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A Multi-Market Strategy and the role of Portfolio  
Managements within it

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A Multi-Market Strategy for Crossing the Chasm and  
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A study on an alternative method for crossing the chasm and the connection to a greater need for portfolio management.

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## Abstract

This study addresses the challenge faced by PowerCell, a hydrogen fuel-cell manufacturer, that is transitioning from early adopters to mainstream markets without relying on Geoffrey Moore's traditional "beachhead" approach. Instead, PowerCell pursues simultaneous entry into multiple market segments, leveraging core-technology commonality and diversification to remain agile during a policy-driven, uncertain market. The purpose of this study is to evaluate how a multi-market strategy can be a valid strategy for crossing the chasm and how structured R&D portfolio management can support this transition.

A single-case study with an abductive research design was employed, combining semi-structured, with a total of 18 interviews of PowerCell employees and analysis of internal documents and secondary sources. Data collection focused on strategic decision-makers and project teams, while thematic analysis identified recurring patterns and insights.

Findings reveal three primary motivations for diversification: reuse of shared technology, risk reduction through market hedging, and cross-segment learning effects. The implementation of a broad-market strategy increases R&D portfolio complexity, demonstrated in greater project interdependencies, resource conflicts, and overengineering, but also enhances agility through dynamic reprioritization and preserves optionality. Empirical evidence shows positive learning synergies that improve organizational resilience. However, PowerCell currently lack a formal portfolio management framework, potentially leading to suboptimal resource allocation and delayed go/kill decisions.

These results suggest that a tailored portfolio management tool can help firms employing a multi-market strategy to balance flexibility with strategic alignment, ensuring R&D investments support both immediate opportunities and long-term goals.

Keywords: Multiple-Market Strategy, Crossing the Chasm, Project Portfolio Management, Broad Market Strategy, Interdependencies, Uncertainty



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# 1 Introduction

The debate around strategies for crossing the chasm in high-tech markets often revolves around Geoffrey Moore's concept of the beachhead strategy. Moore (2014) states that a company should focus its efforts on a single market segment, a "beachhead," to effectively cross the chasm. The beachhead strategy has been largely recognized as one of the most effective strategies in this context. But this raises an important question. Is an alternative path to cross the chasm possible? Can a company navigate this issue with a broader strategy, tackling multiple segments simultaneously? The traditional beachhead strategy may not work best when a company is unsure of which market segment will be mature and ready to become a market, while it also has the technological capacity to serve multiple segments.

However, adopting a more comprehensive market strategy is not without challenges and complexity. When a high-tech or R&D-intensive company targets several market segments, managing the R&D portfolio becomes even more complex. The need to balance the development of technologies that address different market segments causes complexity in the project portfolio. When concentrating on multiple markets, there is an increased risk of a misalignment between R&D efforts and overall business strategy due to a lack of structure in portfolio management. Cooper et al. (1997b) argue that there are no one-size-fits-all solutions for portfolio management. However, the study will incorporate consistent best practices that are common among high performers in this field (Cooper et al., 2001).

The purpose of this master's thesis is to explore an alternative approach to crossing the chasm, one that involves adopting a multiple market strategy instead of the traditional beachhead strategy. A case study on PowerCell, a hydrogen fuel cell company that has chosen a different route to bridge the gap, serves as the basis for the investigation. The crucial problem of managing a complex R&D portfolio within the framework of a multiple market strategy is also addressed in this paper by bridging insights from portfolio management theory and technology adoption literature.

## 1.1 Background

In an ever-evolving world, climate change is more pressing than ever. The most urgent environmental challenge the world is facing today is the increasing concentration of greenhouse gases in the atmosphere. The great utilization of fossil fuels, such as coal, oil, and natural gas, for energy production and industry has led to a rapid rise in carbon dioxide emissions, leading to global warming and climate change (Arora, 2020).

In recent times, rising temperatures and more frequent weather events have led to melting ice caps, rising sea levels, and more long-term aridity. The world's cities are the worst affected by the climate and air pollution crisis. As urban populations continue to expand, millions of individuals are exposed on a daily basis to toxic air pollutants that have been linked to respiratory and cardiovascular diseases. Regions

that previously experienced stable climates are now facing erratic weather patterns, which are having a detrimental effect on agriculture, water resources, and infrastructure (Yoro & Daramola, 2020).

As one of the biggest contributors to global warming is the energy production of fossil fuels, one must find solutions to mitigate global warming and the emissions that occur. Fossil fuels, which are most commonly used today, provide high energy density, meaning they generate much more energy per unit weight than renewable sources. It also has a well-developed infrastructure, i.e., existing pipelines and gas stations, making it easy to use (Martins et al., 2019). The major issue with fossil fuels is the significant carbon dioxide emissions that occur when they are used. It is also the most significant contributor to climate change (Wuebbles & Jain, 2001).

Instead of using traditional fossil fuels, one solution could be to use renewable energy sources (Abbasi & Abbasi, 2012). Renewable energy sources provide a sustainable and natural solution by providing power from sources such as the sun, wind, and water. Unlike fossil fuels, renewable resources do not produce harmful emissions or contribute to environmental degradation. They also reduce dependence on finite resources, ensuring long-term energy security. Additionally, technological advancements have made renewable energy more accessible and economically viable, thereby driving innovation and new opportunities in the energy sector (Kabel & Bassim, 2020).

Over the last decade, the battery industry has developed rapidly. The development in both driving distance and lifetime of the battery has been a big focus for the battery to be able to compete with fossil fuels on the market. With its zero emissions, it has a significant advantage over fossil fuels. Furthermore, batteries have high energy efficiency, which means they convert more energy into usable power compared to other solutions. Although there has been an improvement in lifetime and traveling distance over the years, significant concerns remain. The batteries are not as competitive in traveling distance compared to fossil fuels, and additionally, there is a lack of infrastructure for battery consumption. Charging stations are still under development and are not expected to match the demand on the market, as the expansion of charging networks has been slower than the rapid growth of electric vehicles adoption (Kumar et al., 2023).

According to Shu et al. (2023), hydrogen fuel cells (HFCs) are promising. They could be a favorable option for renewable energy due to their advantages in high energy density, efficiency, and sustainability in the future. Hydrogen fuel cells turn hydrogen and oxygen into electricity, with water and heat as the only byproduct, making it a zero-emission solution. The study says that HFCs outperform other energy storage technologies like lithium-ion batteries, pumped hydro storage, and flow batteries. Because hydrogen can be stored for long periods using suitable storage systems, hydrogen fuel cells can serve as a valuable complement to batteries in the transition to a sustainable energy future.

This shift from fossil fuel to renewable energy is necessary from an environmental perspective and contributes to social, economic, and technological evolution change.

As industries and companies transform to more environmentally friendly energy solutions, they play a vital role in shaping a more sustainable future. This report will look at a company that has developed a renewable energy product. It will highlight its role in the move toward a cleaner and more responsible energy system (Kabel & Bassim, 2020).

With these climate issues in mind, many world leaders signed the Paris Agreement in 2015, a legally binding commitment to reducing greenhouse gas emissions (United Nations, 2015). Achieving these climate goals requires significant changes across industries, particularly in how energy is produced and consumed. As a result, technological shifts have become a central part of the global response to climate change.

One such shift is the transition toward hydrogen fuel cells, which PowerCell is currently pursuing. Unlike traditional technology shifts, where an emerging innovation outperforms existing solutions in key areas and naturally gains market traction, this transition presents unique challenges. Combustion engines still outperform hydrogen fuel cells regarding both machine and fuel costs. Additionally, the infrastructure for hydrogen remains underdeveloped. The real advantages of hydrogen technology are more long-term and are not immediately apparent to the end-user. This means that the technology itself may not be enough to motivate a shift toward hydrogen for potential users. Instead, external factors, such as alternative costs or external pressures, are likely needed to drive adoption. Interventions from governments and international organizations like the EU and UN primarily shape these factors.

This phenomenon isn't a completely new concept. Policy-driven technology shifts have existed before, one example of this is the electric vehicles (EVs). EVs are often more expensive than fossil fuel-based vehicles, with other difficulties such as short battery times and a lack of infrastructure (Ehsan et al., 2024). To facilitate the adoption in China, the government used aid and policies to make it more advantageous. Ehsan et al. (2024) found that two types of policies were successful, financial and preferential policies. Financial policies are easily defined. The Chinese government made EVs cheaper than the market price through tax deductions, etc. Preferential policies revolve around making the usage and feeling of usage of the EV better than the alternatives. In the specific case of EVs in China, these policies were, for example, better parking options, since vehicle parking is a large problem in many places, and creating a better EV infrastructure with more charging stations (Ehsan et al., 2024). These types of policies in terms of helping the adoption of hydrogen are, of course, positive for PowerCell. There is, however, a type of policy that is part of the preferential policy that has not yet been discussed. This is when a government or international organization makes it worse or more expensive for the technology currently in a dominant position. Ehsan et al. (2024) mention how the Norwegian government has a plan to limit the sales of fossil fuel-driven cars by 2025. This could also be done through, e.g., a carbon tax, where a company has to pay a tax per the carbon pollution they produce (Metcalf, 2021). These policies can be implemented based on different market segments, regions, etc., and it is hard to predict what types of policies will be introduced and when they will be implemented. As a result, an environment is created where it is unclear which market segment will be the first, and

the largest, to embrace hydrogen fuel cells. This, in turn, makes it hard for PowerCell to commit fully and target a specific niche.

Geoffrey Moore (2014) “Crossing the Chasm” theory describes technology adoption as an S-shaped curve comprising five segments: innovators, early adopters, early majority, late majority, and laggards. Between the early adopters and the early majority lies a potential “gap” or “chasm” where many technology firms fail to adapt their offerings for a broader customer base.

It is challenging to pinpoint a firm’s exact position on this curve. There are compelling arguments for and against the notion that PowerCell is currently in this challenging position. Historically, PowerCell has supplied fuel-cell stacks primarily for research and pilot applications, where customers seek technical pre-validation and proof of concept. The technical validation achieved in these early projects, combined with growing framework agreements and the first volume deliveries, suggests that PowerCell has at least transitioned from the innovator phase into the early adopter phase. At the same time, the company has introduced standardized product lines and secured its first larger commercial orders, key indicators that it is beginning to “Cross the Chasm,” i.e., move from niche usage toward its first broader customer base. At the same time, efforts to build production capacity and refine manufacturing processes further demonstrate PowerCell’s preparation for a larger market. It’s also clear that at least some of the current customers of PowerCell require more of a complete solution than before, which is a trait of the early majority. Taken together, these signs indicate that PowerCell is at least starting to move closer towards the early majority as described in Moore (2014), meaning that they are approaching the chasm.

The focus of this master’s thesis is to explore an alternative approach to Moore’s beachhead strategy for crossing the chasm, an area that still seems unexplored in existing literature. One possible reason for this gap is that Moore’s *chasm framework* is not an academically established theory but a widely adopted business framework (Wood, 2017). In addition to presenting an alternative strategy, this thesis will examine one of its showcased challenges: structured portfolio management, providing a more comprehensive understanding of the strategy. The case study focuses on the Swedish hydrogen fuel cell company PowerCell. PowerCell was founded in 2008 as a spin-off from Volvo and has since worked on designing and developing fuel cells to compete with combustion engines. In recent years, the company has transitioned from research projects together with customers towards commercialization, securing major orders in both the aviation and marine sectors.

## 1.2 Problem Statement

PowerCell operates in an industry working towards a significant technological shift, with hydrogen fuel cells starting to commercialize but still facing cost and infrastructure challenges to compete with the traditional products on the market. As the company is moving beyond the early adopters, it now must navigate the critical phase of *crossing the chasm*, where the company proceeds from niche markets to more mainstream adoption. The current most established strategy suggests that

firms should specialize in a single market segment before expanding to the early majority (Moore, 2014). However, PowerCell has chosen a different path, pursuing multiple markets simultaneously rather than focusing on a single niche.

This unconventional strategy is primarily driven by two reasons, first, the technical similarities between the technology across market segments allow for flexibility without needing significant product modifications. This creates a situation where the company can focus on multiple niches instead of one without demanding much additional resources. Second, uncertainty about which market segment will scale first makes diversification a way to remain prepared for a demand increase in multiple market segments. While this strategy provides agility and adaptability, it also introduces some strategic challenges. One such challenge is ensuring that the company's R&D investments remain aligned with its overall strategic vision. The multiple market strategy increases complexity in prioritizing and balancing R&D projects, potentially leading to a lack of a holistic understanding of the R&D project portfolio.

A holistic view of the R&D portfolio, looking at it as a whole system, is vital for two main reasons. First, it balances various factors, such as avoiding too many high-risk projects. Second, it helps with implementing the company's strategy. The R&D strategy is executed through the project portfolio, and a holistic view helps align this implementation in a structured manner (Cooper et al., 1997a).

The complexity of portfolio management increases with the choice of a multiple-market strategy because a broader market focus easily leads to a wider R&D scope. Companies still in the early stages of commercialization often have limited resources, making it key to maximize the value of R&D investments (Cooper et al., 2001). Additionally, as Teller et al. (2012) point out, coordination and formal structure become even more important when portfolio size increases and projects are interdependent in terms of knowledge and resource usage. This is particularly relevant for companies like PowerCell, which target multiple markets and benefit from significant synergies in their R&D efforts.

### 1.3 Purpose and Research Questions

The purpose of this study is to analyze how firms, with a case study on PowerCell, can move beyond the traditional "beachhead" strategy for crossing the chasm and instead adopt a multiple market segment strategy. While the common approach to overcoming the chasm is that companies should specialize in a single market segment before expanding, PowerCell pursues a multiple market strategy to remain adaptable to multiple potential demand surges. This study aims to examine the reasons behind this strategy choice, as well as the key strategic challenges it introduces.

One major challenge resulting from this strategy is, as described in the problem statement, the complexity of managing R&D investments across multiple market segments while maintaining alignment with the company's strategy. To address this, the study will explore how structured R&D portfolio management can support firms

using a multiple-market strategy. This study will look into how Powercell, a company employing a multiple-market strategy, structures its portfolio management and compares it to established theory.

This study builds on a main research question that, in turn, has three sub-research questions supporting it.

#### Main RQ

- How can a multiple-market strategy help firms cross the chasm, and how can R&D portfolio management support this transition?

#### Sub RQ

1. What are the reasons for a firm choosing a multiple market strategy to cross the chasm?
2. How does the implementation of a multiple market strategy influence a company's R&D project portfolio?
3. How does project portfolio management in a firm using a Multiple Market Strategy compare to project portfolio theory?

## 1.4 Limitations

Some limitations have been made in order to contribute to the current literature on the subject. The strategy suggested in this master's thesis is presented as an alternative strategy for crossing the chasm. It is not argued to be a superior strategy to the beachhead but rather as a viable choice if certain criteria, discussed in this thesis, are met.

This master's thesis assumes that PowerCell is crossing the chasm. However, pinpointing exactly where a company is on a diffusion curve is not an exact science. A company's position on the curve depends on multiple factors, including customer adoption rates, market perception, and internal strategic decisions. Since these factors can be interpreted in different ways, the conclusions drawn in this thesis should be seen as indicative rather than definitive.

Another clear limitation of this study is its relatively short duration, approximately five months. This has two main implications. First, it limits the depth and breadth of the research that could be conducted. Second, the findings represent only a snapshot of a specific moment in time for both the company and the industry. The hydrogen fuel cell market, as well as PowerCell as a company, are both highly dynamic. As will be discussed later in this thesis, PowerCell is currently undergoing changes in how it structures its project selection process. Therefore, a similar study conducted in the future may yield different results due to these ongoing developments.

One additional limitation of this study is the lack of consideration of investor influence on PowerCell's strategic direction. Since PowerCell is a publicly listed company, it is reasonable to assume that its shareholders and other stakeholders may exert influence over strategic priorities, either formally through board representation or

informally via shareholder expectations. However, investor influence was not a focus of this research and was not discussed in interviews or included in the analytical framework. As such, this study does not account for the potential impact of ownership structure or capital market expectations on the choice to pursue a multi-market strategy or the way portfolio decisions are made. Future research could explore how investor preferences shape strategic flexibility, risk-taking, and resource allocation in similar technology-driven firms.

## 2 Theoretical Framework

Since the research questions address several theoretical domains, this chapter provides a structured review of the literature relevant to the study. The framework is built around two core areas: strategies for crossing the chasm in high-tech markets and R&D portfolio management. Moreover, the chapter addresses complementary ideas, including diverse market segment approaches and shared technology applications in segments. These sections collectively form the theoretical groundwork to understand how a multiple-market strategy affects firms' strategic choice and portfolio complexity, as seen in PowerCell. Lastly, the chapter looks at the connection between project portfolio management and a multiple market strategy

### 2.1 Crossing the Chasm

Everett M. Rogers' book, *Diffusion of Innovations* (2003), presents a detailed framework explaining how innovations spread through a population over time. Rogers diagrams the sequence of adoption chronology, revealing how new ideas or technologies transfer from pioneers into mainstream society's acceptance. The process follows a pattern that can be expected, illustrated by the S-curve, where there is continuous growth in adoption before the point of market saturation. Rogers puts adopters into five categories, each with unique traits that determine the speed and efficacy of innovation diffusion.

The innovators, the smallest but most venturesome segment, lead this process. They are the first to adopt a new technology, driven by curiosity and a willingness to take risks. They are well off financially, technically competent, and tied into research and development networks. They are motivated to adopt early by a desire for novelty rather than practical application. Nevertheless, their effect on the overall market is limited, as they are more interested in experimentation than in widespread usability (Rogers, 2003).

Following the Innovators, Rogers (2003) states that Early Adopters gain prominence in the diffusion process. These individuals, at times regarded as opinion leaders, are the ones who have the ability to see the innovation's potential and strategic advantage. Unlike the Innovators, who adopt technology due to its newness, the Early Adopters carefully examine its utility and impact. They play a critical role in endorsement as they legitimize the innovation and provide a way forward for increased adoption. They serve as the link between Innovators and the mass mainstream, informing the Early Majority that an innovation is not just a trend but a sensible, practical solution.

As the innovation gains credibility, it reaches the Early Majority, the first wave of mass adoption. They are realistic users who have the potential for adopting new notions or technology, but only when being tried and perfected by the Early Adopters. Before embracing an innovation into their business or lives, the Early Majority, who are naturally cautious, refer to case studies, word of mouth from colleagues, and visible benefits. Since their sheer numbers actually establish the tipping point when an innovation crosses the niche to the mainstream, they are responsible for speeding up

adoption. The transition from Early Adopters to the Early Majority marks a crucial phase in the diffusion process, as it determines whether an innovation will continue to scale or stagnate (Rogers, 2003).

Following Rogers (2003), at this stage, the adoption process concerns the Late Majority, who are more conservative and critical in outlook. This section resists change, only embracing innovation after it has gained universal popularity or due to external pressure, for example, competitive pressure or regulatory requirements. As opposed to the Early Majority, who seek competitive advantages, the Late Majority is driven by necessity, and they will wait until the prices drop, the technical issues are resolved, and the innovation is well-established. Their adoption signifies market maturity when innovation reaches saturation, and growth begins to slow.

In conclusion, the diffusion process ends with those who comprise Laggards, the last, most resistant group in the diffusion process, as they accept innovations only when there is no other option. Generally, Laggards are the most sceptical of new technologies and prefer more traditional solutions using long-established practices. Sometimes, their reluctance can also result from financial and access issues to information or rooted inertia. They tend to accept an innovation at a later date when the existing technology becomes obsolete. Adoption usually occurs when there are major shortcomings in the older systems and there is no reliable way to fulfill their needs (Rogers, 2003).

Rogers (2003) model explains how innovations do not diffuse uniformly but pursuant to a formalized, staged process, by social forces, perceived advantages, and market conditions. The S-curve depicts the process, with the gradual early adoption, steep rise as mainstream users accept, and the eventual plateau when adoption is at its limit. The dynamics between these groups of adopters determine if an innovation is effectively diffused into society or not. Through such an understanding of the distinct features of every group, organizations, policymakers, and change agents can formulate plans that make adoption easier, ensuring that innovations reach their maximum potential in ushering change within industries and societies.

Geoffrey A. Moore took this approach further in his book *Crossing the Chasm* (2014). Moore describes the chasm as a wide gap between early adopters and the early majority in the Technology Adoption Life Cycle. The Chasm is described as a phase when new technologies face a challenging process to reach the next stage in the technology adoption lifecycle. The challenge many companies face is the failure to bridge the expectation gap, resulting in the technology never gaining mainstream success. Many technological firms fail at this point since they believe momentum from early adopters will flow naturally into the mainstream market. But the early majority has very different expectations, and those companies that fail to shift strategies frequently find themselves in the chasm and unable to cross over to mass acceptance.

Early adopters, according to Moore (2014), are visionaries who welcome innovation for its possibilities even if the product is still under development or testing. Their view of long-term strategic value in technology drives them to be ready to take risks.

Prospective buyers will not buy a product without being exposed to compelling customer testimonials and a well-designed solution that is compatible with their established operational practices. This fundamental difference in buying behavior constitutes the gap, the chasm, that companies must cross in order to make the transition from niche success to mainstream acceptance.

Moore contends that companies have to change from general, unfocused marketing plans to a very targeted segment, a niche, if they are to cross the chasm. Choosing a single niche market, sometimes referred to as the "beachhead," will help the business to become dominant before going any further. This targeted approach helps the business establish credibility and create strong customer references, qualities necessary to convince the pragmatic early majority to purchase. Companies should focus on being the unquestionable leader in one particular area instead of trying to appeal to several groups at once. Furthermore, Moore (2014) states that winning or establishing itself on the market creates a strong customer reference, which could help the early majority in the technology adoption lifecycle to accept the product. Additionally, after the company has established the beachhead on the market, it can expand the resources into other segments and enter new markets (Moore, 2014).

Although the strategy has worked for numerous companies, it does have limitations. Aaen & Nielsen (2022) argue that the primary danger is that the selection of a beachhead market which is too small, too fragmented, nor scalable may result in the firm being stuck in a niche with low potential towards more general acceptance. Similarly, Dos Santos Paulino & Gudmundsson (2024) found that in high-technology markets, early adopters tend to create barriers that hinder the transition to mass adoption, particularly when there is excessive product diversity and a lack of standardization. This suggests that an overly specialized initial market can slow broader diffusion rather than facilitate it.

Secondly, the expectation that an early adopter segment would automatically become a mass-market acceptance may be mistaken if the needs of early customers do not sufficiently represent a wider pool of customers. Dos Santos Paulino & Gudmundsson (2024) argue that early adopters' unique needs and demands for innovation do not necessarily reflect the requirements of mainstream commercial users, thereby slowing market diffusion. This stresses the importance of firms identifying market size, making sure that it is scalable, and developing an expansion strategic plan prior to investing all their funds in one segment (Aaen & Nielsen, 2022).

Aaen & Nielsen (2022) present a critique of the Crossing the Chasm framework by highlighting the case of BathroomBot, a startup that developed a robotic solution aimed at elderly homecare users needing toilet assistance. The company is a cautionary example of the risks associated with an overly narrow market-entry strategy.

BathroomBot's demise underscores the risks of too much investment in an untested and ultimately non-scalable market segment. The firm's strategy was to market a robot solution to elderly homecare customers who required assistance with toilet

usage on the assumption that this was a sufficiently large and homogeneous segment. BathroomBot's failure underlines the risks involved in too much reliance on a single market segment without testing for scalability and testing. Although the beachhead strategy may work, one has to implement it with a broad-based appreciation of market forces, user heterogeneity, and likely difficulties. Not only was the failure of the company not due to an inadequate product, but its failure was instead due to an inadequate entry strategy that failed to consider the intricacies of actual adoption processes (Aaen & Nielsen, 2022).

Additionally, Gans et al. (2020) argue against Moore's traditional beachhead strategy and point out potential pitfalls. A key critique the article points out is that a startup can easily get stuck in its initial beachhead and later on fail to scale up. Gans et al. (2020) elaborate that when a company is too focused on exploiting its beachhead in one market, the company could lose the incentive to innovate further. Additionally, the article argues that a company could lack the necessary capabilities to move beyond the initially decided niche and face difficulty in repositioning itself for larger, more lucrative markets. The authors strengthen their argument with a case study of Tesla. Tesla went beyond the beachhead strategy by prioritizing exploration over immediate exploitation. Instead of rushing to mass-market EVs, it focused on battery R&D, refining technology through the Roadster before expanding to the Model S, and eventually Model 3. By continuously improving battery efficiency, scaling production, and building infrastructure, Tesla ensured long-term innovation while gradually entering larger markets (Gans et al., 2020).

## 2.2 Diversified Segments

The following section explores why companies can benefit from adopting a more diversified market segment strategy rather than relying solely on a single segment. By broadening their approach, businesses can enhance resilience, reach a wider audience, and capitalize on emerging opportunities.

During the transition from early adopters to the mainstream market, an organization is presented with a high level of uncertainty about which market segment will emerge as its first broad user base. Lysek (2020) points out that companies in the past have not been able to forecast well which segment would be most advantageous for them to transition into the mainstream market. Therefore, it is prudent to examine various opportunities. Furthermore, this view is also corroborated and further developed by Shepherd and Gruber (2020), who argue that a significant proportion of startups overestimate the market they are looking to penetrate first, and that over 70% of early-stage businesses end up serving other segments than originally planned. They emphasize having to evaluate numerous market opportunities rather than making commitments of resources too early to a particular market, since this enhances the prospects for uncovering those of highest potential.

By testing several segments rather than targeting a single market, a company can learn valuable lessons, tweak its positioning, and adjust its strategy based on genuine market responses. Shepherd and Gruber (2020) suggest this adaptive strategy from the perspective of real options logic, where startups are encouraged to

make incremental, staged investments across several segments to test and learn prior to expanding operations. This diversified segment approach facilitates dynamic redistribution and rapid reallocation of resources based on empirical learning, substantially improving the startup company's capacity to handle uncertainty.

According to Sun & Govind (2017), businesses are continuously under pressure to choose between focusing on a small number of market segments or diversifying into multiple markets in today's fast-paced business environment. Given that operating investments, sales initiatives, and marketing expenditures are spread across several product markets, market emphasis is essential to this decision-making process.

Market emphasis refers to the extent to which a company focuses on specific markets compared to others. Some companies serve several market segments but heavily invest in a few, while others allocate their resources more equally. Sun & Govind (2017) point out that market turbulence, characterized by rapid technological shifts, changing consumer preferences, and regulatory unpredictability, presents a significant challenge to companies that are overly reliant on a single market segment. In such situations, it is necessary for companies to be flexible and diversify their presence in other market segments to reduce risk and enhance resilience.

Furthermore, Sun & Govind (2017) state that firms that are overly concentrated in a single market segment are particularly vulnerable to disruptions and also restricted in their responses. In contrast, firms carrying out diversified operations have the avenue of being able to shift strategies, reallocate investments, and identify new opportunities, consequently sustaining long-term stability.

Additionally, Sun & Govind (2017) state that companies that do not distribute their focus evenly across markets might experience greater financial and strategic risks, especially in unstable industries. The investigation finds that firms that place too much emphasis on a small number of markets during expansion into a range of markets create operational inefficiencies and investor uncertainty. This imbalance may create an environment for brand inconsistency, incomplete knowledge across markets, and disconnection with consumer expectations, adding to firm-specific risk (idiosyncratic risk).

A case study by Lysek (2020) shows that Nokia historically diversified across multiple sectors, including forestry, electrical power, rubber, cable, and electronics (Steinbock, 2001, as cited in Lysek, 2020). This diversification protected the company during downturns in certain industries, allowing it to sustain operations in the long term. However, in later years, Nokia abandoned diversification and became heavily dependent on mobile phones. When the smartphone market grew exponentially, Nokia could not react, had no alternative revenue streams, and ultimately lost its market leadership role (Sikka, 2016). This example demonstrates how failing to diversify can restrict long-term development and increase susceptibility to market disruptions.

Lysek (2020) argues that firms with a diversified strategy can disperse risk and enhance their potential for maintaining income. The article contends that companies with a presence in several market segments are more likely to thrive through industry

transformations, as they are not dependent on one product or market need. This is congruent with Mendoza-Abarca & Gras (2017) findings, where diversification strengthens organizational survival because companies can pivot when one segment does not do well. The previous success of Nokia was due to the fact that it diversified across industries such that where one would collapse, the other maintained the company afloat (Steinbock, 2001, as cited in Lysek, 2020). Similarly, Mendoza-Abarca & Gras (2017) highlight how diversified organizations can adapt to uncertain environments, making them more resilient to market fluctuations. Good diversification also allows companies to ride on their current abilities, such as distribution networks, channels of sales, and reputation, when they need to venture into new markets without incurring additional costs. The Nokia example illustrates that although diversification involves investment, it can ultimately protect a firm's long-term survival by offering several channels for growth and adjustment.

## 2.3 Shared Technology

Sharing core technologies within various product segments or markets is a widely practiced strategy within large industrial groups and business organizations. The strategy is also known as technology communalise, whereby different technologies are applied across various product classes, divisions, or geographic markets (Sköld & Karlsson, 2012). At an organizational level, technology sharing can potentially create significant benefits but also poses strategic issues that must be carefully managed.

### 2.3.1 Strategic Advantages of Technology Sharing

Among the main drivers for technology sharing across segments are economies of scale and scope for production and innovation. By using technology components, subsystems, or platforms within several different products or markets, companies can reduce R&D investments, reduce procurement complexity, and consolidate manufacturing processes (Prahalad & Hamel, 1990; Tatikonda & Stock, 2003). This is particularly relevant for those industries with highly advanced product systems with a considerable development expense and extended technical validation.

Sharing technology is also helpful for fast time-to-market because existing solutions could be adopted faster compared to entirely new ideas (Chesbrough, 2003). Internal knowledge exchange is also facilitated when cross-segment teams use a shared technology platform, so there is reuse of design knowledge, test outcomes, and support infrastructures (Frishammar & Hörte, 2005). At the portfolio management level, the strategy helps harvest the return on investment from core technologies by spreading their value across several applications (Chiesa & Manzini, 1998).

In addition, shared technologies improve organizational learning. According to Iansiti & West (1997), companies that excel at integrating and implementing technology, rather than creating it, tend to surpass companies that concentrate on new development only. Shared technologies foster cross-functional and cross-unit interaction, strengthening internal alignment and process integration.

### 2.3.2 Challenges and Strategic Trade-Offs

Despite the advantages, technology sharing across different segments has several risks and limitations. At the forefront is the threat of differentiation loss. When there is shared technology across a spectrum of market segments, companies might struggle with accommodating unique customer requirements or with having differentiating brand identities (Porter, 2008). This is most pronounced for specialist or premium markets, where differentiation by specific performance features or brand is necessary.

One problem is that of technical and architectural compatibility. Technologies conceived for one area may not be easily transferred to the requirements of operation, regulation, or the environment of another. A technology designed for ground vehicles, for example, may require substantial reconstruction or sacrifice performance when applied to the needs of aerospace, naval, or other applications. As Thompson (1967) and Tushman & Nadler (1986) comment, technology path dependencies may inhibit the flexibility of cross-application when systems are highly coupled or optimized for a given environment.

In addition, dynamics within organizations are also likely to discourage technology sharing. Business units are likely to be resistant to shared platforms where they feel their autonomy, strategic maneuverability, or innovative capabilities are being threatened (Steensma & Corley, 2001). Internal rivalry, brand autonomy, and politics usually condition the willingness of units to cooperate even where technology synergies exist, as noted by Sköld and Karlsson (2012).

Finally, the strategy encompasses systemic risk. A failure in a primary common technology could have a domino effect within multiple segments, causing recalls, reputation issues, or regulatory issues. This risk is even greater for safety-critical industries such as aerospace, automotive, or energy, where failure in a given area could contaminate trust in other areas (Teece, 1977).

### 2.3.3 Technology Sharing as Portfolio Strategy

According to strategic technology management theory, technology sharing between segments is not a binary alternative but rather a portfolio choice (Sköld & Karlsson, 2012; Chiesa et al., 2000). The organizations have to balance the advantages of standardization and reuse with the requirements for flexibility, innovation, and differentiation. By classifying technologies into stages of maturity, strategic role, and feasibility, companies may create technology-sharing plans that suit their overall business goals.

This perspective emphasizes a dynamic, context-driven technology management in which some technologies are shared widely for efficiency reasons, but some are purposefully protected for competitive reasons. Successful governance across the portfolio is designed to ensure that shared decisions are technically accurate, strategically rooted, and organizationally facilitated.

## 2.4 Project Portfolio Management

Portfolio management can be defined as “a dynamic decision process, whereby a business’s list of active new product (and R&D) projects is constantly updated and revised. In this process, new projects are evaluated, selected, and prioritized, existing projects may be accelerated, killed, or deprioritized; and resources are allocated and reallocated to the active projects” (Cooper et al., 1997a). The portfolio management process includes multiple decision-making processes with recurring reviews of the complete portfolio, making go/kill decisions on individual projects, and overhauling R&D strategy, rework being a few of them. The process of portfolio decision-making is characterized by a complex environment where ever-changing and uncertain information is combined with a dynamic environment where opportunities, goals, and strategy must be taken into consideration (Cooper et al., 1997a).

While some sort of single project evaluation model is often part of the portfolio management process, it does not answer the same question and give the same answer. While project evaluation models value how well a specific project performs independently, it does not take into account the interdependency between projects (Brunner et al., 2008). In addition to this, project model evaluations do not look at resource allocation division between projects. With this in mind, it leads to a situation where the highest performing projects according to project model evaluations are most of the time not the optimal route to go (Brunner et al., 2008). Derived from this, portfolio management is primarily important for large portfolios that are interdependent (Teller & Kock, 2013). This is because of the costs associated with implementing portfolio management, and the smaller difference between portfolio management and single project evaluation models when there are smaller interdependencies.

According to Cooper et al. (1997a), there are three main goals of portfolio management: value maximization, achieving the right balance and project mix, and aligning the portfolio with the company’s business strategy. Different companies have varying focuses on each of these three goals, which can often be recognized by what types of tools used for the decision-making processes. This view of the portfolio objectives is confirmed by Teller & Kock (2013): “The project portfolio management objectives are well established in literature: the maximization of the portfolio value, the balance of the portfolio, and the project alignment to strategic goals” (Teller & Kock, 2013).

According to the results of Cooper et al. (2001), no single method for portfolio management gives better end results for the companies in their survey. The study did, however, find a few aspects that were consistent for high performers.

*Importance of portfolio management:* The companies that valued portfolio management more highly had better results than those that did not. *Explicit portfolio method:* Companies that had a clear, established method, which they used consistently, for how to value projects from a portfolio management perspective, performed better than those that did not. *Portfolio method used:* Overall, the best

performers relied much less on financial methods as the dominant portfolio tool, and instead more often used their strategy to allocate resources. *Multiple methods used:* Finally, the best performers tended to rely on a larger number of methods than the average in order to gain a larger picture, understanding that not one method can give a complete picture. In summary, having a balanced portfolio management structure that includes methods to measure projects not only individually but also in terms of balance between each other and alignment to strategic fit seems to have a positive impact on firm performance (Cooper et al., 2001).

#### 2.4.1 Formalization, Process and Governance of Portfolio Management

One factor of portfolio management that is mentioned by both Cooper et al. (2001) and Teller et al. (2012) is the formalization of portfolio management. The usage of an explicit portfolio method increases performance in a company (Cooper et al., 2001). The study that was made by Cooper et al. (2001) indicated a clear and consistent difference between good and bad performers in terms of how explicit the portfolio methods used were. According to Cooper et al. (2001), the best-performing companies rank higher than the worst in terms of a few categories:

- They have an explicit method for portfolio management.
- The management team buys into the method, which their action can see.
- The method has clear rules and procedures.
- The method treats projects as a portfolio, i.e, looks and treats all projects together as a whole.
- The method is consistently used across all suitable projects.

In addition, Teller et al. (2012) found that the formalization of both single project management and project portfolio management has a positive effect on PPM quality. The formalization of these processes increases transparency, quality, and speed of resource management (Teller et al., 2012).

Exactly how a company should formalize or structure its project portfolio management (PPM) process and governance system varies widely across firms and industries. However, Cooper et al. (1997b) have identified several process elements that appear to be common among firms with successful portfolio practices. These elements can be grouped into four processes of decision-making:

1. Corporate Planning: This refers to the high-level allocation of resources across broad functional areas such as R&D, marketing, manufacturing, and sales (Cooper et al., 1997b).

2. Business Unit Strategy Development: At the business unit level, strategy development focuses on continuously updating and clarifying strategic directions for innovation efforts and new product development (Cooper et al., 1997b).

3. The New Product Process: This is the operational level where individual R&D or innovation projects are evaluated and managed. A widely used framework here is the stage-gate process, in which projects progress through a series of structured stages, with defined decision points (gates) in between. At each gate, go/kill decisions are

made based on pre-established criteria such as strategic fit, technical feasibility, financial value, and resource availability. This framework enables disciplined project screening while maintaining flexibility for iterative learning. Importantly, Cooper et al. (1997b) argue that stage-gate decisions should include project-level considerations and reflect portfolio-level balance and strategy.

4. Portfolio Review: In addition to project-level gate decisions, a formal and recurring portfolio review process is necessary to evaluate the overall composition and strategic alignment of the firm's project portfolio. Ideally, because portfolio logic is already embedded in individual gate decisions, the portfolio review functions more as a refinement mechanism than a complete overhaul, with projects that are unfit for the portfolio not passing the first stages of the new product process (Cooper et al., 1997b).

#### 2.4.2 Value Maximisation Goal

The objective of this goal is to maximize the value of the portfolio through the allocation of the resources available. The value that is maximised is chosen by the company according to some company objective. Examples of these objectives could be long-term profitability, return on investment, some strategic objective, or a mix of multiple (Cooper et al., 1997a). There are also multiple different methods that can be used to maximise this goal. The most common methods often involve some sort of financial model or scoring model. Some examples of methods that are used in practice according to Cooper et al. (2002) are *net present value* (NPV), *expected commercial value* (ECV), *productivity index*, and *scoring models*.

The simplest method for maximising the value of the portfolio is to calculate the NPV of the projects and compare them to each other. The main weakness of this method is that it only takes into account the financial aspects without diving into other factors that might be relevant to whether a project is good or not. These other aspects could, for example, be probabilities, risks, and strategic considerations (Cooper et al., 2002).

The ECV method is a rather well thought out method that involves multiple aspects to value the projects. The ECV method uses a decision tree and considers aspects such as potential future incomes, probabilities of technical and commercial success, costs, as well as some sort of strategic importance factor to produce the expected commercial value of a project (Cooper et al., 1997a). This makes it a method that tries to look at multiple aspects of what should make a project more or less prioritized, making it a quite complete method for portfolio management. There are still some issues, mainly regarding the dependence on good financial and probability data. This data in early phases of a project planning is often unreliable or sometimes not even available, making the resulting expected commercial value unreliable (Cooper et al., 1997a).

The scoring model method is done by choosing a set of criteria and valuing the projects according to these criteria. The valuation often consists of setting a value between 1-5 or 0-10 in each criterion. The values are then often weighted based on

the importance of each criterion to create a list of all the projects that can be prioritized based on the total value of the scoring cards (Cooper et al., 1997a). Cooper et al (1997a) highlight how a real-life example of this scoring card can be divided into five categories: Reward of the company, Business strategy fit, strategic leverage, probability of commercial success, and probability of commercial success.

### 2.4.3 Balancing Goal

The balancing goal of portfolio management, according to Cooper et al. (1997a), is about achieving balance in a few pre-decided parameters. The most commonly used method to showcase balance is visual charts. The methods most widely used are bubble diagrams, as well as pie charts and histograms. Bubble diagrams are an adapted version of the widely used four-quadrant BCG. These diagrams plot the existing projects as the “bubbles” with the 2 dimensions being different parameters in which the company wants to find balance. By plotting the bubbles in different sizes, companies can also showcase a third factor of liking, eg, annual resources spent on the project.

There are many ways a company can achieve balance. The most common balance diagram used is the risk-reward diagram. This is commonly demonstrated with a bubble diagram where one dimension is the estimated reward, the other being the probability of success, and where the size of the bubble often represents the annual resources spent or projected to be spent on the project (Cooper et al., 1997a). In addition to this, Cooper et al. (1997a) list nine factors they see as used in practice and are worth considering when trying to find a balance in the portfolio. All these nine factors can be put together as the aspects of a bubble diagram.

- Fit with business or corporate strategy.
- Inventive merit and strategic importance to the business.
- Durability of the competitive advantage.
- Reward, based on financial expectations.
- Competitive impact of technologies (base, key, pacing, and embryonic technologies).
- Probabilities of success (technical and commercial success).
- R&D costs to completion.
- Time to completion.
- Capital and marketing investment are required to exploit

Apart from the usage of bubble diagrams, other methods to showcase balance exist, such as pie charts and other types of diagrams. Cooper et al. (1997a) mentions that companies use these to look at balance in factors such as short term vs long term, balance of release dates, timing in regards to cash flow, project types such as incremental vs radical or other, as well as balance in eg market segments, product types and technology (Cooper et al., 1997a).

While there are many upsides to using diagrams in the search for balance, there are also some downsides and risks to be aware of. Three of these problems mentioned by Cooper et al. (1997a) are:

- Too much information. It's important to avoid the temptation of too many maps and charts.
- The balancing methods mainly visualize information, not complete decision models. Decision makers still need to interpret and evaluate the information on display.
- Uncertainty what the “right balance” is. Without a clear understanding of how a desired balance looks like, it's hard to evaluate if the portfolio is balanced.

#### 2.4.4 Strategy Alignment Goal

The strategy alignment goal of portfolio management is to make sure that the project portfolio reflects the company's business strategy. Strategy is applied first when money is spent based on the strategy. Without alignment between this, the strategy is just empty visions without any clear effect on the company as a whole (Cooper et al., 1997b). Cooper et al. (1997b) state that there are two main ways to look at the link between strategy and the portfolio. The strategic fit: If all projects are consistent with the business strategy, and the spending breakdown: If the resources allocated in different projects reflect the focus in the strategy. One common method to ensure that each project is consistent with the strategy is to incorporate strategic fit valuations in scoring models. Another method for this could be to have a set of “must-criteria” that must be met before moving to the next stage (Cooper et al., 1997b). Methods for ensuring the spending breakdown are often a little bit more complex. The strategic buckets method is probably the most famous method for this. This is a top-down approach where managers start from the company's strategy, creating different buckets built on criteria, into which projects are put. Managers then check if the actual money spent on each bucket is close enough to the desired spending according to the strategy (Cooper et al., 2002). The dimensions that these buckets are based upon can vary between companies, but some dimensions that are mentioned by Santiago & Soares (2020) are *Technology*, *Market*, *Capabilities*, *Organization process*, and *External environment*. These buckets could then be based on, for example, innovation level or between different market niches. One example of this is how one of the strategic goals of the company Natura was to increase portfolio diversification. Therefore, they implemented a bucket for radical innovations, which makes the portfolio consistent with strategy (Santiago & Soares, 2020).

#### 2.4.5 Negative Effects of Project Portfolio Management

Many of the issues that companies face in their new product processes can be derived from poorly incorporated portfolio management (Cooper et al., 2001). Cooper et al. (2001) found four main themes of negative effects of badly implemented portfolio management that exist within companies:

*No focus*: One effect of bad portfolio management is a reluctance to kill projects. If there are no clear criteria for go/kill decisions, many companies just keep adding projects to the ongoing project list. This creates an issue where resources are too thinly spread and a lack of focus in the R&D section. The result is often a decreased success rate and longer project times (Cooper et al., 2001).

*The wrong projects:* With poor portfolio selection models, the wrong projects are more likely to go through at the expense of better options. Decisions are, to a lesser degree, made on facts and data and instead on politics and opinion, leading to worse performance on the selected portfolio (Cooper et al., 2001).

*Low-value projects:* A third effect of bad portfolio management is leniency toward safer projects. Without a clear strategy, many companies drift toward shorter, incremental projects rather than searching for longer, higher-reward projects (Cooper et al., 2001).

*Strategic:* Cooper et al. (2001) mention strategy implementation as the final effect. If strategic criteria are missing in the portfolio selection process, no strategic direction is implemented in the company's R&D. This leads to many strategically unimportant projects in the portfolio that are not consistent with the company's strategy (Cooper et al., 2001).

#### 2.4.6 Adaptability in Project Portfolio Management

While studies show a positive correlation between using a systematic portfolio management method and good performance in chosen criteria, there are still some questions surrounding the underlying assumptions of portfolio management (Martinsuo, 2013). Martinsuo (2013) argues that while previous studies see portfolio management as a systematic objective solution, there might be some issues with this. Instead, Martinsuo (2013) suggests that portfolio management should not solely be seen as a systematic and objective process but rather as a dynamic one. The dynamic process is influenced by constant adaptation to changing conditions, besides its systematic nature (Martinsuo, 2013).

This view is shared by Rodrigues Coelho et al. (2025), who say that the portfolio value is dynamic and is influenced by what stakeholders find to be most important at certain times. This dynamism requires that portfolio management processes are flexible and able to adapt based on changes in the internal or external environment (Rodrigues Coelho et al., 2025).

### 2.5 Connection Between Multiple Market Strategy and Project Portfolio Management

While the explicit connection between pursuing multiple market segments and portfolio management has not been widely studied, underlying relationships can be found in existing literature. Firms that focus on innovation breadth tend to face increased complexity in their R&D project portfolios (Klingebiel & Rammer, 2014), which in turn creates a greater need for structured portfolio management to ensure strategic focus and efficient resource allocation (Cooper et al., 2001). Additionally, diversification increases the need for coordination, as managing information flows and interdependencies becomes more challenging with increasing portfolio complexity (Sun & Govind, 2017). Teller et al. (2012) further emphasize that formalized portfolio management can help address these coordination challenges. Finally, diversification can serve as a risk-reducing strategy in turbulent markets (Sun

& Govind, 2017), where portfolio management plays a crucial role in strategic alignment and adaptability in the same type of environment (Rodrigues Coelho et al., 2025). This theoretical framework chapter examines how diversification strategies influence portfolio complexity and the role of portfolio management in addressing these challenges.

Klingebiel & Rammer (2014) resonate around how, in today's fast-moving markets, many products fail. These authors have found advantages in having breadth in the resource allocation and having a broad range of innovation projects. They argue that because companies often have little understanding about innovation projects' commercial viability, having a broad set of innovation projects might be advantageous, thereby hedging their bets against a wider range of customer demands. Klingebiel & Rammer (2014) do still see disadvantages of having a broad range of innovation projects, such as reduced managerial attention and a lack of strategic focus. In addition, companies often spread resources too thin with projects seen as unnecessary, taking resources from more important projects (Blichfeldt & Eskerod, 2008). Cooper et al. (2001) cite seven reasons of importance for portfolio management. One of the main advantages is strategy alignment, which then mitigates some of the issues that diversification might create. Another of the seven reasons mentioned is to achieve focus in R&D. Portfolio management can help focus resources on projects that matter the most, thus utilizing the available resources more optimally. This means that portfolio management, to a degree, can help mitigate the risks that a broad market diversification creates.

Rodrigues Coelho et al (2025) see portfolio management as a tool for strategic alignment, aiding adaptability in an environment with changing adaptable markets. At the same time, Sun & Govind (2017) argue that when market turbulence is high, a high diversification strategy decreases firm risk more than when market turbulence is low. Market Turbulence is defined as "the changeability, uncertainty, and unpredictability in the market that a firm is operating in" (Sun & Govind, 2017). These arguments show that when market conditions are uncertain, there are advantages to diversifying/ pursuing multiple markets, while portfolio management works as a tool for performance improvement in the same type of environment.

According to Sun & Govind (2017), a market diversification strategy creates a larger need for coordination. When a company is engaged in more markets, the information flow and understanding of it become more complex, making it a more difficult job than when pursuing a single market. Teller et al. (2012) highlight something similar when mentioning how an increasing portfolio size and strong interdependencies lead to a higher need for coordination. It is also mentioned that more complex portfolios have an even higher need for coordination. Teller et al. (2012) also mention that a potential solution to the coordination issue is the clear formalization of portfolio management.

### 3 Methodology

Bell et al. (2022) describe two different research studies, qualitative and quantitative research. Qualitative research is an approach that emphasizes understanding and exploring phenomena in their natural context. It is focused on obtaining an in-depth understanding of people's experiences, behaviors, perceptions, and interactions. Unlike quantitative research, which focuses on numerical data and statistical analysis, qualitative research seeks to uncover underlying motivations, cultural contexts, and the meanings individuals or groups attach to their experiences. This type of research is particularly effective when exploring complex, context-dependent phenomena that cannot be easily reduced to numbers.

In this study, when looking at how a firm can conduct a multiple market strategy, qualitative research was more suitable as it allows for a detailed exploration of the strategic decisions, challenges, and nuances of managing R&D across multiple market segments. Unlike quantitative methods, which focus on measuring predefined variables, qualitative research provides the flexibility to capture the complexities of decision-making in an uncertain and dynamic environment. This approach allowed for a deeper understanding of the human and organizational factors that shape strategic outcomes (Bell et al., 2022).

The research was conducted as an abductive approach, based on a modular methodology that combines empirical observations with theoretical implications to make sense of high-order or complex phenomena (Bell et al., 2022). In this context, this particular type of research was very suitable for this master's thesis, as it is of an exploratory and explanatory nature. The researchers want to understand why and how a firm like PowerCell approaches a different strategy than the general "beachhead" strategy by targeting different market segments at the same time. The abductive approach enables an iterative movement between data and theory, which differs from the inductive and deductive approaches. The inductive approach instead builds its theory from compiled data, which would make it difficult for this master's thesis to build its findings around. The deductive approach starts with a theory and tests it with specific data. This approach doesn't fit this master's thesis due to the focus of discovering new insights rather than testing an existing theory, which a deductive approach is more suitable for. The abductive approach enables an iterative interplay between theoretical concepts and empirical data (Bell et al., 2022). This allowed the authors to refine or extend existing models, such as those related to crossing the chasm and R&D portfolio management, based on concrete experience in real-world settings. Abductive reasoning is particularly well suited to this master's thesis, in that it encourages the development of contextually relevant meanings and practically effective explanations in a multidimensional and rapidly changing technological and strategic landscape.

This report was designed as a single case study on the hydrogen fuel cell company Powercell. A case study approach was selected due to the depth of knowledge that can be gathered through this approach. Case studies are intensive, meaning they comprise lots of details and depth in comparison to other research design methods (Flyvbjerg, 2011). Further, Flyvbjerg (2011) states that while case studies can not

provide reliable information for an entire class, they can provide hypotheses, which makes them a good choice in preliminary studies. This motivation made the case study a good fit for this master's thesis. One of the key objectives of this study was to demonstrate that alternative approaches to the beachhead strategy exist and may, in some cases, be preferable, rather than assuming it to be the universally optimal solution. Given this exploratory approach, a case study should be a good choice. Additionally, this master's thesis studied the connection between this alternative strategy and portfolio management. This is a connection that has not been widely studied before. This situation aligns well with Flyvbjerg (2011) view in early-stage research.

The company chosen for this master's thesis was Powercell. Powercell was chosen for several reasons. The company was in a commercializing phase, transitioning from working with early adopters to the early majority. It was found that Powercell has approached this gap differently compared to Moore's beachhead strategy. In addition to this, Powercell is working towards the commercialization of a product within a policy-driven technology shift. Hydrogen fuel cells are not yet and will likely not become fully competitive with combustion engines for many years. Instead, policy decisions, such as those from the EU, are creating this potential technology shift. This creates a market environment with large uncertainties and the potential for rapid shifts, making Powercell an interesting company to study in terms of the purpose of this master's thesis.

### 3.1 Data Collection

This master's thesis used some data gathering methods. These methods primarily consisted of three parts: qualitative interviewing, document gathering within the limits of PowerCell, and observation.

Within the work of this case study, a number of qualitative interviews were conducted to gather data. The majority of those interviews followed a semi-structured format. Semi-structured interviews consist of a set of open-ended questions. These open-ended questions were prepared in advance through an interview guide. While the interview guide was important to provide structure and help maintain focus in the interviews, it is also important to remain flexible. Bell et al. (2022) state that flexibility is key and that a good interviewer is able to rearrange questions to follow the flow of the interview while also remaining open to new perspectives and emerging topics. In addition to semi-structured interviews, unstructured interviews have also been conducted. These unstructured interviews played a key role in shaping the problem statement, serving as an initial foundation of data. The insights gained from these interviews contributed to the formulation of the problem statement and informed the development of the interview guide for the semi-structured interviews. Table 1 below presents information about the respondents who participated in the study. While the names of all participants are kept anonymous, their roles within the company are indicated to some extent. The only respondent whose exact role is disclosed is the CEO. This gives readers a clearer understanding of the context when responses are attributed to the CEO.

Respondent	Role	Number of interviews	Format
R1	Management team	3	On-site
R2	Management team	4	On-site
R3	Engineer	1	On-site
R4	Management team	1	Teams
R5	Management team	1	On-site
R6	Management team	1	Teams
R7	CEO	2	On-site
R8	Management team	1	On-site
R9	Management team	1	On-site
R10	Finance	1	Teams
R11	Sale	1	Teams
R12	Sale	1	On-site
R13	Engineer	1	On-site

**Table 1:** *List of respondents*

The interviewees were selected based on relevance to the research questions. 19 formal interviews were conducted with 13 employees of Powercell. This number consists of interviews with the majority of the management team, as well as some interviews with other people in the organisation. The interviewees were selected based on their relevance to answer the research questions. The employees outside of the management team that was interviewed were two persons from the sales team, two from the engineering/R&D team, and one business controller. Out of the 11 people in the management team, interviews were conducted with eight of them. The argument to not interview the remaining three was due to a saturation in response, along with the roles of these three people being deemed as not aligned with this master thesis. It is based on the goal to interview the majority of the management teams, which consists of 11 people, as well as some employees who are executing the company's strategy in practice. The five people not part of the management team were chosen through considerations of the employee's role, while also considering guidance from the author's supervisor at Powercell and suggestions from other interviewees. In addition, some employees were interviewed multiple times since additional data was required.

An extensive interview document was created and structured with different categories and subcategories, with questions under each part. The main categories used were the different research questions, with subcategories being, for example, technical questions and sales questions. In this large interview question document, all questions used in the interviews were written down in advance. Before an interview, an interview guide for the specific interviewee was created. Here, the authors of this master's thesis choose what categories and subcategories of questions would be included in the interview. By doing it this way, the authors were able to be both structured by using the same questions for answering the research questions, while remaining flexible between different interviews by choosing the

subcategories relevant for the interviewee, based on their role in the company, as well as their background and knowledge. An outline of the table of contents for this interview document can be seen in Figure 1 below.

<b>1 RQ1</b>	<b>1</b>
1.1 Technical questions customer applications	1
1.2 Technical questions engineering	1
1.3 Marketing/organizational questions	2
1.4 Sales questions	2
<b>2 RQ2</b>	<b>2</b>
2.1 Technical questions	2
2.2 Marketing/sales/organizational questions	2
<b>3 RQ3</b>	<b>3</b>
3.1 Broad questions about portfolio management	3
3.2 Questions about parameters in portfolio management	3
3.3 Questions about connection between portfolio management and strategy	3
<b>4 Introductory questions</b>	
<b>5. Questions surrounding own thoughts</b>	
<b>6. Concluding questions</b>	<b>4</b>

**Figure 1: Outline of interview document**

Another method of data collection that was used was the collection of secondary data. Secondary data is a data type that has already been collected by someone else and can be found in books, journals, documents, or in other forms (Mazhar et al., 2021). The primary secondary data that was used in this master's thesis are internal documents of PowerCell. This was primarily executed through a database search. The database used was the case company PowerCell's internal intranet. The search words used were derived either from the interviews or based on the research questions. Internal documents might also be handed to the authors of this master's thesis directly by interviewees in order to make the collection phase more effective. The internal documents used might be, for example, strategy documents, process descriptions, and manuals.

Apart from internal documents, other types of secondary data have been used. These types of data consist of, e.g., media outputs, investment analyses, and other forms of written data. These data types would primarily be used to contextualize the case company, PowerCell, and understand the hydrogen fuel cell market dynamics as a whole.

Lastly, the authors also used the method of observation for data collection. During the majority of the time of this study, the authors were located at PowerCells' offices in Gothenburg. Due to this, the authors were able to get close to the employees of the company, helping them to understand company culture as well as noticing both well-functioning parts of the company and potential issues. In addition to this, the authors sat in on multiple meetings of relevance, studying the cooperation, structure, and communication by themselves without the need for a respondent to describe it.

## 3.2 Data Analysis

“Qualitative data analysis is a process of the description, classification, and interconnection of phenomena with the researcher’s concepts” (Palic et al., 2016, p. 8). By analysing the data collected during the data collection phase, meaningful conclusions can be drawn, and the data can be categorized into different concepts. Two of the most common strategies for data analysis of qualitative data are thematic analysis and grounded theory. In this report, thematic analysis was the main approach that was chosen. Thematic analysis is done through finding patterns (themes) within the collected data, and it is then categorized accordingly (Clarke & Braun, 2016). Various techniques can be used to identify patterns, such as recognizing recurring topics or references to theoretical concepts (Ryan & Bernard, 2003). One of the key advantages of thematic analysis is its flexibility and applicability across many types of studies and methods of data collection (Clarke & Braun, 2016). This was the main reason why this strategy was chosen for this study. Due to the varying types of research questions that this study includes, a flexible strategy for data analysis was a good choice.

## 3.3 Societal and Ecological Considerations

As this thesis aims to support PowerCell in addressing one of its key challenges, portfolio management, it can contribute to the company’s long-term business success. A more effective business strategy implementation at PowerCell could help increase the adoption of hydrogen fuel cells, which, in many cases, would replace combustion engines that emit carbon emissions and other harmful pollutants.

This thesis work with PowerCell aspires to contribute to broader environmental and societal benefits. Over time, its findings could aid efforts to combat climate change and mitigate air pollution, particularly in urban areas. Air pollution in cities is a significant societal concern, and by helping PowerCell improve, this thesis has the potential impact in which we address this issue. The widespread use of fossil fuels has led to severe air pollution, negatively affecting public health (Kampa & Castanas, 2008). Increasing the adoption of hydrogen fuel cells could help counter this, which is one of the positive effects this thesis aims to promote.

On another note, no long-range travel is required for the completion of this thesis. The majority of the work is conducted at PowerCell’s facility in Gothenburg, with the authors commuting primarily by bus and tram. At this stage of the thesis, no significant negative societal effects have been identified.

## 3.4 Ethical Considerations

Throughout the project, personal data and integrity protection were key considerations when conducting the study. To ensure that interviewees were treated with respect and could provide informed consent, they were contacted prior to the interviews to explain the purpose and the topics that would be discussed (Gajjar, 2013). Furthermore, the authors asked the interviewees for permission to record the interviews. Privacy and respect were key considerations of ethical research.

Therefore, the interviewees are anonymous to ensure that this is acknowledged (Gajjar, 2013). Additionally, the interviewees were able to review the collected data from the interviews. The purpose of this was to ensure and validate the collected data from an ethical perspective and add additional data or adjust the collected data (Gajjar, 2013).

In the early stages of the project, a substantial amount of time was invested in understanding the company, PowerCell, and the industry in which the company operates. This time was necessary to narrow down the scope of the project and also understand what the company and the students saw as enjoyable and reassuring to conduct the project. The project's first stage has thus mainly focused on Problem formulation, Purpose statement, and developing Research questions for the master's thesis. Additionally, the methodology phase has been structured to clarify how this project will be conducted. Furthermore, reading and learning have been done as a literature review of the topics that cover the project, simultaneously as the project has been formalized, and will also continuously be done as the project goes forward.

Supervision sessions with both supervisors from Chalmers and PowerCell are excluded and not explicitly shown in the time plan and Gantt chart. However, both parties have decided to hold meetings continuously as the project progresses. As of today, the plan is to hold weekly meetings with the supervisor on PowerCell and every other week with a supervisor from Chalmers.

## 4 Empirical Findings

This chapter presents the study's empirical results, based on in-depth interviews with key individuals at PowerCell. The findings explore how the company's R&D portfolio and strategic decision-making are shaped by its use of a multiple market strategy, and how these practices align with, or diverge from, established theories of project portfolio management (PPM). The chapter is structured to correspond with the three research questions guiding the study. Section 4.1 outlines the underlying reasons for PowerCell's choice to pursue a multiple market strategy, based on recurring arguments and motivations raised by the respondents. Section 4.2 explores the consequences of this strategy on the company's R&D project portfolio, with a particular focus on complexity, agility, and learning effects. Section 4.3 presents how PowerCell's current portfolio management practices compare to theoretical recommendations from portfolio literature. The findings are visualized in Table 2 below to provide a clearer overview for the reader.

Research Question	Subcategory	Subclassification
4.1 What are the reasons for a firm choosing a Multiple Market Strategy to Crossing the Chasm?	4.1.1 Same core technology across	
	4.1.2 Risk reduction through diversification	
	4.1.3 Synergies and learning effects between market segments	
4.2 How does the implementation of a Multiple Market Strategy influence a company's R&D project portfolio?	4.2.1 Increased complexity at portfolio level	4.2.1.1 Increased number of R&D projects
		4.2.1.2 Missed deadlines and cascading projects delays
		4.2.1.3 Interdependencies between projects and technology platforms
		4.2.1.4 Overengineering and split technical focus
	4.2.2 Agility and dynamic resource allocation	4.2.2.1 Responding to market uncertainty and maintaining optionality
		4.2.2.2 Dynamic reprioritization in portfolio execution
4.2.3 Positive cross-segment learning effects	4.2.3.1 Transferring knowledge and building organizational resilience	
	4.2.3.2 Strategic positioning in the value chain	
4.3 Powercell's Portfolio Management	4.3.1 Formalization of Portfolio Management	
	4.3.2 PowerCell's governance and leadership culture	
	4.3.3 Value maximization goal	
	4.3.4 Balancing goal	
	4.3.5 Strategy alignment goal	
	4.3.6 Issues with current portfolio management	

**Table 2:** Overview of empirical findings for research questions

## 4.1 What are the Reasons for a Firm Choosing a Multiple Market Strategy to Cross the Chasm?

The following section concludes the empirical findings and the data retrieved for the sub-RQ1. Respondents highlight three main reasons behind PowerCell's decision to pursue a multi-market strategy. These include the reusability of core technology, risk mitigation through diversification, and learning effects generated by operating in several market segments.

### 4.1.1 Same Core Technology Across Market Segments.

One of the most recurring arguments for why PowerCell has chosen a broad market strategy is that its core technology is easily applicable across the market segments they operate in. It is not the core technology (hardware) that has to be customized into the different segments, it is instead the whole system around the technology that has to be adapted so the product can meet the dynamics and commercial requirements for that specific segment. Many respondents highlighted that this makes it possible to operate over different market segments, instead of targeting a single segment. Furthermore, respondents pointed out that this benefit makes it easier for the company to start new projects. Knowledge has already been gained and can be used for new projects. PowerCell can reuse key technical components across multiple projects and segments without redesigning the product from scratch each time.

#### **R3:**

*"We don't have to reinvent the wheel every time in the early phases of new projects."*

### 4.1.2 Risk Reduction Through Diversification

During the interviews, the most common argument for the company targeting different market segments is due to the risk reduction through diversification.

The hydrogen fuel cell market is still developing and experiencing growth. Because of the early stages of this new technology, there are significant uncertainties in the whole market. Basically, the company and the market do not know which segments will establish and become a market first. According to the respondents, the main argument for being diversified and for the company to operate in many different segments is the uncertainty. The early stages of the technology have not shown any strong or clear signal that a specific segment is the most ready for the product. According to the respondents, the company is waiting for a clear indication that a segment is mature enough to break through as a distinct market. The uncertainty lies in not knowing what will influence the technology to become a strong competitor to the existing solutions on the market. Hydrogen technology has been a topic of discussion for a long time, but its maturity has fluctuated over the years.

Furthermore, the respondents express that they see enormous potential in the technology and what it offers, not just for the segments the company currently targets, but for many more. The broad approach that the company is pursuing is about minimizing the risk of allocating resources to the wrong segment or too few

resources to a segment that could quickly become a clear market. By diversifying across several segments and keeping many doors open, through developing knowledge in multiple areas and staying at the forefront of technology's development, the company aims to be ready when a clear market signal emerges.

According to the respondents, the technology and the product are ready to be commercialized. This has been confirmed, as the company has received its first commercial orders. The respondents explained that the factors surrounding the product are not yet mature enough for it to be fully commercial. Instead, these external factors influence the product's establishment in the market. These factors include, among other things, the infrastructure for the product, which is not sufficiently developed to support the product's utilization. The storage and refueling of hydrogen are not yet ready at this stage for the company's product to be commercially viable. Furthermore, one respondent explains that many different segments could use the company's product and technology, but the product has not yet established itself. The segments the company is targeting have enormous potential, but external factors are slowing the development of the technology.

The respondents further describe the industry as undergoing a "policy-driven technology shift." This means that significant changes surrounding technology are influencing the pace at which the market can become "ready" to adopt it. According to the respondents, "policy-driven" refers to the idea that technology can be supported in reaching the market by introducing new laws or regulations. Today, environmentally harmful energy sources such as gasoline and diesel combustion are still permitted, allowing actors to continue using what currently works. However, as environmental impacts increase and new laws or regulations, such as those from the EU, are implemented to limit the use of environmentally harmful technologies, this will help the company to strengthen its market position and reach out to customers. According to the respondents, the company's technology enables zero emissions during use. If regulations and policies concerning emissions and environmental impact become stricter, this could help PowerCell more easily enter the market and reach customers, since the company's technology produces no environmentally harmful emissions. As the requirements become increasingly strict, the respondents believe that market actors will view PowerCell as a good alternative and solution for their operations.

However, this transition from a technology that works today to a new one that people are unfamiliar with can often make customers feel concerned. Respondents explain that people are usually "afraid of change," which increases the difficulty of getting customers to accept a new technology that could replace the existing one. One respondent explains that people don't want to switch from something that works well today to something they know less about. Working across multiple segments allows PowerCell to convince people or customers who are "against" or afraid of change by showing that the technology works, not just in one segment, but across several. This can lead to a greater chance of convincing customers that the technology is applicable to their needs as well.

The respondents further explain that waiting for a market signal and operating across multiple segments makes the company agile. By operating in several segments, the company positions itself at the forefront of technological development, which enables it to respond quickly to unpredictable events. Since the market is still taking shape, this diversified approach provides the advantage of spreading risk and allocating resources while waiting for a strong signal to emerge from a particular segment. The ability to stay agile and allocate resources effectively is also emphasized by the respondents as necessary. The company firmly believes that market timing is a high priority. The respondents further state that the reason for operating across several segments stems from observing how competing companies have failed to bring their technology to market. Some competitors chose to focus exclusively on a single market segment and developed strong technological solutions with high product maturity. However, according to respondents, their timing did not align with market readiness. These companies were not able to shift their operations toward other segments in the way PowerCell has through its diversification strategy. As a result, they are now struggling financially, as the specific market they committed to has not yet reached sufficient maturity.

**R5:**

*“There has been an incredible amount of uncertainty about where fuel cells fit in... so we've been broadly positioned to be able to act when something takes off.”*

**R7:**

*“By being flexible, we are building a more resilient and scalable business - instead of depending on the growth of a single industry.”*

#### 4.1.3 Synergies and Learning Effects Between Market Segments

Having previously worked within one segment, the company gained valuable insight into how to enter a new segment and how to “navigate toward development.” When entering the marine segment, many new regulations, policies, and requirements must be met to advance the technology. According to one respondent (**R2**), the initial experience felt almost hopeless, and there was a strong urge to give up due to the overwhelming number of new demands and certifications that had to be fulfilled. However, after achieving success and making progress, the motivation returned, and the team continued to push forward.

This success made the company better prepared and more capable when entering the next segment, aviation. The aviation segment comes with even more regulations and policies. Still, since the company had already been through a similar process, they were better prepared and equipped to handle the situation. Having gone through this journey in one segment, the company could carry those learnings into the next, allowing them to navigate forward more confidently and effectively.

Another important insight from the interviews is that PowerCell deliberately adjusts its strategic role depending on the market segment. According to the respondents, in some markets, such as marine, PowerCell acts as a system integrator, delivering

complete solutions to the customer. In others, such as aviation, the company positions itself as a technology enabler, supplying core systems that the customer integrates into their products. This dual role strategy allows PowerCell to accumulate broader value chain knowledge and to remain flexible in how they position themselves commercially. By learning both how to lead system integration and how to support others' integrations, the company strengthens its technological and strategic capabilities across multiple industries.

**R4:**

*“We see synergies in how much 'reuse' there is of things we have already done... how much carryover we have from previous projects.”*

## 4.2 How does the Implementation of a Multiple Market Strategy Influence a Company's R&D Project Portfolio?

The following section concludes the empirical findings and the data retrieved for the sub-RQ2. This section presents how PowerCell's multi-market strategy affects its R&D project portfolio. Respondents describe both increased complexity due to resource coordination and interdependencies, as well as positive effects such as learning, agility, and strategic flexibility.

### 4.2.1 Increased Complexity at Portfolio Level

The most overarching effect of PowerCell's multiple market strategy is a significant increase in complexity at the portfolio level. Rather than increasing complexity within individual projects, the broader strategic focus across numerous market segments (e.g., marine, aviation, and stationary power) impacts how the complete R&D project portfolio is structured, coordinated, and managed.

Several respondents (**R1-R4**) highlight that pursuing several markets simultaneously inevitably leads to a larger number of parallel initiatives, each with specific requirements, certifications, and integration challenges. This expansion demands careful allocation of engineering, testing, and application resources across projects with different time horizons, technological demands, and customer expectations.

Beyond the increased number of projects, interviewees emphasize that interdependencies between projects, through shared technology platforms, testing capacities, or resources, create complex interdependencies, making coordination and prioritization significantly more difficult.

Delays in one project are often spread across the portfolio, as late deliveries or shared resource issues affect other initiatives. Furthermore, attempting to meet multiple customer needs simultaneously sometimes results in overengineering, where products become unnecessarily complex to satisfy all possible requirements, slowing industrialization and time to market.

**R4:**

*“Right now, we are probably in the phase of understanding the portfolios... It's part of a portfolio management that can then be developed.”*

4.2.1.1 Increased Number of R&D Projects

A common observation across the interviews is that it is believed that PowerCell's multi-market strategy leads to more active projects in the R&D portfolio compared to a single-market strategy. **R2** and **R3** explain that each new market segment or key customer typically demands development effort to address specific system integration or certification requirements. **R4** notes that this increase in projects places an increasing differentiation on PowerCell's engineering teams, who must split their focus across a broader range of initiatives, often without a proportional increase in available resources.

**R7** describes that while having more projects creates more opportunities, it also makes prioritization much harder. Many projects are commercially important, but not all can be fully resourced simultaneously.

Thus, the expansion into multiple markets not only stretches internal capacities but also forces the company to make more complex trade-offs between different technological and commercial opportunities.

**R4:**

*“How does this project affect the resource situation? We have projects that are between DP2 and DP5 - in the execution phase. If this new project is brought in, does it mean anything for the other projects?”*

4.2.1.2 Missed Deadlines and Cascading Project Delays

The ever-increasing complexity of tasks is also making it harder to meet deadlines for the R&D projects, negatively impacting the entire R&D portfolio.

Respondents illustrate that if a critical development team is stuck at the last finishing touches of one customer-specific integration, it may also postpone the testing and validation activities for another project relevant to a different segment.

**R3** emphasizes that because the dependencies are not clearly visible, it is very difficult to forecast where these bottlenecks can emerge until it's too late.

**R7** also supports that overshooting deadlines is not only an engineering problem, it impedes PowerCell from reaching the market when needed, invoicing and servicing clients, and controlling cash flow, therefore making time-to-market a strategically sensitive issue.

**R3:**

*“It often happens that one project affects another. It is difficult to keep to schedules because resources slip between projects.”*

#### 4.2.1.3 Interdependencies Between Projects and Technology Platforms

The respondents reveal that PowerCells' diverse market strategy creates increased interdependencies between projects and the different segments they operate in, which is due to the same core technology that is used across the different segments.

**R1** explains that while reusing a standard technology base (the fuel cell stack and associated systems) enables faster development, it also creates coupling between projects that would otherwise be independent.

**R4** highlights how changes made to adapt technology for one segment, like improving durability for marine applications, can introduce unintended consequences for other segments if not carefully managed. This sets off a chain reaction of complexity since choices made in one project can drown out negotiating costs in design for other projects.

**R2** emphasizes that these interdependencies are not readily apparent to most teams, making proactive management difficult and increasing the likelihood of technical or timeline conflicts that only become apparent during the later stages.

**R1:**

*“You have synergies, but it also means that you build dependencies. If you change something for one customer, you have to double-check that it doesn't cause problems for others.”*

**R2:**

*“You can't always see these dependencies in advance.”*

#### 4.2.1.4 Overengineering and Split Technical Focus

The last mechanism that portfolio complexity increases is the tendency toward overengineering and a split technical focus.

**R2 and R5** note that trying to satisfy different customers from distinct industries is often a case of “build a product that does everything,” even if not every capability is strictly required in every segment into which the product is marketed. Since both the market and technology are not yet fully mature, customers need to realize that some shortcomings in the product have to be accepted. There is no reason for over-engineering at this stage other than the need to define what is “good enough” for current needs. However, PowerCell will have to continuously enhance and refine its offering as the market and technology evolve and mature.

Furthermore, **R2** describes that chasing too many requirements simultaneously dilutes engineering focus, leading teams to spread their energy thinly across too many fronts instead of delivering highly optimized solutions for specific needs.

Pursuing multiple segments without clearly defined technical boundaries paradoxically reduces the speed and quality of R&D execution.

**R5:**

*“Right now we sell the same system to power generation, a backup installation, as well as to marine that has to run 6000 hours a year. It's overspecified for this backup application.”*

**R2:**

*“We try to face everything and everyone. But it's hard to do something really good when we have to run onto too many balls.”*

#### 4.2.2 Agility and Dynamic Resource Allocation

Several respondents emphasize that PowerCell's broad strategy enables a high degree of flexibility. Projects are reprioritized as market signals evolve, and the ability to shift resources across the portfolio is seen as key in a dynamic, policy-driven environment.

##### 4.2.2.1 Responding to Market Uncertainty and Maintaining Optionality

A recurring topic in the interviews is the importance of agility and dynamic resource allocation in managing an R&D portfolio shaped by a multiple-market strategy.

The nature of the hydrogen market is still immature, policy-driven, and unevenly developed by segments. Therefore, there is much uncertainty about which part of the market will develop first. In these conditions, interviewees emphasize that PowerCell must be capable of changing direction rapidly when there are indications of market readiness, and develop projects or reallocate resources accordingly.

Respondents underline this notion by describing PowerCell's strategic argument as one that first and foremost aims to preserve optionality. In this strategy, the firm invests consciously and step-wise in many spaces until clear market signals indicate a greater investment. By this strategy, the firm avoids risking premature or excessive investment in one space while, at the same time, maintaining development across many possible directions.

##### 4.2.2.2 Dynamic Reprioritization in Portfolio Execution

The requirement for flexibility extends beyond general strategic planning, it also directly manages internal resources across the research and development portfolio. Respondents indicate that project priorities need to be recalculated dynamically, even sometimes when the project is already in its operational stages, depending on customer readiness evolution, regulatory environments, or competitors' actions. Conventional long-range planning methods, like setting yearly project budgets, are increasingly perceived as too inflexible to accommodate the variable circumstances that come with multi-market expansion.

**R2** also emphasizes that such agility necessitates clear, early-stage decision points (e.g., feasibility and concept phases) at which projects can be accelerated or terminated. The respondent's point is that not making timely go/kill decisions diverts

precious resources and pushes out more viable initiatives. **R3** complements this by stating that without open and mutual knowledge about project status and continuation criteria, it is challenging to change direction as a team when circumstances change.

#### 4.2.3 Positive Cross-Segment Learning Effects

Respondents describe several examples of how working across multiple market segments has led to learning effects that benefit the R&D project portfolio. These learning effects include both technical knowledge transfer and broader organizational capabilities, as described in the following subsections.

##### 4.2.3.1 Transferring Knowledge and Building Organizational Resilience

Respondents indicate that operating across multiple market segments has not only increased project portfolio complexity but also contributed to cross-segment learning effects within PowerCell's R&D project portfolio. Several respondents (such as **R2**, **R3**, and **R5**) describe how experiences gained in one segment, particularly regarding regulatory processes, system integration, and customer-specific requirements, have been applied in other projects. According to the respondents, this has supported more effective execution of R&D activities across the portfolio and increased the company's confidence when entering new segments.

**R2** and **R3** cite the marine segment as an example, which had challenges in meeting complex regulatory and technical requirements at first. However, in time, the experience created internal routines, technical practices, and organizational confidence that would prove to be highly valuable when PowerCell entered the aviation segment with even stricter regulatory requirements. Such transferable knowledge lessens the time to ramp up, better prepares for, and reduces the chance of repeating mistakes of the past when going into a new field.

However, **R4** emphasizes that learning effects go beyond the bare technicalities. Instead, they elaborate on the concept of organizational maturity and resilience, in that teams form an approach towards addressing unfamiliar challenges. Instead of reinventing the wheel for every segment, PowerCell has learned to utilize specific tools, frameworks, and coordination measures, thus tackling uncertainty in a structured and efficient manner.

##### **R2:**

*"It was almost like giving up at the beginning. The requirements were completely new, rules and certifications we had never worked with. But then we found routines and were able to take that with us when we went into aviation."*

##### 4.2.3.2 Strategic Positioning in the Value Chain

Operating across several market segments contributes a further necessary consequence. The flexibility in how the company should position itself in the value chain depends on the maturity, structure, and request of each specific segment.

Respondents such as **R2, R5, and R7** indicate that PowerCell does not have a fixed commercial or technical position in all markets but varies its positioning according to segment-specific conditions.

In some segments, mainly marine and stationary power, PowerCell usually takes the system integrator role and provides complete, fully ready-to-deploy systems to the customer. This, again, gives the company control over the system architecture, integration process, and overall performance of the delivered solution.

**R5** also points out that in these segments, customers lack the technical competence or infrastructure to integrate subsystems themselves, so PowerCell's expanded role is required.

Conversely, in technologically advanced or highly regulated segments like aviation, PowerCell tries to be a technology enabler by providing core fuel cell systems installed by the customer or by a third-party system integrator. **R7** explains that this role allows PowerCell to focus on its technological strengths without taking on full-system risk or overextending into domains where others are more capable.

This flexible approach increases PowerCell's ability to address a broader range of customers and market types. It also increases the Company's strategic optionality. By scaling up or down its level of integration, the company can tailor its commercial offering to fit the capabilities and needs of each specific market, a valuable advantage when operating in an environment characterized by regulatory uncertainty, evolving standards, and varying customer readiness.

From a project portfolio management perspective, this role flexibility can be seen as a strategic asset. It allows PowerCell to adjust the scope, risk profile, and integration level of different projects within the project portfolio depending on the target segment. This enables a more dynamic balance between high-risk innovation projects and lower-risk integration efforts, helping the company align its project mix with strategic goals while managing resource allocation across distinct value chain positions.

**R7:**

*"In some segments, we act as an integrator ourselves... in others, we work with customers who take on the role."*

### 4.3 Powercell's Project Portfolio Management

The following chapter presents how PowerCell currently governs its R&D project portfolio according to the respondents. The chapter is divided into six sections that mainly corresponds to the *2.3.4 Portfolio management theory* chapter. This is done to aid the reader in its understanding of the chapter. Included in this section apart from PowerCell's current governance, are areas where respondents have a clear willingness to change its approach in the near future.

#### 4.3.1 Formalization of Portfolio Management

PowerCell, at the time of writing this thesis, does not use a complete formalized portfolio management method. They have, however, showcased a will to move in that direction. **R7** expressed an ambition to move towards a more systematic approach to portfolio management, describing how this area could have a real positive impact if managed well. **R2** sees some weaknesses in how they decide on projects today and highlights issues regarding how the people in charge of choosing the projects sometimes do not have enough information to make decisions with the whole portfolio in mind. The primary example brought up by **R2** is how the management group, and others in the firm, sometimes don't understand what consequences a 'go decision' on one project has for other projects in the future. **R2** expressed a lack of graphics or other types of information to showcase dependencies and effects of decisions to those who make decisions.

**R7:**

*"This is an area where we need to be more systematic going forward. Today, we do it organically and in a more artisan way. Can we make this more structured? We will benefit dramatically."*

**R2** does mention that these effects and the bigger picture are still taken into account by the respondents themselves and some others in the firm, but that it is not done in a formalized way, which sometimes could create some confusion or uncertainty. This is somewhat backed up by **R7**, who describes an overall content with how decisions regarding project portfolio have been made before, but still sees room for improvement, with a more formalized portfolio management approach becoming more important as the company grows.

During the latter stages of this master thesis duration, a formal portfolio meeting was conducted by the company to plan the R&D efforts that would be possible after the completion of a large project that was now ongoing, in this meeting. Several different projects were suggested and motivated. In this meeting, all potential projects were ranked against each other and were either planned into their technological roadmap, put on hold for the future, or killed before even being begun. This selection process was based on several criteria, but all were more subjective and informal than a standard value maximisation method. This was still seen as a step forward for the company and was described by **R2** as a large step forward in their project selection process, while still recognising room for improvement in their value assessment methods and a willingness to move towards more objective valuation.

**R2:**

*"This is one hundred times better than we have ever done before."*

### 4.3.2 PowerCell's Governance and Leadership Culture

PowerCell currently has a quite formalized process for selecting individual projects. All projects should go through 6 decision points (DP0- DP5) until fully commercialized. At each DP in this stage-gate model, some requirements must be fulfilled to move on to the next stage. From DP0 to DP2, A project manager is often responsible for filling out a template for each stage. It is then up to the Project council, mainly consisting of people from the management team, to decide if the project should be killed, put on hold, or proceed to the next DP. Subweekly meetings are also conducted with all project leaders and the manager of the R&D, where all ongoing projects are looked at and discussed. In these meetings, projects learn from each other while issues and resource questions can be raised. These meetings are called PPQA meetings.

One aspect that **R7** tries to clarify in the interview is that decision-making doesn't occur only in formal stage gates or portfolio meetings by the management team. **R7** stresses that in an innovation-driven environment like Powercell's, short decision cycles with lots of collaboration and good information flow are needed.

**R7:**

*"We emphasize short decision cycles, decentralized intelligence, and a high degree of cross-functional collaboration."*

**R7** also expresses a certain type of leadership that encourages experts in certain areas to spread information in the company. This is done through cross-functional meetings, ensuring information spreads across the organization.

**R7:**

*"We hold meetings that go beyond the traditional reporting structures, bringing together not only management but also informal leaders and technical experts across the organization. These discussions ensure that our strategic direction is informed by real-world insights from those closest to the challenges and opportunities we face."*

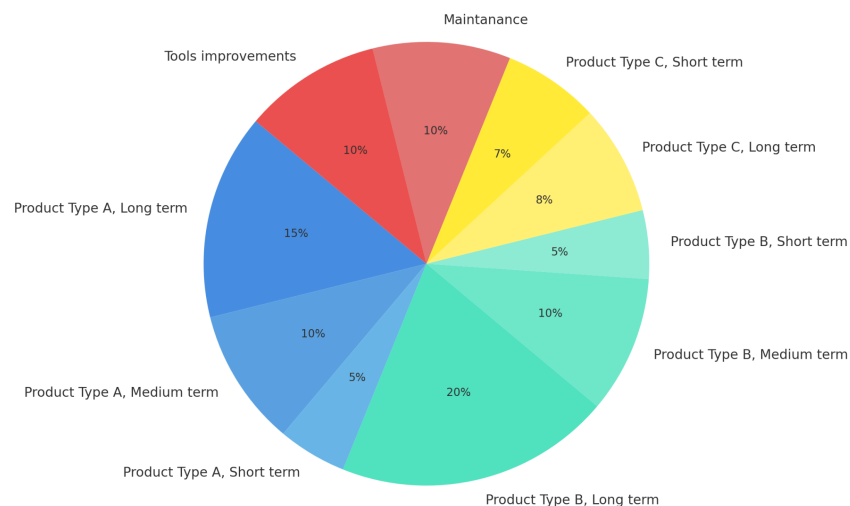
### 4.3.3 Value Maximization Goal

Value maximization tools used by PowerCell are limited. It's clear from the interviews that financial valuations and comparisons are often quite informal and are introduced relatively late in the decision process. **R2** explained that most of their value assessments began in Decision Point 2 (DP2), where a business case is developed for the project. The value assessments used in these early DPs vary between projects and project managers. The minimum method used according to both **R2** and **R13** is a basic calculation of how many units need to be sold to pay for the development costs, but a little bit more complex methods are used for larger projects. **R2** does, however, express interest in moving to a more systematic approach to valuing projects against each other.

Another aspect that is often included in value maximization methods is risk. Both technological and commercial risks can be used in value maximization methods to increase validity in the methods used. At PowerCell, **R13** mentions how they are supposed to include technological risks at early DP, while commercial risks aren't mentioned in the same way. This could be due to the large uncertainty that is induced in the market. **R7** mentioned the difference in the market that PowerCell is in compared to a traditional OEM. **R7** says that success in this market depends on the company's ability to continuously recalibrate based on new technologies, shifting regulations and evolving customer needs, with that being said. Being able to quantify different options under uncertainty is something both **R7** and **R1** want to do in the future. **R7** mentions real option theory or similar methods as a possibility, and that being able to reallocate resources in response to new opportunities and risks is desirable in the future.

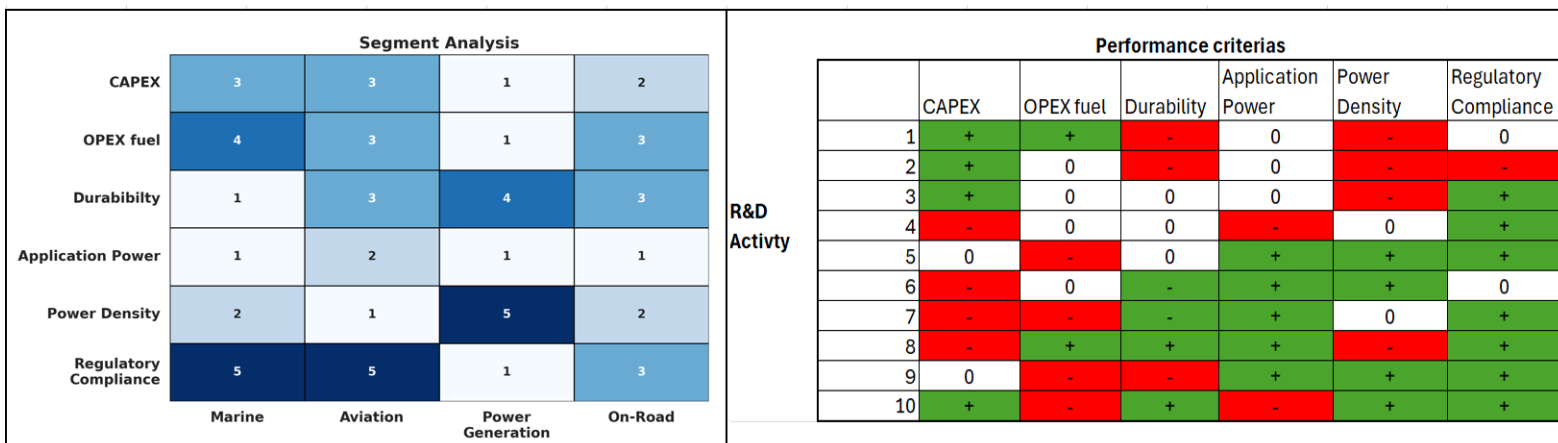
#### 4.3.4 Balancing Goal

The second goal mentioned by the theory is the goal of achieving balance in the project portfolio. This can be in several different dimensions based on the company's needs, with the most common dimension being a balance in risk and reward. At PowerCell, this is an aspect that some respondents point out as a goal that they want to become much better at. There are some graphs that are used in some instances to showcase and follow a balance. These are according to **R2**, mainly found in the budget planning for the upcoming years, as well as in some management meetings. The main balancing graph used according to **R2** is a pie chart dividing the resources available between different types of projects. An example of this can be found in Figure 2 below. In addition to this, an engineering technology roadmap is created and continuously updated. This roadmap serves both as a forward-planning tool and as a means to ensure that R&D efforts are neither underutilized nor overloaded at any point in the planned timeline.”



**Figure 2:** Example of a budget for resource spending for the upcoming year that PowerCell creates. In this example the numbers and some categories are randomized.

As mentioned, this is an area that PowerCell feels that they could improve upon. **R2** has talked about visualizations and graphs to show multiple dimensions. **R2** has also expressed a willingness to visualize a few dimensions for the management team and the project council. **R1** mentioned a will to identify and visualize synergies in a more systematic way and has proposed a synergy scoring to understand what projects cover what segment/ performance criteria. **R1** also created an example of what this type of visualization could look like. Inserted below in Figure 3 is an adjusted version of this visualization where the numbers have been randomized. Note that this type of synergy scoring is not currently used within PowerCell, this is merely an example of how **R1** would want it. In these two tables PowerCell would map how important different market segments rate different performance categories. From the table on the right, PowerCell could then also find that there is a balance between what the segments find most important and the current R&D project portfolio. This would help provide a holistic view of the portfolio and what synergies can be derived. **R1** also proposed that the use of some kind of risk-reward diagram would be a positive addition to their project selection model.



**Figure 3:** Hypothetical example of how a segment scoring system could look from **R1**. The numbers and characters are randomized and do not reflect PowerCells R&D portfolio.

#### 4.3.5 Strategy Alignment Goal

The strategy alignment goal of portfolio management is often achieved by the alignment of two parts. That each individual project is consistent with the strategy, and that the overall spending of R&D efforts is consistent with the strategy in several dimensions. PowerCell seems to do well, especially in one of these dimensions. At PowerCell, there is a clear structure to follow regarding the strategic alignment of individual projects. In the early DPs, one part of the checklist that needs to be filled out is according to **R13**, whether an individual project is consistent with the strategy or not. While this, in theory, should mean that all projects individually are consistent with PowerCell's strategy, there are some uncertainties. The first uncertainty is regarding how well grounded the checks in the checklists are filled in. According to **R13**, there is a fine line between overworking and not doing enough when answering the template in each DP. **R13** mentions that it is possible that *people check off the checklist quite casually in less important projects*.

**R13:**

*“There is a checklist question If the project fits into the strategy. That is something I usually look at. What is difficult is, how good is good enough? Sure, I think about whether I believe it's good, but is that enough? Should I ask other people if they think that too? Does it need to be documented?”*

Another aspect that could impede how well the projects are aligned with strategy is the understanding of the strategy of those who fill in the template. Some respondents have mentioned a slight insecurity regarding how clear and understandable the company's strategy is, while others assure that it is clear.

**R13:**

*“I actually think that it [the strategy] is quite clear. I have heard others complain, but I think that it is clear. Both from my boss and what we discuss in our group meetings. We also have the subweekly breakfasts where the CEO often shows the most important parts. We also had some strategy workshops last year, both within the company and with the board of directors, to talk about strategy and all that. So yeah, I think that is good.”*

There is however no clear formalization of the overall spending breakdown of the portfolio. **R2** says that this is somewhat managed through the decision makers' awareness of strategy. This can be seen in the focus of the R&D department on the market segments that are most important to the company's strategy.

#### 4.3.6 Issues with Current Project Portfolio Management

In the interviews, a few respondents have pointed out a lack of focus in the R&D department. **R2** mentioned how projects that are deemed as less critical still take up a substantial part of the work at the company, which affects the whole portfolio of projects. An example of this was observed by the authors when they sat in on a PPQA-meeting. In this meeting, all projects, regardless of size, were given the same amount of time. A similar issue was brought up by **R6**, who highlighted how in a single council meeting, they could move from decisions regarding projects that could alter the course of the entire company to then discuss a minuscule detail in a small project, which, according to **R6**, deprived focus on what was important. **R2** does mention that when the company is actually able to focus their efforts on an important project, they are really good, but that small projects and discussions about projects that aren't even ongoing are dividing their time too much. The lack of focus can also be seen through the effect of a reluctance to kill projects. This is an issue that **R8** points out, mentioning how they should have killed a project that was long overdue months ago, but it is still ongoing. Also, **R2** points out that this is an issue that they have started to work on. In the portfolio meeting that was held during the latter stage of this study, some projects were killed, which was seen as an important step for the company, according to **R2**.

**R8:**

*“We need to start killing projects... We do not do that [kill projects] today.”*

**R2:**

*“We have had some old 'gunk' that has tagged along. I think we took a huge step by killing these projects yesterday.”*

While Powercell believes that they are currently mainly making good decisions, many respondents acknowledge that many of their decisions are based on gut feeling and experience. A few respondents want to improve upon this in the future, with **R1**, **R2**, and **R7** mentioning a larger use of data and quantifiables as a necessary step.

While PowerCell has a holistic formalized structure for single project selection, some parts of it are up to different employees and how they structure their data gathering. An example of this is how the early DP templates ask for what potential risks might exist. There is, however, no formal process for finding these risks, and they are instead up to each project manager. An example of this is how **R13** has created its own framework for working with these risks.

## 5 Discussion

This chapter discusses the empirical findings presented in Chapter 4 in relation to existing theories and literature. The aim is to interpret and critically reflect on the results and to place them in a broader theoretical and managerial context. In doing so, this chapter contributes to answering the overarching research questions of this thesis by comparing the observed practices at PowerCell with established concepts in strategy and project portfolio management.

The discussion is structured according to the following:

- First, the benefits of a multiple market strategy are discussed in light of strategic innovation theory and the Crossing the Chasm framework.
- Second, this strategy's implications for PowerCell's R&D project portfolio are analyzed, focusing on complexity and what that complexity might lead to.
- Third, PowerCell's approach to project portfolio management is compared to theoretical best practices to assess strengths, limitations, and potential improvements.

Throughout the chapter, managerial implications and tensions are highlighted, and relevant theoretical models are revisited to evaluate how well they explain or fail to explain the observed empirical patterns.

### 5.1 Benefits for a Firm Choosing a Multiple Market Strategy to Cross the Chasm

This section mainly discusses the empirical findings on the benefits that PowerCell reaps for having chosen a multiple market strategy instead of following the traditional beachhead approach described in Moore's "Crossing the Chasm" framework. The analysis connects the company's reasoning to relevant theoretical literature perspectives, including diversification under uncertainty, shared technology platforms, and inter-segment learning.

#### 5.1.1 Analysing the Commitment to Reach the Mainstream Market

A preeminent theme of the theory of innovation adoption is the behavioral gap that exists between Early Adopters and the Early Majority. As Rogers (2003) describes, Early Adopters are visionaries who are open to adopting technology that is not yet stabilized. Still, the Early Majority are cautious pragmatists who resist change. Early majority want to stand back until technology has been tried and is supported by respected peers, until then, with minimal risk, they are willing to commit. This mental reluctance to commit is part of the reason Moore (2014) has characterized "the chasm", the space where so many high-tech innovations stall in their move from niche success to mass adoption.

A behavioral gap is also evident from the empirical findings of PowerCell. Some respondents indicate that customers are wary of embracing new technology, not due to technical immaturity but due to the fact that they are not familiar with it. As a

respondent commented, “People are not willing to move away from something that works today to something they are less knowledgeable about.” This description is consistent with Rogers’ characterization of the Early Majority’s risk-aversiveness. Despite achieving initial orders and being commercially viable in some instances, adoption remains hindered by customers’ reluctance to deviate from established, trusted systems.

PowerCell’s strategic approach, at this point, is not in line with Moore’s suggestion that firms concentrate on winning a single niche to acquire focused expertise. PowerCell competes in several segments simultaneously. The empirical data illustrate that the motivation for this is not so much to achieve maximum early market traction as is the argument for the beachhead strategy, but instead to maintain capabilities for responding to demand shifts across various segments, to have common technology platforms to exploit, and to avoid early commitment to a single market. This can be seen as a main differentiation of when to use the beachhead strategy compared to alternative strategies, such as the multiple market strategy. With differentiating goals or motivations when going into the chasm, different strategies might be applicable.

One effect of the multiple market approach is that PowerCell’s credibility is distributed across a wider set of applications rather than concentrated in one. The respondents describe how cross-segment visibility is used to demonstrate the robustness of the technology, by showing that it works in marine, aviation, and stationary power, the company can indirectly strengthen its legitimacy in the eyes of potential customers. This multi-segment presence, however, is not directly consistent with the kind of reference-based influence that Moore considers essential to overcoming the chasm.

In Moore (2014) framework, the Early Majority relies on tightly scoped case studies, domain-specific word-of-mouth, and deep trust within one segment. PowerCell’s approach, while coherent with their technological setup and risk logic, may not generate the concentrated social proof required within any single market. The breadth of presence does not necessarily translate into the depth of reference that typically characterizes successful chasm-crossing efforts.

This reveals an important strategic tension. On one hand, PowerCell has adopted a diversified approach that provides resilience and readiness in a volatile, policy-influenced market. On the other hand, this same diversification may result in weaker segment-specific narratives, making it harder to reassure the Early Majority in any one domain. The empirical data does not suggest that PowerCell is unaware of this dynamic, but rather that it accepts the trade-off in light of the surrounding uncertainty and the generalizability of its technology. This ties back to the earlier statement that different environments and markets sometimes require differentiating goals when crossing the chasm, leading to the choice of different strategies. Because of PowerCell’s dynamic, uncertain environment, they decided that a multiple market strategy was the best way forward. As described in this thesis, there are both advantages and disadvantages connected to this, creating a tension that the company needs to balance to the best of their ability.

### 5.1.2 Risk Reduction

The empirical evidence shows a recurring theme that PowerCell's multi-market approach is an explicit response to uncertainty over which market segment will scale up first. Respondents continually argue that the hydrogen fuel cell market is fragmented and uncertain, with no one segment yet giving a compelling market signal that makes a full strategic commitment appropriate. This has encouraged PowerCell to stay active across several segments concurrently. Diversification is not merely a strategic option in this context but rather an expression of the company's analysis of the market as fundamentally unstable.

This aligns with Lysek (2020) and Shepherd & Gruber (2020), who emphasize that companies tend not to forecast which nascent niche is most likely to scale into the mass market in environments of high uncertainty. Shepherd & Gruber (2020), applying real options logic, argue that diversifying across market options allows firms to postpone irreversible commitments until critical information is revealed. PowerCell's empirical logic reflects this almost precisely. Respondents articulate a desire to avoid "backing the wrong horse" and note that previous competitors have done so and now face critical financial strain. In this sense, PowerCell's diversification serves as a real-time hedge against market misjudgment.

In addition, the findings show that uncertainty is not just commercially but also policy-based. Respondents characterize the hydrogen market as heavily reliant on external regulation, subsidies, carbon taxation, and infrastructure investment. This institutional dependency makes traditional market forecasting insufficient as a decision-making tool. As one respondent puts it, the company's diversified positioning allows them to remain "positioned to act when something takes off." Here, Sun & Govind's (2017) concept of market turbulence becomes especially relevant. They argue that when environmental volatility is driven by unpredictable external forces, such as regulatory shifts, the diversification of market exposure significantly reduces firm-level risk. PowerCell's actions conform closely to this pattern.

In addition to external logic, the empirical findings show that PowerCell's diversification is enabled internally by the platform-like nature of its core technology. Respondents explain that the fuel cell stack and surrounding systems can be reused with minor adaptations across different segments. This technological reusability reduces the marginal cost of entering new segments and lowers the internal threshold for diversification. These results resonate with Sköld & Karlsson (2012), explaining how shared technologies across divisions facilitate economies of scope, decrease development time, and support innovation spanning segments. In the case of PowerCell, this technical framework facilitates and strategically reinforces their diversified market positioning.

In addition, several respondents explain diversification as a means of proving applicability and credibility. By illustrating that the same technology is being used across multiple segments, PowerCell is indirectly proving its legitimacy. This reflects the idea presented by Mendoza-Abarca & Gras (2017) that diversified presence in multiple segments can build organizational robustness and external trust, not only

through redundancy, but through perceived adaptability. However, unlike the kind of deep, domain-specific credibility described in Moore's (2014) beachhead model, PowerCell's credibility is distributed across segments, resulting in a different form of legitimation.

Interestingly, the empirical evidence also indicates an organizational normalization of diversification. It is not regarded as a precautionary measure or risk-reduction tool but as a built-in aspect of how the company manages its context. This is consistent with the approach of Rodrigues Coelho et al. (2025), which proposes that portfolio logic is a strategic framework, framing firm-level flexibility when dealing with changing technological and regulatory factors.

While diversification helps protect against external risks, the empirical findings also highlight internal challenges. Several respondents pointed out that operating across multiple market segments adds complexity and increases the need for coordination. Despite these difficulties, the company views this trade-off as worthwhile. The core rationale is that the cost of managing complexity is preferable to the risk of premature specialization in an uncertain market. This perspective is highlighted by Klingebiel & Rammer (2014), who show that in dynamic industries, companies often broaden their innovation efforts to increase survival chances. Their research emphasizes the importance of internal mechanisms for reallocating resources, something PowerCell appears to be actively developing.

### 5.1.3 Learning Effects and Agility of a Multiple Market Strategy

Apart from risk mitigation, PowerCell's multi-market strategy has other positive effects. The empirical findings also reveal substantial positive effects that emerge specifically because of this broad strategic orientation. These effects are both technical and organizational in nature and play a key role in enhancing the adaptability and learning capacity of both the firm's R&D project portfolio and the organization as a whole.

One of the widely mentioned strengths is technology reusability between projects and segments. Several respondents explain how the technology's central building blocks, specifically the fuel cell stack and its associated subsystems, get reused across projects with little adaptation required. Not only does this reuse of core technology lower the cost of development, but it also shortens the lead times of projects. The observed efficiency gain is in line with Sköld & Karlsson (2012), who state that shared technology platforms enable economies of scope and speed up the product development cycle by eliminating the need for customization.

This technical modularity is particularly valuable in a portfolio where projects are spread across different segments with varying levels of maturity and regulation. The empirical findings indicate that PowerCell is able to engage in parallel development efforts in part because of this *platform-based efficiency*. In this sense, the broad strategy not only complicates the portfolio, but it also enables it.

The second theme that keeps recurring in the interviews is resource allocation agility. Respondents highlight the need to stay responsive to changing market signals,

particularly in a policy-driven context. The company's diversified project portfolio enables it to constantly reprioritize projects as the external conditions change and put resources into segments where there is commercial traction or favorable policy support. This is in keeping with the rationale offered by Rodrigues Coelho et al. (2025), who see portfolio management as not a static evaluation process but a strategic coordination process in unstable environments. According to Rodrigues Coelho et al. (2025), flexibility and mobility of resources are not exceptions but requirements for long-term strategic consistency.

Another concept strongly related to agility is the fact that PowerCell's extensive involvement enables positive learning across segments. A number of respondents detail how lessons learnt in highly regulated segments like marine certification inform how projects within other segments, such as aviation, are handled. The transfer of such inter-segment learning lessens newcomers' ramp-up times, avoids repetitive errors, and enhances the overall implementation capacity of the organization. These observations accord with the views of Lansiti & West (1997), that competitive advantage is more likely to derive not from developing new technology but from greater skill in applying it across segments.

In addition to learning at the technical level, the findings suggest a more general process of organizational learning. Respondents describe how coordination facilitates routines, toolsets, and frames of reference across the teams. This suggests a greater level of organizational maturity in the company with internal process standardization induced by cross-segment coordination and greater resilience in the face of complicated development scenarios. This is supported by Lansiti & West (1997), who argue that companies with high capabilities in the implementation and integration of technology tend to outcompete companies that concentrate on invention alone. At the portfolio level, this organizational learning increases PowerCell's capacity to absorb, integrate, and act on different streams of information throughout the landscape of projects. As supported by Rodrigues Coelho et al. (2025), portfolio management in complex contexts should not rely on some fixed methods, but rather emphasize an organization's inherent ability to be adaptive and change the processes based on external and internal changes.

The empirical evidence also emphasizes PowerCell's adaptability in strategic positioning along the value chain. Based on the market segment it addresses, the company assumes various roles, playing the role of a system integrator in the marine segment but that of a subsystem provider in the aviation segment. This variability of roles allows the company to adapt its market access and partner coordination strategies to the structure of each segment. From a project portfolio strategy standpoint, such flexibility creates strategic depth and diversification possibilities that enable the company to balance between creating customized systems with leaner, more standardized subsystems according to the context. Further, Sun & Govind (2017) emphasize that companies in turbulent markets gain from not remaining locked into a specific operational segment but rather adapting with open-ended positioning in order not to become overly exposed and miss out on opportunities as they emerge. In the case of PowerCell, such adaptability of roles across the value chain enforces the dynamic nature of the portfolio and its resilience in the light of

market-specific requirements. Without the ability to position itself on different levels of the value chain, PowerCell would probably not be able to operate in all the market segments that it currently does, since different segments have different needs and possibilities. In addition to this, PowerCell's ability to adapt between different levels of the value chain also ties back to the risk reduction highlighted in 5.1.2. By operating on multiple levels of the value chain, they can adapt more easily in case of changes in the market dynamics in the future. As the market grows, bigger companies might become more invested, leading to bigger competition by companies with more resources than PowerCell in parts of the value chain. By creating capabilities on varying levels of the value chain, PowerCell has the capability of being adaptive if that is required in the future.

## 5.2 A Multiple Market Strategy's Influence on a Company's Project Portfolio

This section analyzes how PowerCell's multiple market strategy affects the structure, dynamics, and governance of its R&D project portfolio. Based on the empirical findings, the discussion highlights both the increased complexity and coordination challenges that arise from serving several market segments simultaneously. The following subsections examine these effects in more detail, first by addressing the portfolio difficulties and then by exploring how this complexity affects the company in terms of its project portfolio.

### 5.2.1 Increased Project Portfolio Complexity

One of the apparent consequences of PowerCell's multi-market strategy is that there is a significant amount of portfolio-level complexity. As illustrated by the empirical data, instead of arising mainly within individual projects, such complexity arises across projects due to intersecting timelines, standard technology components, and competing demands on resources across diverse segments. The more the company expands its activity across numerous segments, the more its portfolio becomes structurally more complex to coordinate.

Some respondents indicate that this multi-segment approach creates a growth in the number of R&D projects with separate certification needs, technical specifications, and customer demands. Individually, each of these projects might be manageable, but when taken together, they challenge the organization in setting priorities effectively. This trend reflects that of Cooper et al. (1997a), referring to the "balancing problem" of portfolio management. Too many ongoing projects render it challenging to maintain alignment between projects in motion and the strategic aim of the R&D.

One of the recurring empirical patterns is the creation of interdependencies among projects based on reusing core technologies across segments. Respondents clarify that standard components, such as subsystems or a fuel cell stack, create an interdependence between projects where technical decisions in one context cascade into others.

It is an example of the same type of architecturally-based dependence that Tushman & Nadler (1986) and Thompson (1967) cautioned against in highly integrated technical systems. Even as a shared platform facilitates up-front efficiencies, it initiates downstream vulnerabilities when separate timelines, certifications, or performance thresholds apply to different projects.

The empirical findings also found that project delays might be an outcome of these interdependencies. Respondents state that if a single project is delayed due to resource bottlenecks or unexpected reconfigurations, it can have knock-on effects throughout the project portfolio. Interconnected projects become increasingly vulnerable to shared disruptions, indicating a complexity that goes beyond logistics and is fundamentally systemic (Teller et al., 2012).

This resonates with critiques from Klingebiel & Rammer (2014) and Blichfeldt & Eskerod (2008). These observers contend that an overly broad innovation strategy can create a dilution of resources and a lack of focus. In broad market ambition-driven portfolios, engineering groups might become too diluted across several requirements, which hinders deep optimization, makes communication and decision-making more complex, and hinders project structuring.

### 5.2.2 Increased Complexity Leading to a Larger Need for Portfolio Management

One of the most notable consequences of adopting a multiple market strategy is the increased complexity at the R&D project portfolio level. As previously discussed in section 5.2.1, this complexity manifests in several ways, a growing number of projects, more frequent interdependencies between projects and technology platforms, risks of overengineering, and cascading delays. These challenges are not isolated but rather systemic, stemming from the firm's choice to operate across several market segments simultaneously.

This strategic breadth introduces a higher need for coordination and amplifies the risk of misalignment between projects and the company's strategy. Klingebiel & Rammer (2014) and Sun & Govind (2017) both argue that innovation breadth and market diversification, while beneficial in terms of risk mitigation and learning, tend to reduce managerial focus and strategic clarity unless mitigated with proper governance mechanisms.

Portfolio management theory emphasizes the importance of managing R&D investments not only at the individual project level but as part of a cohesive and strategically aligned portfolio (Cooper et al., 1997a). This is particularly critical in high-complexity environments like that of PowerCell, where the reuse of core technology across markets offers both opportunities and challenges.

The need for formalized project portfolio management increases proportionally with portfolio complexity. As Teller et al. (2012) highlight, formalization improves transparency, coordination, and resource allocation efficiency, especially when projects share interdependencies or compete for similar resources.

Therefore, while a multiple-market strategy can be a rational response to uncertainty and can create optionality in emerging markets, it inevitably increases portfolio complexity. This complexity can become a risk factor in itself unless it is mitigated through a well-functioning portfolio management process. A structured project portfolio management system ensures that the firm's innovation efforts remain focused, resources are effectively distributed, and the overall strategy is implemented consistently across segments.

### 5.3 Comparison Between Projects Portfolio Management Theory and Powercell

The following chapter has been divided into three sections: *Alignment between theory and practice*, *Misalignment with theory and recognised need for improvement*, and *Intentional deviations from theory*. These sections serve as the answer for RQ3, where project portfolio management theory is compared with how PowerCell conducts it. Table 3 below highlights the three sections included and also the subthemes within each section.

Main Theme	Subthemes
5.3.1 Alignment Between Theory and Practise	Strategic Alignment
	Single project selection model
	Portfolio management being a dynamic process
5.3.2 Misalignment With Theory and Recognized Need for Improvement	Formalized Valuation methods for portfolio management
	Balancing tools for portfolio management
	Reluctance to kill projects
5.3.3 Intentional Deviations from Theory	Informal judgement and dialogue vs formalized tools
	Fully quantified value maximisation methods

**Table 3: Overview of the discussion in this section**

#### 5.3.1 Alignment Between Theory and Practice

Several elements of PowerCell's portfolio management approach align with established theoretical frameworks, even if the execution is less formalized than what appears to be beneficial according to Cooper et al (2001) and Teller & Kock (2013). One of these areas is strategic alignment, which many interviewees emphasize. While PowerCell lacks structured tools, such as a strategic bucket method, to ensure strategy-project fit, interviewees describe an ongoing strategic dialogue where projects are regularly evaluated regarding their contribution to the company's long-term market goals. **R13's** references to technology roadmaps and strategy workshops indicate a strong will from the company to encourage the understanding of the company's strategy. This, along with **R2's** statement on how they feel content with how the spending breakdown reflects the strategic focus, aligns well with the theory's emphasis on linking the portfolio to business objectives (Cooper et al., 2001).

Another area where PowerCell appears well aligned with theory is in its project selection model. Interviewees consistently described the stage gate method as structured and well established, with defined criteria guiding which projects are prioritized. This reflects the emphasis in the literature on formalized selection models (Cooper et al., 2001). While there may still be room for refinement, PowerCell's approach demonstrates a mature foundation for making decisions regarding single

project valuation, an important foundation of successful portfolio management (Cooper et al., 2001; Teller et al., 2012).

In addition, PowerCell follows theory (Rodrigues Coelho et al., 2025; Martinsuo, 2013), emphasizing that project portfolio management is not a static system but instead a dynamic process that evolves over time. It is clear that PowerCells' R&D processes are shaped by internal learning and external changes. This perspective highlights the importance of reflection, adaptation, and continuous improvement in how portfolios are structured and managed. PowerCell demonstrates a strong alignment with this view. While the company acknowledges that its portfolio management processes are not yet fully formalized or optimized, practically all interviewees describe a clear trajectory of learning and evolution. For instance, the recently held portfolio planning meeting signals an organizational shift toward greater portfolio-level visibility, where it's now easier to compare potential projects with each other.

Respondents like **R1** and **R7** expressed that they were both reasonably content with how the process has worked so far, while still acknowledging that clear improvements are underway. Importantly, they also showcased a strong desire to develop the process further going forward. This drive towards iterative learning mirrors Martinsuo's (2013) view of portfolio management as evolving along with a company's organizational maturity. Rather than static alignment with predefined frameworks, their approach embodies the spirit of adaptive learning emphasized in the literature.

### 5.3.2 Misalignment with Theory and Recognized Need for Improvement

While some of PowerCell's practices are well aligned with portfolio management theory, other areas deviate from theoretical recommendations. Yet, the company actively acknowledges some of these deviations as opportunities for improvement. One such area is the formalization of value assessment in project selection. According to Cooper et al. (2001), firms that employ a formalized portfolio selection process that includes multiple methods, including financial models, risk assessments, and scoring tools, generally tend to outperform those relying on intuition or ad-hoc evaluation. At PowerCell, however, evaluations are often introduced relatively late in the process and vary considerably between projects. The methods used remain relatively informal, particularly in early-stage evaluations. Importantly, though, this limitation is not ignored. Many interviewees described a strong interest in the inclusion of more objective, data-supported decision-making, particularly as the company grows.

Another example is the company's current approach to balancing the portfolio. While some charts and roadmaps are used to monitor workload distribution, PowerCell lacks a formal system for evaluating balance across dimensions such as project type, risk level, time horizon, or market segment, which are emphasized in the literature (Cooper et al., 1997a). Still, the desire for improvement is evident. Several interviewees expressed an interest in implementing visual tools like risk-reward diagrams and synergy maps, which would enhance transparency and support better

strategic balancing. The fact that these tools are already being discussed internally shows signs of both awareness of the issue and a willingness to improve alignment with best practices.

A third area where theory and practice aren't completely aligned is PowerCell's reluctance to terminate projects. Cooper et al. (2001) note that reluctance to kill projects is a common effect of bad portfolio management that can be solved through clear criteria for go/kill decisions. PowerCell's earlier tendency to let outdated or marginal projects continue contributed to somewhat of a lack of focus within the R&D organization, a point raised by some respondents. This is, however, an issue that has been increasingly recognized within the company. In particular, the recent portfolio review meeting resulted in the termination of multiple projects that were deemed expendable. This was described by **R2** as a significant step in the right direction and a sign that the organization is now beginning to prioritize its efforts more deliberately. The meeting reflects a shift toward better portfolio discipline, which brings PowerCell closer to theoretical recommendations.

Together, these examples demonstrate that while PowerCell's portfolio management practices are not yet fully mature in line with theory, the company is aware of this and is actively taking steps toward improvement. This can be seen as a sign of organizational learning that itself aligns with dynamic PPM models (Rodrigues Coelho et al., 2025).

### 5.3.3 Intentional Deviations from Theory

While some of the differences between portfolio management theory and PowerCell reflect areas for improvement, others seem to be more deliberate and context-driven choices. These intentional adaptations to theory are likely due to the unique challenges that occur when operating in a highly uncertain environment, along with their strategy of pursuing multiple markets at once. In these types of contexts, some methods of portfolio management suggested in theory may not only be impractical but might even be counterproductive.

One such example is PowerCell's reliance on informal judgment and dialogue rather than fully formalized evaluation tools. According to Cooper et al. (2001), high-performing firms tend to use structured and explicit methods to assess and compare projects. However, Martinsuo (2013) and Rodrigues Coelho et al. (2025) argue that portfolio management must adapt to contextual complexity. At PowerCell, decision-making often occurs through constant dialogue with many stakeholders involved in the decision-making processes. This is something that **R7** emphasizes in the interview, saying that they want short decision cycles, a decentralized intelligence, and a high degree of cross-functional collaboration. **R7** also mentions that frequent meetings are conducted together as an organization with both managers, technical experts, and informal leaders in the organization. These meetings are meant to ensure that real-world insights inform the company's strategic direction. While many respondents show a will to move towards more data-driven decisions, several interviewees also noted that the current method allows the organization to stay flexible and respond quickly to new information. This is

something that is seen as particularly valuable when markets are immature and technology development timelines are uncertain. Even with more emphasis on data and better visualizations, PowerCell still wants to keep much of this flexibility in the future. In this light, PowerCell's informality must not be a gap, but is rather a somewhat deliberate adaptation to fluid conditions.

Another example is the absence of fully quantified value maximization models in the early stage of project evaluations. While much of the literature (Cooper et al., 2002; Cooper et al., 1997a) recommends the use of scoring matrices or financial valuation methods like Net Present Value (NPV) or Expected Commercial Value (ECV), PowerCell often uses simpler assessments, especially in the early stages of a project. This reflects on a recognition that in uncertain, innovation-driven environments, financial data might be too unreliable to form a solid foundation for comparison. Interviewees like **R1** and **R7** acknowledged this limitation but also pointed to future possibilities such as real option theory or other similar valuation models. **R1** also suggested breaking down gut-based decisions into distinct components. By doing so and assigning scores to each part using a scoring model, it may be possible to make gut feelings somewhat more measurable. For now, however, the company purposefully delays a more detailed financial assessment until a later stage, when assumptions are more grounded.

In sum, these examples show that deviations from theory are not necessarily flaws but may instead be a conscious choice based on the company's context. PowerCell operates under conditions that portfolio theory has not always fully accounted for, high uncertainty, an immature market, and the simultaneous pursuit of multiple markets. As such, PowerCells' adaptations represent pragmatic trade-offs trying to maintain strategic agility while gradually evolving toward more structured portfolio practices.

## 6 Conclusion

The goal of this master's thesis was to explore the multiple market strategy as an alternative to the beachhead method of crossing the chasm while also looking at the effects it causes within the organization, with an extra focus on portfolio management. The thesis was conducted as a case study on PowerCell, a hydrogen fuel cell company in Gothenburg currently in a commercialization phase. Through working with one main and three sub-research questions, this thesis hopes to showcase reasons why choosing a different route compared to the beachhead method might be fruitful. This master's thesis also found a connection between diversified segment strategy literature and the increased need for portfolio management, which has not been discussed in the literature before. Finally, this master's thesis looks into how the case company works with portfolio management compared to theory.

The first contribution of this master's thesis is the listing of reasons why a company would decide to use a multiple market strategy instead of the established way of using the beachhead method for crossing the chasm. The findings from this show that there are many reasons why a company would choose this approach. There are a few main reasons discussed in this thesis, with one being the large market uncertainty, where it's unclear which market segment will progress first. Pursuing multiple markets simultaneously helps the company reduce the risk of the company choosing the wrong segment. Second, all market segments use the same core technology, making it possible for the company to explore all markets without losing too much focus. Thirdly, there were significant learning effects between the segments, helping the company become even better in some areas despite being broad. Alternative ways of crossing the chasm have not been discussed much in the literature. This master's thesis hopes to have provided a situation where an alternative might prove to be working. This provides not only theoretical implementations, but also managerial implications where the industry should explore different alternatives and adapt their strategy based on the environment in which they are.

The second contribution that this master thesis has found is the connection between using a multiple market strategy and an increased complexity in the company's project portfolio, leading to a greater need for portfolio management. Overall, a multiple market strategy created an environment with larger dependencies, a larger number of R&D projects with more complex aspects for the decision makers to make decisions based on. In this master's thesis, it was found that while portfolio management might be a viable strategy in some scenarios, it also has risks associated with it that need to be understood and mitigated. A more complex R&D project portfolio is one of the potential risks.

Thirdly, the last contribution of this master's thesis was an analysis of how a company using the multiple market method is structuring its project portfolio management compared to theory. Included here is a practical example of a company that is not yet mature. This section provides insight into three areas: where the company aligns with theory, where it does not but shows a strong intention to

improve as the company matures, and where the company deviates from theory due to the complexity of its environment.

## 6.1 Suggestions for Further Research

While this study has provided multiple insights for both theory and practice there are still lots of potential further research that can be made. Firstly, this study has provided an argument for why an alternative approach to the beachhead might be suitable in some scenarios. A multiple market strategy for crossing the chasm has not been well explored before, making further research needed. While this case study has found arguments for using a multiple market strategy, further research should validate these findings. This could be done in multiple ways. It could be made by validating the assumptions and findings in similar cases to the one described in this thesis. Further research could also look to find other situations where an alternative strategy to the beachhead might be possible.

Second, further research could investigate the effects of a multiple market strategy. This master's thesis only looked into one risk of a multiple market strategy, the increased complexity in the R&D portfolio. With further research, more risks and potential ways to mitigate risk could be found, providing a better basis for practitioners when deciding on a strategy.

Further research could also investigate the connection between pursuing multiple markets and more complex R&D portfolios. Some literature briefly mentions this without going further into the need for well-functioning portfolio management. This could be investigated further, both to confirm a link and to define what a link entails precisely.

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