in novel projects. Direct subsidies are particularly effective in fostering innovation in high-risk areas, while tax incentives allow companies to allocate resources based on their strategic priorities, contributing to a market-oriented approach (Beck, Junge, and Kaiser 2018).

The impact of public funding on corporate IPM is substantial, as these financial incentives help firms navigate the complexities of resource allocation. Public subsidies often have a medium-term effect, enhancing companies' capacity to pursue riskier, transformative innovations over time (David, Hall, and Toole 2000). Conversely, tax incentives tend to produce more immediate boosts in R&D spending, creating a dynamic interplay between short and long-term innovation strategies (Becker 2015).

Funding authority significantly influences the allocation of resources for innovation. Fixed funding occurs when managers lack control over the budget, while variable funding

allows them to use revenue from new innovation products. Managers often prefer variable funding for better resource management. However, this can lead to a focus on incremental innovation, as managers prioritize improving existing products that generate immediate revenue, shifting the development portfolio toward less risky, short-term projects (Chao, Kavadias, and Gaimon 2009).

Risk Tolerance & Uncertainty in Innovation

Risk tolerance plays a pivotal role in shaping innovation project decisions, as companies must weigh the balance between risk and potential reward. Incremental innovation projects, which generally involve lower uncertainty, align more closely with manageable risks and predictable outcomes, whereas disruptive innovation projects, often present higher uncertainty, making outcomes difficult to predict (Namazi et al. 2023). While risk can be estimated, uncertainty remains a more complex variable that traditional risk management tools fail to adequately address (Koen et al. 2010 cited in Namazi et al. 2023). Consequently, organizations must develop tailored approaches to innovation risk management that account for these unpredictable factors. Moreover, an overly cautious approach may stifle innovation, as the fear of failure could prevent the pursuit of transformative ideas, leading to long-term stagnation (Valikangas, Hoegl, and Gibbert 2009 cited in Namazi et al. 2023).

Methodology

The research conducted in this study follows an interpretative philosophy with an exploratory approach, adopting qualitative research methods aimed at understanding how Portuguese companies allocate resources in their innovation portfolios. This preliminary study seeks to contribute to the knowledge of a phenomenon that is relatively under-researched in the Portuguese context, providing an analysis of the factors that influence resource allocation

decisions.

Data collection was carried out through five semi-structured interviews with five Portuguese companies: BPI, Delta Cafés, Fidelidade, Galp, and NOS Inovação (c.f. Annex 7). The interview guide (c.f. Annex 8) was constructed based on the questions underlying the problem identified in the literature review, yet it allowed for flexibility so that the interviewees could address related topics. Additionally, a literature review was conducted to complement and contextualize the collected data.

The participating companies were selected based on specific criteria: being Portuguese companies with decision-making processes within the country, having a turnover of over 100 million euros, and a significant history of investments in innovation. Diversity among sectors was considered to ensure a comprehensive view of different business contexts. The interviewees were directors or managers responsible for innovation, selected according to their strategic role in decision-making related to the innovation portfolio and resource allocation.

The interview data were analyzed using thematic analysis, particularly for categorizing responses according to the research objectives and identifying recurring patterns. However, it should be noted that the application of this method does not aim to derive a conceptual model based on the observed patterns, mainly due to the small sample size. Nonetheless, the results and patterns observed may inform the design of more in-depth research that could culminate in a proposed model. The literature review provided a theoretical foundation to contextualize and interpret the results, offering a broader view of the challenges faced by Portuguese companies in their innovation portfolio management practices.

Results and Findings

This chapter provides an in-depth analysis of the insights gathered from the interviews, framed within the context of IPM theory, resource allocation strategies, and organizational

ambidexterity from the literature review, highlighting the connection between theoretical frameworks and real-world practices to enrich understanding of how selected Portuguese companies manage their innovation portfolios and allocate resources, as well as the strategies and challenges they face in balancing short-term performance with long-term growth.

Strategic Innovation Objectives

Most of the companies interviewed demonstrated a clear alignment between their innovation strategies and their broader corporate objectives. As identified in the literature, this alignment is a key determinant of portfolio success (Cooper and Edgett 2003; Lerch and Spieth 2012). However, a distinct approach was identified in NOS and BPI, where both companies intentionally pursue innovation strategies that are not directly linked to their core business objectives. This method aims to reduce cognitive biases during the exploration of new ideas, allowing for the discovery of potentially disruptive innovations that might fall outside traditional strategic boundaries. This finding aligns with the need for flexibility in innovation, particularly when companies seek to balance exploitation and exploration (March 1991).

Fidelidade's innovation strategy focuses on building adaptability and preparing the organization for industry-wide transformations. Similarly, BPI and Galp emphasized transformational business innovation, targeting areas like energy transition and digital finance. The strategic innovation objectives of Delta reflect a proactive approach to market differentiation, while NOS seeks to maximize the potential of emerging technologies, creating an innovation platform for future business use cases.

Motivation and Approach to Innovation

The companies' motivations for innovation fell into two broad categories: external and internal. For instance, BPI and Galp are driven by external market forces, such as the rise of

open banking, decentralized finance, and energy decarbonization, which align with systemic changes in their respective sectors and illustrate how external factors significantly influence resource allocation for innovation (Floricel and Ibanescu 2008).

In contrast, Fidelidade and Delta focus on internal drivers, such as improving existing products and exploring new adjacent markets. This internal motivation reflects the influence of organizational culture, leadership, and governance structures on resource allocation (Meskendahl 2010). Despite this internal motivation, at Fidelidade, resource allocation is highly dependent on the economic cycle. In bullish markets, the focus is on expansion initiatives, growth, new markets, and new products, whereas in bearish markets, the emphasis shifts towards operational efficiency and resilience. Balancing external and internal motivations is crucial for maintaining an adaptable and competitive portfolio (Floricel and Ibanescu 2008; Voss and Kock 2013).

A notable distinction emerged between the bottom-up and top-down approaches to innovation. While most companies adopted a top-down strategy, where senior management prioritized use cases and needs (Aghion and Tirole 1997), NOS stood out with its bottom-up approach, driven by technological exploration. This decentralized model allows for flexibility and fosters a culture of innovation, which, as Meskendahl (2010) suggests, is essential for fostering organizational agility.

Organizational Ambidexterity and Resource Allocation

One of the central findings from the interviews is the adoption of the Three Horizons of Growth model by all the companies (Baghai, Coley, and White 2000). The companies' resource allocation strategies closely align with this model (Figure 3), confirming the literature's emphasis on the importance of balancing short-term and long-term activities (Tushman and O'Reilly 1996). BPI allocates 25% of its innovation resources to transformational initiatives,

demonstrating a strong focus on long-term disruptive innovation, while the other firms place more emphasis on incremental and adjacent innovation.

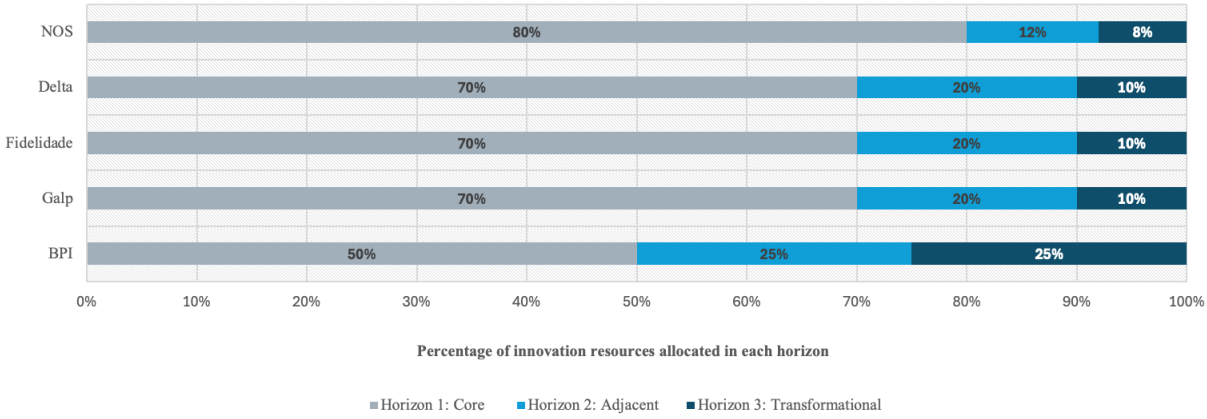


Figure 3: Innovation resource allocation in the three growth horizons

Challenges in Maintaining Long-Term Transformational Innovation

The interviews revealed that most companies struggle to maintain long-term transformational initiatives, which are often deprioritized in favor of short-term, incremental innovations. This finding is consistent with March's (1991) exploration-exploitation trade-off, where organizations face the risk of a "success trap" if too much focus is placed on short-term, exploitative innovation. As Lenfle (2016) points out, transformational projects carry higher risks and uncertain outcomes, which can deter investment from companies focused on immediate returns.

To address this issue, most of the companies have established dedicated structures for transformational innovation. Fidelidade's Center for Transformation (CFT), NOS Innovation, and Delta's Diverge (Nabeiro Group Innovation Center) all focus on long-term, disruptive projects, a strategy supported by the literature on structural ambidexterity (Tushman and O'Reilly 1996; Boumgarden, Nickerson, and Zenger 2012; O'Reilly and Tushman 2013).

Interestingly, Galp has taken a different approach by relying on open innovation partnerships, working with external collaborators to drive transformative projects. This strategy

aligns with the concept of managerial ambidexterity (Mom, Van Den Bosch, and Volberda 2009), where leaders have the role of balancing activities through strategic decision-making, ensuring resource and collaboration across the organization. The benefits of this model are multifaceted: 1) it avoids a potential disconnect between the transformational innovation area and other departments within the company; 2) long-term contracts with partners help secure continuous funding during the strategic planning review process; and 3) collaborating with diverse external teams brings different perspectives, enriching the innovation process. Given the need to work with partners of various sizes, including startups, Galp developed a specialized procurement process for the acquisition of products and services. The traditional process was too rigid and time-consuming, often hindering collaboration. This adaptation has enabled more agile and effective partnerships, crucial for driving innovation forward.

Innovation Funding Strategies

The funding strategies adopted by the companies are another critical finding. While BPI relies solely on internal capital for innovation due to regulatory restrictions, other firms utilize a mix of private and public funding, drawing from programs such as SIFIDE (Tax Incentive System for Business R&D), which aims to increase business competitiveness by supporting research efforts, Portugal 2030 (a partnership agreement between Portugal and the European Commission that utilizes European structural funds to finance projects across various areas, including research, innovation, and regional development), and the mobilizing agendas of the RRP (Resilience and Recovery Plan), which aims to implement reforms and investments to restore sustained economic growth. Delta and Galp fund around 20% of their innovation investments through government resources, which allows them to pursue higher-risk, transformational initiatives with reduced financial pressure. This aligns with the literature on the role of public funding in supporting corporate innovation (Beck, Junge, and Kaiser 2018).

The concept of funding authority was also prevalent in companies like Fidelidade, NOS and BPI, where part of the innovation budget is derived from the revenue generated by successful new products. Fidelidade directly uses part of the revenue generated from new products, which is becoming increasingly significant, to finance new projects and thus increase its innovation budget. NOS is expected to begin exploiting intellectual property in the coming years, generating an additional source of funding for its initiatives. BPI employs a mechanism of receiving internal "royalties" from successful innovation initiatives to increase its budget, creating a compounding effect (interest on interest) that provides long-term incentives. This approach encourages a compounding effect on innovation investments, echoing Chao, Kavadias, and Gaimon (2009) findings on the importance of variable funding mechanisms in sustaining innovation momentum.

At Delta, alongside the annual budget allocated for initiatives prioritized in collaboration with the business units, a new annual fund called the "Black Box" was established. This fund is reserved for potential transformational and high-impact projects that may emerge throughout the year. It serves as an incentive for serendipity, encouraging different thinking and streamlining processes, providing a shortcut for financing innovative projects with strong business potential. This approach closely aligns with the concept of "Strategic Buckets," as identified in the literature (Cooper 2004). The strategic buckets method tends to outperform others, especially for more difficult and risky initiatives (Cooper 2004; Hutchison-Krupat and Kavadias 2015). This model aligns resources with strategic objectives while allowing for spontaneous innovation, which is key for balancing the pursuit of incremental and transformational projects. By maintaining this bucket, Delta ensures it can capitalize on new ideas and breakthroughs that may not have been anticipated during the initial budget planning phase, which enhances its overall innovation portfolio management.

Criteria for Allocating Resources and Prioritizing Innovation Initiatives

The interviews highlighted several key criteria used by companies to allocate resources within their innovation portfolios (Figure 4). Business impact, market maturity, competition level, and strategic alignment emerged as the most commonly cited factors (c.f. Annex 9).

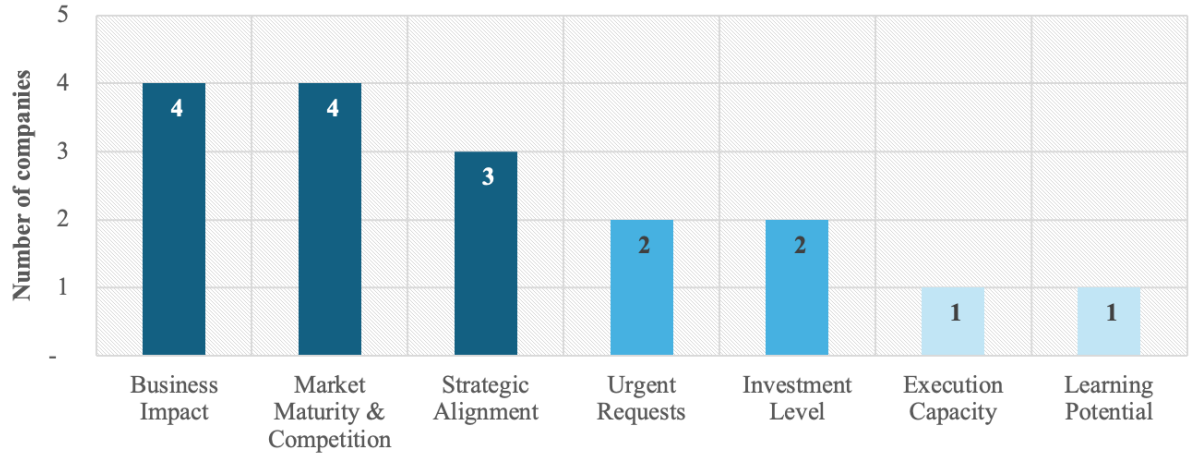


Figure 4: Key criteria to allocate resources in innovation initiatives

The findings also suggest that companies are moving toward more structured and data-driven processes for prioritizing initiatives. Scoring models and market analysis are commonly used to assess project viability and risk, confirming the importance of systematic evaluation methods highlighted in the literature (Cooper, Edgett, and Kleinschmidt 2001).

Kill Criteria: When to Discontinue Innovation Initiatives

Discontinuing underperforming projects, or making "kill decisions," is another key aspect of IPM that was explored in the interviews. The findings indicate that most companies utilize a combination of financial, technical, and market-based criteria to assess whether an innovation initiative should be terminated (Figure 5). The most commonly cited criteria included market feasibility, financial viability, and technological readiness (c.f. Annex 10).

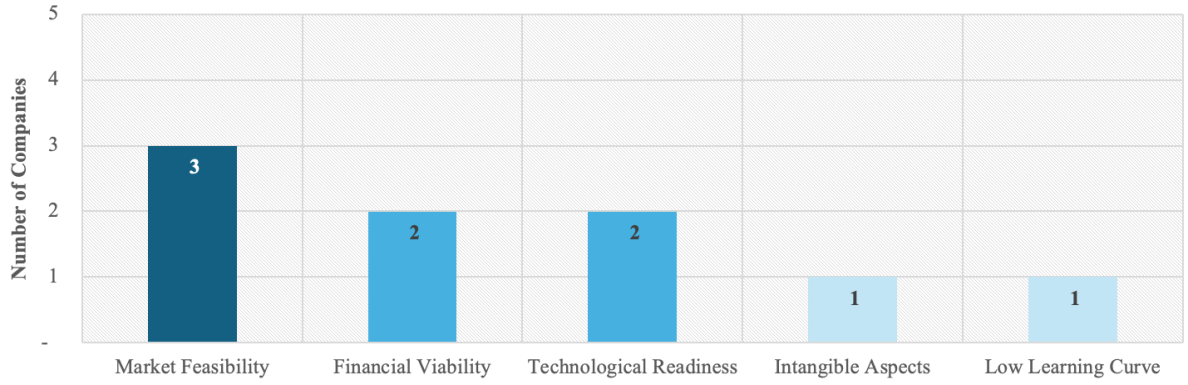


Figure 5: Key criteria to kill innovation initiatives

Fidelidade, for example, assesses projects based on user engagement, customer acquisition costs, and market penetration, aligning with the literature's focus on performance metrics (Killen, Hunt, and Kleinschmidt 2006). NOS, on the other hand, evaluates innovation initiatives based on the outcome of proof-of-concept trials and market trends, while Delta takes a more flexible approach, sometimes allowing projects to continue based on instinct, even in the absence of concrete performance data.

Risk Tolerance and Uncertainty Management

Managing risk and uncertainty is a significant challenge in innovation, as discussed previously (Koen et al. 2010). The companies interviewed displayed varying levels of risk tolerance, with BPI and Delta exhibiting a higher tolerance for risk in their portfolios, while the other firms prefer to invest in projects with lower uncertainty. This finding echoes the work of Namazi et al. (2023), who argue that risk tolerance shapes the types of innovation projects that organizations pursue.

Companies utilize a range of tools and practices to reduce uncertainty in decision-making. These include market studies, networking with industry experts, and academic partnerships to stay informed on the latest technological developments.

Delta has a very innovative culture, and the willingness to take risks comes from its

founder, who always genuinely sought to bring new products to consumers ahead of time. They conduct focus groups with consumers to test new product concepts. These practices align with the literature on managing innovation risk through continuous market monitoring and stakeholder engagement (Teller, Kock, and Gemünden 2014). Additionally, Delta emphasizes the importance of selecting innovation partners with the right profile, sharing part of the risk with companies willing to tackle unconventional challenges. BPI manages portfolio risks at a macro level, ensuring that resources are not overly allocated to a single initiative or that the investment thesis are not too correlated, thus avoiding systemic risk for the organization.

For low maturity and therefore riskier technologies, such as quantum computing, NOS prefers to work in partnership with the academic world by providing scholarships for master's research. This approach aims to explore and deepen the understanding of the technology while keeping investment at a low level.

Fidelidade and NOS use several practices to reduce uncertainty in decision-making by consulting various information sources for a more holistic view of opportunities. Fidelidade continuously reviews market reports such as Crunchbase and CB Insights to estimate the market potential of new initiatives. They also validate this potential with Venture Capital (VC) funds and specialized investors in their target segments. Additionally, they maintain close connections with academia to stay informed about the latest developments in research and technology. NOS conducts quarterly market studies and engages in networking with experts in key areas to understand industry trends. They monitor regulatory and governmental issues that may affect the business and maintain close ties with business units, communication, and marketing teams to gauge the market's potential.

In BPI and Galp, risk is assessed similarly based on three key categories: the maturity level of the technology in the market, the amount of investment (CAPEX) required, and the complexity of implementation.

Portfolio Overload

One of the recurring themes across the interviews was the challenge of portfolio overload, a common issue in IPM where too many projects stretch organizational resources thin (Cooper, Edgett, and Kleinschmidt 1999). Most of the companies acknowledged the need to carefully manage their portfolios to avoid resource strain.

At NOS, the innovation portfolio consists of 11 initiatives, with a focus on completing existing projects before starting new ones. BPI takes a selective approach, deliberately limiting the number of initiatives to focus on the most critical projects. This strategy, which involves not catering to all departmental demands, reflects a deliberate attempt to avoid overextension and aligns with the resource capacity analysis approach recommended in the literature (Cooper, Edgett, and Kleinschmidt 2000).

Delta also faced a period of portfolio overload in the past. To increase execution capacity, they implemented a system where business unit employees dedicated one day per week to innovation projects. This measure helped maintain the progress of ongoing projects without reducing the number of initiatives.

Galp experiences similar resource constraints. As its Head of Innovation noted, “We never have the resources or people to do everything we want”. To mitigate this, they partner with universities, transforming a network of over 1,200 researchers into an extension of the organization’s innovation team. This limitation in resources, according to the Head of Innovation, brings a diverse range of perspectives that benefit the organization: “If we had unlimited resources, we would probably do everything internally and lose this breadth of thought”.

Conclusions, Limitations and Future Work

This study provided valuable insights into how Portuguese companies manage their innovation portfolios, particularly in resource allocation. A key finding was the adoption of IPM practices and strategies that balance short-term incremental innovation with long-term transformational initiatives, like the Three Horizons of Growth model (Baghai, Coley, and White 2000) or the different types of ambidexterity approaches (Mom, Van Den Bosch, and Volberda 2009; Constant, Calvi, and Johnsen 2020). The companies recognize that while transformational innovation is essential for future competitiveness, it often faces challenges due to the high risks and uncertainties involved. The tendency to prioritize incremental projects, which deliver faster and more predictable returns, was observed across organizations, consistent with the literature's emphasis on the "short-term success" trap that can hinder long-term disruptive innovation.

Another significant finding was the diversification of funding sources. While some companies, such as BPI, rely exclusively on internal capital, the other ones supplement their innovation investments with public subsidies, providing greater flexibility for high-risk initiatives. Government funding programs, such as SIFIDE and the RRP, play a crucial role in enabling innovation projects. The structuring of strategic buckets for disruptive innovation, such as Delta's "Black Box" fund, could be an effective practice to ensure agility and responsiveness to emerging and impactful opportunities.

Regarding resource allocation, companies apply strict prioritization criteria, such as business impact, market maturity, and strategic alignment. However, the criteria for discontinuing projects ("kill decisions") still vary. While some companies use more quantitative and structured approaches, others rely on intuition and subjective judgments, particularly for highly uncertain projects.

Despite the valuable insights generated by this research, some limitations should be noted. First, the small sample size and the exclusive focus on large Portuguese companies may limit the generalizability of the results to other organizational contexts, such as small and medium-sized enterprises (SMEs). Additionally, while attempts were made to gather information on actual expenditure in innovation, companies did not provide this data despite related questions being included in the interview guide. Furthermore, the qualitative methodology, based on semi-structured interviews, while rich in detail, does not allow for quantitative extrapolation about resource allocation practices across the broader Portuguese business ecosystem.

Future research could benefit from a more robust quantitative analysis and benchmarking to evaluate the impact of different resource allocation strategies on both financial performance and innovation outcomes. Applying classical financial market techniques, such as Markowitz's Modern Portfolio Theory (Markowitz 1952), could offer valuable insights into how companies manage risks and can better balance their innovation portfolios across various project types. Another promising avenue for further study is the development and application of antifragility models (Taleb 2012) for corporate innovation portfolios. These models could help organizations identify vulnerabilities and build more resilient portfolios that withstand market and technological disruptions.

Additionally, expanding the concept of sequential ambidexterity to design and develop a dynamic approach would allow companies to shift focus on transformational projects based on both internal and external factors, such as competition, technological disruption, market share, and economic cycles, dynamically optimizing its resources over time.

Finally, the influence of emerging technologies, such as artificial intelligence, on IPM and resource allocation remains a relatively unexplored yet highly relevant field and could offer significant advancements for the future of IPM and resource allocation strategies.

References

Aghion, Philippe and Jean Tirole. 1997. "Formal and real authority in organizations." Journal of Political Economy, 105 (1): 1–29.

Baghai, Mehrdad, Stephen C. Coley, David White, Charles Conn, and Robert J. McLean. 1996. "Staircases to growth." The McKinsey Quarterly 4: 39-41.

Baghai, Mehrdad, Stephen C. Coley, and David White. 2000. The Alchemy of Growth: Practical Insights for Building the Enduring Enterprise. New York: Perseus Books.

Beck, Mathias, Martin Junge, and Ulrich Kaiser. 2018. "Public funding and corporate innovation". KOF Swiss Economic Institute Working Papers, 437.

Becker, Bettina. 2015. "Public R&D Policies and Private R&D Investment: A Survey of the Empirical Evidence." Journal of Economic Surveys, 29 (5): 917-942.

Benner, Mary J., and Michael L. Tushman. 2003. "Exploitation, exploration, and process management: the productivity dilemma revisited" Academy of Management Review, 28 (2): 238-256.

Beringer, Claus, Daniel Jonas, and Hans Georg Gemünden. 2012. "Establishing project portfolio management: an exploratory analysis of the influence of internal stakeholders' interactions" Project Management Journal, 43 (6): 16–32.

Brennan, Tom, Philipp Ernst, Jonathan Katz, and Erik Roth. 2020. "Building an R&D strategy for modern times." McKinsey & Company.

Boumgarden, Peter, Jackson Nickerson, and Todd R. Zenger. 2012. "Sailing into the wind: Exploring the relationships among ambidexterity, vacillation, and organizational performance." Strategic Management Journal, 33 (6): 587-610.

Burleson, Scott. 2021. "4 Symptoms of poor portfolio management for innovation." AIM Institute.

Chao, Raul O., and Stylianos Kavadias. 2008. "A theoretical framework for managing the new product development portfolio: when and how to use strategic buckets." Management Science, 54 (5): 907–921.

Chao, Raul O., Stylianos Kavadias, and Cheryl Gaimon. 2009. "Revenue Driven Resource Allocation: Funding Authority, Incentives, and New Product Development Portfolio Management." Management Science, 55 (9): 1556–1569.

Constant, François, Richard Calvi, and Thomas E. Johnsen. 2020. "Managing Tensions between Exploitative and Exploratory Innovation through Purchasing Function Ambidexterity." Journal of Purchasing and Supply Management, 26 (4): 100645.

Cooper, Robert G., Scott J. Edgett, and Elko J. Kleinschmidt. 1999. "New product portfolio management: practices and performance" Journal of Product Innovation Management, 16 (4): 333–351.

Cooper, Robert G., Scott J. Edgett, and Elko J. Kleinschmidt. 2000. “New Problems, New Solutions: Making Portfolio Management More Effective” Research-Technology Management, 43 (2): 18-33.

Cooper, Robert G., Scott J. Edgett, and Elko J. Kleinschmidt. 2001. “Portfolio management for new product development: results of an industry practices study.” R&D Management, 31 (4): 361-380.

Cooper, Robert G., and Scott J. Edgett. 2003. “Benchmarking best practices performance results and the role of senior management.” Product Development Institute Report, 1 (7).

Cooper, Robert G., Scott J. Edgett, and Elko J. Kleinschmidt. 2004. “Benchmarking best NPD practices—I.” Research-Technology Management, 47 (1): 31–43.

Cooper, Robert G. 2004. “New products—What separates the winners from the losers and what drives success.” in The PDMA Handbook of New Product Development. New Jersey: John Wiley & Sons.

David, Paul A., Bronwyn H. Hall, and Andrew A. Toole. 2000. “Is public R&D a complement or substitute for private R&D? A review of the econometric evidence.” Research Policy, 29 (4-5): 497-529.

Dewar, Robert D., and Jane E. Dutton. 1986. “The adoption of radical and incremental innovations: an empirical analysis.” Management Science, 32 (11): 1422-1433.

Eckert, Theresa, and Stefan Hüsig. 2021. “Innovation portfolio management: A systematic review and research agenda in regards to digital service innovations.” Management Review Quarterly, 72 (1): 187–230.

Ernst, Holger, and Ulrich Lichtenthaler. 2009. “Innovation portfolio management: an understudied driver of innovation success?” International Journal of Technology Intelligence and Planning, 5 (2): 111–117.

Floricel, Serghei, and Mihai Ibanescu. 2008. “Using R&D Portfolio Management to Deal with Dynamic Risk.” R&D Management, 38 (5): 452–467.

Foster, Richard N., and Sarah Kaplan. 2001. Creative Destruction. Cambridge, MA: Perseus.

Gibson, Cristina B., Julian Birkinshaw. 2004. “The antecedents, consequences and mediating role of organizational ambidexterity.” Academy of Management Journal, 47 (2): 209-226.

Hadjinicolaou, Nick, Mohamad Kader, and Ibrahim Abdallah. 2021. “Strategic Innovation, Foresight and the Deployment of Project Portfolio Management under Mid-Range Planning Conditions in Medium-Sized Firms.” Sustainability, 14 (1): 80.

Hunt, Robert A., and Catherine P. Killen. 2008. “Best practice project portfolio management” International Journal of Quality & Reliability Management, 25 (1): 1–6.

Hunt, Robert A., and Catherine P. Killen. 2013. “Robust project portfolio management: capability evolution and maturity” International Journal of Managing Projects in Business, 6 (1): 131-151.

Hutchison-Krupat, Jeremy, and Stylianos Kavadias. 2015. “Strategic Resource Allocation: Top-down, Bottom-up, and the Value of Strategic Buckets.” Management Science, 61 (2): 391–412.

Jugend, Daniel, Sérgio Luis da Silva, Manoel Henrique Salgado, and Paulo Augusto Cauchick Miguel. 2016. “Product portfolio management and performance: Evidence from a survey of innovative Brazilian companies.” Journal of Business Research, 69 (11): 5095–5100.

Kavadias, Stylianos, and Raul O. Chao. 2007. “Resource allocation and new product development portfolio management.” in Handbook of New Product Development Management. Oxford: Butterworth Heinemann Elsevier.

Killen, Catherine P., Robert A. Hunt, and Elko J. Kleinschmidt. 2006. “Benchmarking innovation portfolio management practices: methods and outcomes” in International Conference on Management of Technology (IAMOT) - International Association for Management of Technology, 1–10.

Killen Catherine P., Robert A. Hunt, and Elko J. Kleinschmidt. 2008. “Project portfolio management for product innovation.” International Journal of Quality & Reliability Management, 25 (1): 24–38.

Killen, Catherine P., Shankar Sankaran, Michael Knapp, and Chris Stevens. 2023. “Embracing Paradox and Contingency: Integration Mechanisms for Ambidextrous Innovation Portfolio Management.” International Journal of Managing Projects in Business, 16 (6–7): 743–766.

Koen, Peter A., Heidi Bertels, Ian R. Elsum, Mike Orroth, and Brenda L. Tollett. 2010. “Breakthrough innovation dilemmas” Research Technology Management, 53 (6): 48-52.

Laslo, Zohar. 2010. “Project portfolio management: an integrated method for resource planning and scheduling to minimize planning/scheduling-dependent expenses” International Journal of Project Management, 28 (6): 609–618.

Lenfle, Sylvain. 2016. “Floating in space? On the strangeness of exploratory projects” Project Management Journal, 47 (2): 47-61.

Lerch, Martin, and Patrick Spieth. 2012. “Innovation Project Portfolio Management: a meta-analysis” International Journal of Product Development, 16 (1): 77-94.

Lettice, Fiona, and Peter Thomond. 2008. "Allocating resources to disruptive innovation projects: challenging mental models and overcoming management resistance." International Journal of Technology Management, 44 (1-2): 140-159.

March, James G. 1991. “Exploration and exploitation in organizational learning” Organization Science, 2 (1): 71-87.

Markowitz, M. Harry. 1952. “Portfolio Selection” The Journal of Finance, 7 (1): 77-91.

Martinsuo, Miia. 2019. “Strategic value at the front end of a radical innovation program” Project Management Journal, 50 (4): 431-446.

Meifort, Anna. 2016. "Innovation portfolio management: A synthesis and research agenda." Creativity and innovation management, 25 (2): 251-269.

Meskendahl, Sascha. 2010. “The influence of business strategy on project portfolio management and its success—A conceptual framework.” International Journal of Project Management, 28 (8): 807–817.

Mittal, Shobhit. 2024. “Strategic Foresight in Action: Leveraging McKinsey’s 3 Horizon Model for Balanced Financial and Strategic Planning.” International Journal of Science and Research (IJSR), 13 (4): 1166–1172.

Mom, Tom J., Frans A. Van Den Bosch, and Henk W. Volberda. 2009. “Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms.” Organization Science, 20 (4): 812-828.

Morcos, Maged S. 2008. “Modeling resource allocation of R&D project portfolios using a multi-criteria decision-making methodology” International Journal of Quality & Reliability Management, 25 (1): 72–86.

Nagji, Bansi, and Geoff Tuff. 2012. “Managing your innovation portfolio.” Harvard Business Review, 90 (5): 66-74.

Namazi, Mehdi, Madjid Tavana, Emran Mohammadi, and Ali Bonyadi Naeini. 2023. “A New Strategic Approach for R&D Project Portfolio Selection Using Efficiency-Uncertainty Maps.” Benchmarking: An International Journal, 30 (10): 4193–4220.

O’Connor, Gina Colarelli, Richard Leifer, Albert S. Paulson, and Lois S. Peters. 2008. Grabbing Lightning: Building a Capability for Breakthrough Innovation. San Francisco, CA: Jossey-Bass.

O'Reilly, Charles A., and Michael L. Tushman. 2004. “The Ambidextrous Organization” Harvard Business Review, 82 (4): 74-83.

O’Reilly, Charles A., and Michael L. Tushman. 2013. “Organizational ambidexterity: past, present, and future” Academy of Management Perspectives, 27 (4): 324-338.

Rothaermel, Frank T., and David L. Deeds. 2004. “Exploration and exploitation alliances in biotechnology: A system of new product development.” Strategic Management Journal, 25 (3): 201-221.

Park, Michael, Shuping Wu and Russell J. Funk. 2024. “Regulation and innovation revisited: How restrictive environments can promote destabilizing new technologies.” Organization Science.

Si, Haijian, Stylianos Kavadias, and Christoph Loch. 2022. “Managing innovation portfolios: From project selection to portfolio design.” Production and Operations Management, 31: 4572–4588.

Stadler, Christian, Tazeeb Rajwani, and Florence Karaba. 2014. “Solutions to the exploration/exploitation dilemma: Networks as a new level of analysis.” International Journal of Management Reviews, 16 (2): 172-193.

Taleb, Nassim Nicholas. 2012. Antifragile – Things that gain from disorder. New York: Random House.

Teller, Juliane, Alexander Kock, and Hans Georg Gemünden. 2014. “Risk Management in Project Portfolios Is More Than Managing Project Risks: A Contingency Perspective on Risk Management” Project Management Journal, 45 (4): 67–80.

Townsend, William R. 2010. “Innovation and the value of failure” International Journal of Management and Marketing Research, 3 (1): 75–84.

Turner, Neil, Juani Swart, and Harvey Maylor. 2013. “Mechanisms for managing ambidexterity: a review and research agenda” International Journal of Management Reviews, 15 (3): 317-332.

Tushman, Michael L., and Charles A. O'Reilly. 1996. “The ambidextrous organizations: Managing evolutionary and revolutionary change.” California Management Review, 38 (4): 8-29.

Unger, Barbara Natalie, Hans Georg Gemünden, and Monique Aubry. 2012. “The Three Roles of a Project Portfolio Management Office: Their Impact on Portfolio Management Execution and Success.” International Journal of Project Management, 30 (5): 608–620.

Valikangas, Liisa, Martin Hoegl, and Michael Gibbert. 2009. “Why learning from failure isn’t easy (and what to do about it): innovation trauma at Sun Microsystems” European Management Journal, 27 (4): 225-233.

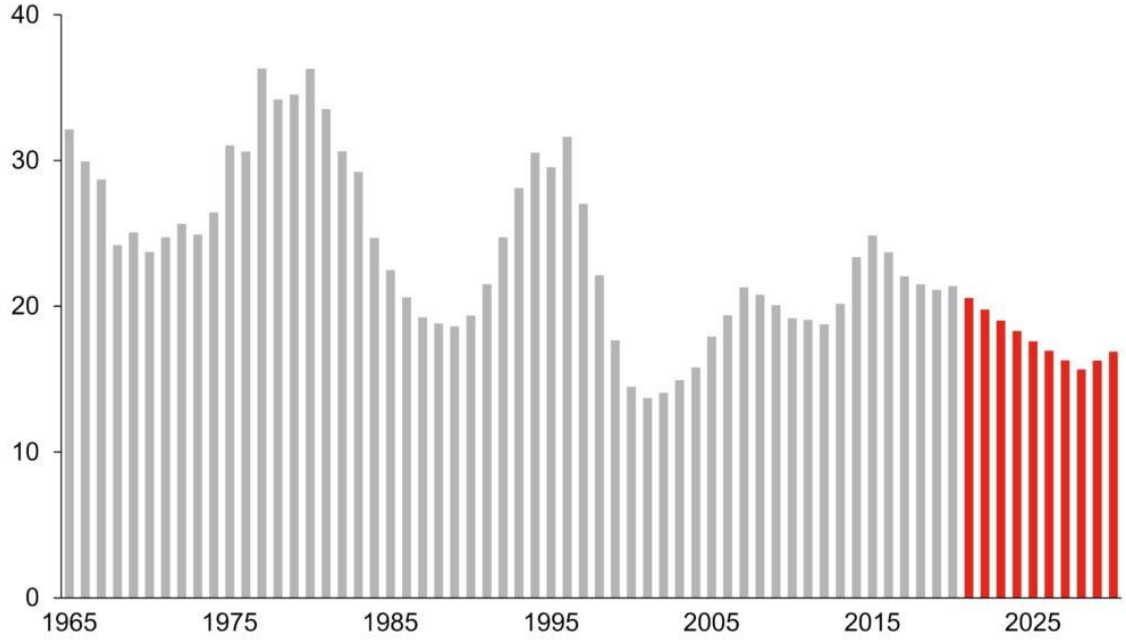
Viguerie, S. Patrick, Ned Calder, and Brian Hindo. 2021. “Corporate Longevity Forecast: As S&P 500 Lifespans continue to decline, fast-shaping hybrid industries create new risks and opportunities.”, Innosight.

Voss, Martin, and Alexander Kock. 2013. “Impact of Relationship Value on Project Portfolio Success – Investigating the Moderating Effects of Portfolio Characteristics and External Turbulence.” International Journal of Project Management, 31 (6): 847–861.

Weinreich, Simon, Tarik Sahin, Tobias Huth, Helmut Breimesser, and Thomas Vietor. 2021. “How to Manage Disruptive Innovation - A Conceptual Methodology for Value-Oriented Portfolio Planning.” Procedia CIRP, 100: 403–408.

Appendices

ANNEX 1 - AVERAGE COMPANY LIFESPAN ON S&P 500 IN YEARS



This chart was extracted from Innosight (Viguerie, Calder, and Hindo 2021) analysis based on public S&P 500 data sources.

Notes: The S&P 500 turnover analysis is based on data compiled from public sources and is inspired by research conducted by former Innosight director Richard Foster. “Churn” is calculated by dividing the number of constituent changes each year by 500. For instance, 2020 had 16 constituent changes; 2021 churn = 3.2% (=16/500). Next, “seven-year rolling compound annual growth rate” (7yrCAGR) in “churn” is calculated to smooth year-on-year volatility and capture long-term trends. Average company life span is calculated by the reciprocal of 7yrCAGR (= 1 / 7yrCAGR). The resulting life span history is plotted and reveals a cyclical pattern in long-term decline.

ANNEX 2 - SIGNIFICANT CHALLENGES FACED IN PORTFOLIO MANAGEMENT

Rank	Challenges
1	Creating a positive climate, culture and buy-in for our Portfolio Method
2	Better allocation of resources, selection of projects & balancing of projects
3	Finding the right balance between short term & long term projects
4	Obtaining better input data & forecasting estimates: markets, volumes, costs, etc.
5	Better linkages of our strategy to the portfolio of projects
6	Better balance & resource allocation) across SBUs, divisions & technologies
7	Better balancing across functions and level of involvement
8	Having more credible financial metrics & tools

• Rank-ordered in terms of frequency of mention; unaided, top-of-mind comments.

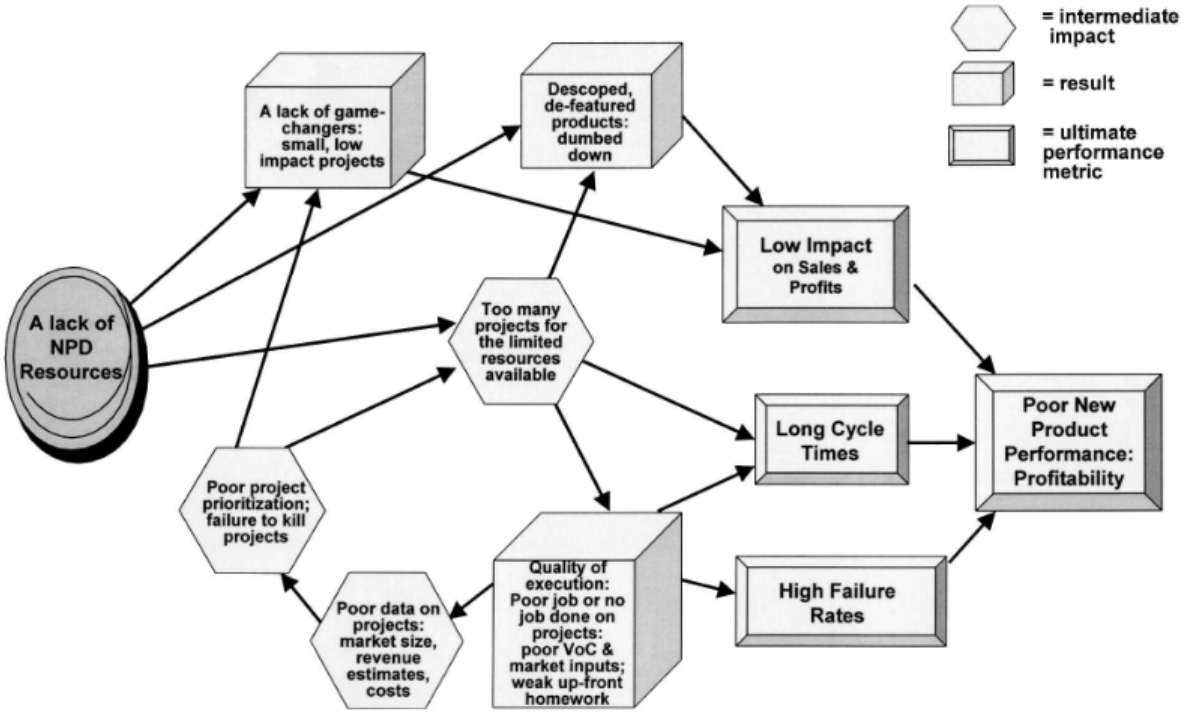
This table lists the result of a study conducted by Cooper, Edgett, and Kleinschmidt (2001), where managers were asked to identify what are the most significant challenges ahead in their organizations related to portfolio management.

ANNEX 3 - OVERVIEW OF INNOVATION PORTFOLIO CHALLENGES

Author and Year	Method	Key findings of portfolio challenges
Adams and Boike (2004)	PDMA 2004 survey	Increased resources are allocated to minor product changes and small improvements, focusing on incremental NPD efforts.
Burleson (2021)	Case study	Symptoms of poor portfolio management: just incremental improvements; "lack of resources" cited as the reason for new product difficulties; new products not launched on time; inability to act on new opportunities.
Cooper et al. (2000)	Survey in 205 companies	Too many projects for limited resources; ineffective optimization; absence of solid information; minor projects in portfolio
Daugherty et al. (2020)	Accenture survey in 1090 executives across 11 industries	Innovation investment not allocated strategically; innovation investment not made with discipline; companies that govern innovation extensively achieve stronger revenue growth over time.
Eckert and Hüsig (2021)	Literature review	Focus too much on incremental innovation; focus too little on long-term, radical innovation; ambiguity in decision making due to lack of solid information; decision-making bias due to overconfidence in reducing cost; managers often display termination decision bias.
Goffin and Mitchell (2010)	Conceptual paper	Valuation problems: which project are worth doing is not identified; balance problem: high risk vs. low risk, incremental vs. radical; difficulty in having an open management process where all actors involved are committed to the achievement of good results.
Killen et al. (2008)	Survey in 60 Australian organizations	Lack of "central, well-communicated, formal process"; lack of "the support or buy-in for the PPM process from all relevant areas and levels of the organization." Shortages of time and resources make it difficult to implement PPM; lacking reflection of strategy.
Markham and Lee (2013)	PDMA 2012 survey	Radical and more innovative projects are reviewed less than in 2004; more radical projects reviewed less often than incremental projects.
(Melis, 2018)	Survey in 468 industrial practitioners	Clear gap between strategy and execution; insufficient alignment with strategy; too many projects for limited resources; decisions going back and forth.
Tolonen (2014)	Interview 47 executives in 10 companies	Disconnect between company strategy and expected portfolio target; idea and role of portfolio are not thoroughly understood by management team; PPM not consistently implemented as a concept and a tool; portfolio and subportfolios are not clearly defined; the portfolio process requires more clarity; governance of portfolio management is not formally structured and implemented.
Ward et al. (2010)	Case study at HP	Multiple similar projects in portfolio result in increased demand volatility and reduced forecast accuracy.

This table provides a brief overview of several studies in innovation portfolio management challenges that have been mapped by Si, Kavadias, and Loch (2022).

ANNEX 4 - LACK OF RESOURCES NEGATIVE CONSEQUENCES



This figure provides a systematic root-cause analysis on the lack of New Product Development (NPD) resources and its negative consequences, ultimately resulting in low NPD profitability (Cooper and Edgett 2003).

ANNEX 5 - A TYPICAL SCORING MODEL FOR PROJECT PRIORITIZATION

Strategic Alignment:
- Degree to which project aligns with our strategy
- Strategic importance

Product/Competitive Advantage:
- Offers customers/users unique benefits
- Meets customer needs better
- Provides value for money for the customer/user

Market Attractiveness:
- Market size
- Market growth rate
- Competitive intensity in the market (high=low score)

Synergies (Leverages Our Core Competencies):
- Marketing synergies
- Technological synergies
- Operations/manufacturing synergies

Technical Feasibility:
- Size of technical gap (large=low score)
- Technical complexity (barriers to overcome) (many/high = low score)
- Degree of technical uncertainty (high=low score)

Risk Vs. Return:
- Expected profitability (magnitude: NPV)
- Return on investment (IRR)
- Payback period (years; many=low score)
- Certainty of return/profit estimates
- Low cost & fast to do

The six Factors are scored (0-10) for each project at gate review meetings by the 'gatekeepers". Bulleted items are discussed to arrive at Factor Scores. Each Factor must clear a minimum hurdle. They are then added (weighted or unweighted) to yield the Project Attractiveness Score, which is used to make Go/Kill decisions at gates and to prioritize projects.

A typical scoring model for project prioritization (Cooper and Edgett 2003).

ANNEX 6 - POPULAR CHART PLOTS FOR PROJECT PRIORITIZATION

Rank	Type of Chart	Axis		Axis	%
1	Risk Vs. Reward	Reward: NPV, IRR, benefits after years of launch; market value	BY	Probability of success (technical, commercial)	44.4
2	Newness	Technical newness	BY	Market Newness	11.1
3	Ease Vs. Attractiveness	Technical feasibility	BY	Market attractiveness (growth potential, consumer appeal, general, attractiveness, life cycle)	11.1
4	Strengths Vs. Attractiveness	Competitive position (strengths)	BY	Attractiveness (market growth, technical maturity, years to implementation)	11.1
5	Cost Vs. Timing	Cost to implement	BY	Time to impact	9.7
6	Strategic Vs. Benefit	Strategic focus or fit	BY	Business intent, NPV, financial fit, attractiveness	8.9
7	Cost Vs. Benefit	Cumulative reward	By	Cumulative development costs	5.6

Rank ordered, in descending order of popularity; last column shows percentage breakdown of bubble diagram usage (as a percent of businesses using bubble diagrams).

Lists of the most popular chart plots used in mapping tools for project prioritization, with the common risk vs. reward plot at the top of the list, by a considerable margin (Cooper, Edgett, and Kleinschmidt 2001).

ANNEX 7 - INTERVIEWED COMPANIES PROFILES AND BACKGROUND

BPI (Banco Português de Investimento) - *Sector: Banking & Financial Services*

Banco BPI, founded in 1981, is one of Portugal's largest private financial institutions. It offers a wide array of financial services, including retail banking, corporate banking, and investment management. Headquartered in Porto, BPI became part of the Spanish CaixaBank Group in 2017. With a significant footprint in the Iberian Peninsula, the bank is known for its customer-centric approach, financial stability, and role in supporting innovation and digital transformation within the banking sector. BPI is a key player in both corporate and individual financial services markets in Portugal.

Delta Cafés - *Sector: Food & Beverage*

Founded in 1961 by Rui Nabeiro in Campo Maior, Portugal, Delta Cafés is part of the Nabeiro Group. The company is a leading player in the coffee industry, both in Portugal and internationally. Delta Cafés is known for its high-quality products and has a broad range of coffee solutions for both retail consumers and businesses. The company has grown significantly over the decades and now exports to more than 40 countries. It employs thousands of people and continues to expand its market presence through innovation in products and services.

Fidelidade - *Sector: Insurance*

Founded in 1808, Fidelidade is one of Portugal's oldest and largest insurance companies, offering a wide range of insurance products across life, health, property, and casualty sectors. It is a market leader in Portugal and operates globally, with a strong presence in Portuguese-speaking countries such as Brazil, Angola, and Mozambique. With its headquarters in Lisbon, Fidelidade serves millions of customers and has a robust reputation for financial strength and innovation in the insurance industry, particularly through the use of digital solutions and data-

driven insights to enhance customer experience and risk management.

Galp Energia - *Sector: Oil, Gas, and Renewable Energy*

Founded in 1999, Galp is one of the leading energy companies in Portugal, with a diversified portfolio that spans oil and gas exploitation and production, and renewable energy initiatives. Galp operates in several countries in Europe, Latin America, and Africa. With a strong commitment to transitioning towards cleaner energy, Galp has been investing heavily in renewable energy sources, including solar and wind power, aligning its strategy with global sustainability goals. It employs thousands of people and is a significant contributor to the energy security and sustainability strategy of Portugal.

NOS Inovação - *Sector: Telecommunications & Media*

NOS Inovação is a subsidiary of NOS, one of the largest telecommunications and entertainment companies in Portugal, which is itself part of the larger Sonae Group. Founded in 2014 after the merger of ZON and Optimus, NOS has a significant market share in the Portuguese telecommunications industry. NOS Inovação focuses on technological advancements and digital transformation initiatives that span telecommunications, media, and entertainment sectors. The company plays a crucial role in the innovation strategies of NOS, contributing to new services, platforms, and technologies that drive digital transformation across Portugal.

ANNEX 8 - INTERVIEW GUIDE

Interviewed Role	**Give a brief description of the current role in the company**
Innovation Department	**What was the main motivation for creating the innovation area?** When was the area created, and how is it structured? How many people are part of the current team, and what is their academic degree?
Innovation Strategy	**What is the importance of innovation for the organization?** In general terms, what is the innovation strategy you use? How does the innovation strategy relate to the corporate strategy?
Budget & Funding	**How does the budgeting and funding process for innovation work in your organization?** Who is responsible for defining the innovation budget? What is the investment in innovation for 2023? (innovation budget) What percentage of this investment comes from external funding? Do you use the concept of "funding authority" to increase the innovation budget?
Innovation Portfolio Management	**Do you use IPM tools to manage innovation initiatives?** How many initiatives are currently in development in the innovation portfolio? Do you believe the number of initiatives is consistent with the available resources?
Resource Allocation	**What mechanisms does your organization use to decide which innovation projects should be supported or not?** Who is responsible for the allocation/reallocation of resources in initiatives? What tools/methods/criteria are used to allocate resources to initiatives? What tools/methods/criteria are used to measure the uncertainty/potential of initiatives? In general terms, what are the main difficulties in this process?
Ambidexterity	**How does the company adapt its innovation portfolio to balance short and long-term initiatives?** How do you classify the balance of the innovation portfolio regarding McKinsey's 3 horizons of growth? Core (optimizing existing products for existing customers) Adjacent (expanding from existing business into "new to the company" business) Transformational (developing breakthroughs and inventing things for markets that don't yet exist) Do you believe the portfolio balance is aligned with the company's strategy? In general terms, what are the main difficulties in this process?
Risk Tolerance	**How would you define the organization's current risk tolerance?** How do you classify the current risk balance of the innovation portfolio? Is it consistent with the strategy? How do you see the concentration level of investments in initiatives?
Innovation Metrics	**What was the innovation revenue in 2023?** (revenue generated by products introduced to the market in the last 3 years) How is this revenue divided into the following categories? Minor developments, promotional developments, and package changes Incremental product improvement and changes Major product revisions Products new to the business Products new to the world

This script was used during the interviews conducted in this study and served as a baseline to support the conversations. Since the interview followed a semi-structured format, the questions were not necessarily asked in this order and/or exactly form.

ANNEX 9 - CRITERIA FOR ALLOCATING RESOURCES IN INNOVATION

Fidelidade	1) Strategic alignment 2) Impact it will generate in the short or long term 3) Maturity, competition, and market saturation 4) Level of associated investment: capex and opex 5) Internal capacity to execute and/or the need for external resources
Delta	1) Strategic alignment 2) Sense of urgency 2a. "Bread and Butter" products that feed the core business 2b. Regulatory requirements 2c. Market giving clear signals of demand for the new product 3) Degree of disruption (potential return)
NOS	1) Projects with fixed deadlines and prioritized for business areas 2) Value that technology can bring to the company
BPI	1) Opportunity cost of the initiative, seeking the best learning ratio 2) Risk (technology maturity, amount of investment)
Galp	1) Business criteria considering relevance, added value, and strategic alignment 2) Scientific criteria (novelty in the market and academic field)

This table summarizes the main criteria used by interviewed companies to allocate resources and prioritize initiatives in their innovation portfolios.

ANNEX 10 - CRITERIA FOR ENDING INITIATIVES (KILL DECISION)

Fidelidade	Number of users; Interactions, time spent and engagement with the solution; Recommendations to others; Conversion rates; Market penetration; Customer acquisition cost (CAC).
NOS	Proofs of concept that do not succeed; Low market receptivity; Very high financial risk; Low market trends.
BPI	Opportunity cost of the initiative, seeking the best learning-to-risk ratio.
Galp	Results below expectations; Implementation difficulties; Project complexity.
Delta	Gut feeling. Even without clear evidence from the experiments carried out, they may choose to continue investing in the initiative for a longer time.

This table summarizes the main criteria used by interviewed companies to reallocate resources and deprioritize initiatives in their innovation portfolios.