
Exploring the Experience of Start-ups in Open Innovation Programs in
Portugal: An Analysis of Perceptions and Positive Impacts

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Abstract

Open innovation has become a popular approach for innovation all over the world, including in Portugal. This study explores the experience of start-ups in Open Innovation programs from Portugal, analysing their perception and positive impacts of adopting this approach.

A qualitative research method was used to achieve this goal based on in-depth interviews with four start-up entrepreneurs who have engaged in open innovation practices and 1 of the companies responsible for these open innovation programs.

The interviews were analysed using thematic analysis, which revealed several prominent themes. The positive perceptions identified are (i) the significance of validation and reputation for start-ups when collaborating with larger companies; (ii) the advantages of gaining a better understanding of corporate procedures, particularly for those who lacked prior experience working with larger companies; (iii) the impact of open innovation programs on business scaling and revenue generation; (iv) the monetary prize offered by such programs was seen as crucial for establishing long-term strategies; (v) accessing the perspectives of industry experts was also identified as a valuable advantage, which validate the previous studies on the topic.

The findings of this study provide insights into the open innovation experience of start-ups and underscore the significant role that large companies play as validators and facilitators of further opportunities. The start-up feedback highlights the value of working with established companies to validate their solutions and access new projects.

Further research could build upon these findings to examine the open innovation experience of start-ups in other countries and to identify best practices that can be applied to support start-ups in their open innovation journey. The findings of this study could have implications for policymakers and practitioners interested in promoting innovation ecosystems, particularly those focused on start-up development and entrepreneurship. In conclusion, this study sheds light on the experience of start-ups participating in Portuguese

open innovation programs and highlights some of the positive and negative impacts they gain from adopting this approach.

Future research could also explore how established companies can learn from the open innovation practices from the start-ups' point of view and how they can create a culture that supports innovation, fosters collaboration with external partners, and encourages adopting open innovation practices.

Keywords: open innovation, open innovation programs, start-ups, Portugal, perceptions, impacts.

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1. Introduction

1.1. Introduction to the topic

Open innovation is a term that Henry Chesbrough first coined in his 2003 book "Open Innovation: The New Imperative for Creating and Profiting from Technology." In this book, Chesbrough defined open innovation as a paradigm that "views the firm as a system that takes in knowledge from outside as well as inside and uses that knowledge to innovate and create value" (Chesbrough, 2003, p. 5). This approach contrasts the traditional innovation model, in which a firm or organisation keeps its knowledge and expertise in-house and focuses on developing new ideas and solutions internally.

There are several key characteristics of open innovation. First, it involves collaboration and partnerships between different organisations, companies, and individuals (Chesbrough, 2003). The collaboration can include sharing of resources (Wang & Islam, 2017), expertise (Ren et al., 2020), and knowledge (Singh et al., 2021) to work on common problems or goals. Second, open innovation often involves bringing together people and organisations from various fields and backgrounds, which can help foster creativity and generate new ideas and solutions (Singh et al., 2021; Aschehoug & Ringen, 2013). Third, open innovation often involves the use of crowdsourcing and other techniques to gather ideas and feedback from a wide range of people and organisations (Ahmad et al., 2021).

The use of open innovation has grown in recent years as more and more companies and organisations have recognised the value of collaboration and the need to find new and innovative solutions to challenges (Mastrocinque et al., 2022). Open innovation has been applied in a variety of fields, including technology (Faems et al., 2010; Johnston, 2021; McCormack et al., 2015), healthcare (McCormack et al., 2015; Wass & Vimarlund, 2016), education (Tacke, 2011; Santos, 2011), and more. For example, open innovation has been used in the technology industry to develop new products and services, such as mobile apps and software tools (PETRAITÉ, 2010; Jin et al., 2019). In the healthcare industry, open innovation has been used to develop new treatments and therapies for diseases (Kar, 2010).

Open innovation is a powerful approach to fostering creativity and driving innovation. By bringing together people and organisations from different backgrounds and fields, open innovation can help to generate new ideas and solutions to challenges faced by companies.

1.2. Objectives of research

The current study seeks to explore the phenomenon of open innovation and its impact on the development of start-up businesses. The topic is particularly relevant given the increasing prevalence of open innovation programs among large companies in recent years. For example, programs such as Vodafone Power Labs, which has invested in over 100 start-ups in Portugal, raised more than €3,5 M of investment and created at least fifty jobs in the last five years (Soares, 2016), demonstrate the significant impact of open innovation on start-up development.

The field of open innovation is also of significant interest within academia, with numerous researchers focused on investigating the topic and proposing frameworks for measuring results, developing methodologies, and compiling best practices.

1.3. Research question

Based on the literature review, several studies have explored the topic of open innovation in start-ups, providing insights into the benefits and challenges of participating in open innovation programs. Spender et al. (2017) highlighted the importance of open innovation for start-ups and identified several benefits, such as increased access to resources, knowledge, and networks. Usman and Vanhaverbeke (2017) studied how start-ups can successfully organise and manage open innovation with large companies. They found that start-ups need a clear strategy and focus on building solid relationships with partners. Popescu and Warmenhoven (2022) provided a comprehensive overview of the motivations, success factors, and challenges of open innovation for start-ups.

Additionally, Freitas (2019) analysed open innovation strategies in SMEs located in Portugal, highlighting the importance of collaboration and partnerships. Based on these studies, the research question ***"How do start-ups participating in open innovation***

programs in Portugal perceive the benefits of it, and what are the main challenges they face in participating in such programs?" was formulated to explore the topic further and provide insights into the Portuguese context. A critical factor that influenced the development of the research question was the limited literature on open innovation from the start-up point of view. At the same time, numerous studies on open innovation have focused on the perspective of established companies rather than start-ups, as Spender et al. (2017) pointed out.

The research questions for this study were developed following a structured process comprising three stages. As Yin (2018) suggests in his book "Case Study Research and Applications: Design and Methods", these stages provide a helpful framework for formulating research questions. In the first stage, a thorough review of the literature was conducted to identify critical topics related to the research area. The objective at this stage was to narrow down the focus and gain a deeper understanding of the subject matter without precisely formulating research questions. In the second stage, a closer examination of select studies within the identified topic was carried out. These studies were carefully analysed, dissected, and scrutinised to identify the research questions they addressed and whether they left any unanswered aspects or potential areas for future investigation. By studying these existing studies, valuable insights were gained, which sparked critical thinking and stimulated the formulation of potential research questions. The third stage involved examining another set of studies on the same topic. This additional review validated the relevance and importance of the potential research questions identified earlier while also providing opportunities to refine and sharpen those questions based on the insights derived from the collective body of literature. Through this systematic approach, the research questions evolved, ensuring their alignment with the existing knowledge base and their potential to contribute to the field.

The research question "How do start-ups participating in open innovation programs in Portugal perceive the benefits of it, and what are the main challenges they face in participating in such programs?" is particularly relevant in the context of Portugal as it addresses the specific perspectives and experiences of start-ups in a moderate innovative

country (European Commission, 2018). According to Freitas (2019), the analysis of less innovative contexts, such as moderate innovator countries like Portugal, is fundamental due to the potential benefits that open innovation strategies may offer for their respective companies, especially for start-ups (Bereczki, 2019; Fabrício et al., 2015; Jucá & Alves, 2022). In particular, studies have shown that companies operating in these contexts may have a greater need for external knowledge and resources, which can be provided through open innovation (Brem et al., 2017).

This is important as start-ups are often seen as key players in driving innovation and economic growth and understanding their perceptions of open innovation programs can provide valuable insights into how to effectively support and nurture start-up development.

This research question aims to identify the main challenges faced by start-ups when participating in open innovation programs and how they perceive the benefits of these programs. This research can help to identify areas for improvement in the design and implementation of open innovation programs to support start-ups better. Additionally, understanding the start-ups' perceptions of open innovation can provide insight into how to better communicate the value of open innovation to start-ups and how to engage them more effectively.

Research on open innovation in start-ups is still scarce, especially in the Portuguese context, and this research will help to fill this gap by providing new insights into the perceptions and experiences of start-ups in Portugal.

1.4. Research Motivation

The current study aims to investigate the phenomenon of open innovation and its impact on the cooperation between large companies and start-ups. My interest in this topic stems from my prior experience working with start-ups and technology and my observation of various open innovation initiatives implemented by large companies.

In 2016, I began working for a leading cosmetic company and had the opportunity to observe the positive effects of open innovation on various aspects of the company. These

included improvements in chemical formulas through collaborations with universities, improvements in logistics and human resources through partnerships with start-ups, and initiatives aimed at supporting the start-up ecosystem. As I approached the end of my bachelor's degree in 2017, I sought to explore open innovation further as a topic for my graduation dissertation. My personal interest in the topic and the potential for networking opportunities with industry leaders motivated me to delve deeper into the subject. I conducted a case analysis of a corporate acceleration program for start-ups in the Amazon rainforest area. The open innovation program studied aimed to support and accelerate start-ups with a geographical impact on the Amazon. Through in-depth interviews with managers of the open innovation program, the start-up accelerator company, and the co-founder, I aimed to study the impact of the open innovation project titled "*Desafio Natura Amazônia: Negócios para Floresta em Pé*" (Corporate Start-up Acceleration: An Investigation on the Challenge of Natura Amazon: Business for Standing Forest). Since then, my interest in open innovation and start-ups has grown, leading me to pursue further research in this area. The lack of literature considering the start-up point of view and open innovation studies for Portugal further motivated me to explore this topic in the Portuguese context.

2. Methodology

2.1. Approach: A case study

This study adopts a case study approach to qualitatively explore the perceptions, experiences, and challenges faced by start-ups on open innovation programs. Based on the research questions of this study, the choice of a case study research design is justified. According to Yin (2018), case study research is particularly suitable when the main research questions revolve around understanding "how" and "why" phenomena. In this case, the study seeks to understand how start-ups perceive the benefits of open innovation programs in Portugal and what challenges they face in participating in such programs. Additionally, the nature of the research topic, focusing on contemporary start-ups and their experiences, aligns with the case study approach. This research design allows for an in-depth examination of the phenomenon within its real-life context, providing valuable insights into the perceptions and challenges start-ups face in open innovation programs.

Although the second part of the research question falls under the category of a "what" question - ***"What are the main challenges start-ups face in participating in open innovation programs?"*** - it possesses an exploratory nature. As discussed by Yin (2018), exploratory "what" questions allow for flexibility in choosing the appropriate research method. While prevalence-based "what" questions typically call for surveys or archival record analysis, the exploratory nature of this question opens up the possibility of employing various research methods. In this study, a case study approach was deemed the most suitable choice to address the research question.

In particular, the study relies on in-depth interviews with start-up founders and key decision-makers of Portuguese start-ups that have participated in open innovation programs. This approach allows for an in-depth exploration of the perceptions, experiences, and challenges faced by these start-ups concerning open innovation, as well as the benefits they have derived from participation in such programs. This approach is ideal for exploring

the perspectives of start-up founders and decision-makers, as it allows them to articulate their experiences and perceptions in their own words.

The selection of appropriate cases for this study is a careful process, considering the aim to shed light on broader population characteristics. Case studies of this nature go beyond individual cases, aiming to provide insights into more significant phenomena. Therefore, the chosen cases are expected to represent and provide valuable insights into a population of cases beyond their individual context (Seawright & Gerring, 2008).

2.2. Type of case study: Exploratory

In light of the research question, an exploratory case study approach was chosen for this study. The choice of an exploratory case study approach aligns with the inclusive and pluralistic view that research methods can be utilised for different purposes, including exploration, description, and explanation. While the distinction between different modes of inquiry is not hierarchical, there are three critical conditions that inform the selection of a case study approach. It avoids misfits by ensuring that the chosen mode of inquiry is advantageous for the research objectives. Therefore, the exploratory case study approach was deemed appropriate for this study as it allows for an in-depth exploration of the perceptions and challenges faced by start-ups regarding open innovation programs in Portugal.

2.3. Multifaceted Evidence Gathering

In the proposed case study, multiple sources of evidence will be utilised to ensure a comprehensive and rich understanding of the subject matter. As Yin (2018) suggests, case studies rely on various evidence-gathering techniques, including primary documents, secondary documents, cultural and physical artefacts, direct observation, interviews, and participant observation. By incorporating these diverse sources of evidence, the case study approach allows for a thorough exploration of the research topic, capturing both historical and contemporary aspects. The use of primary and secondary documents, along with cultural and physical artefacts, aligns with traditional historical research practices. However,

the case study extends beyond conventional historical studies by also incorporating direct observation and interviews to capture firsthand accounts and insights from individuals involved in the events being studied. This comprehensive approach enables a deeper understanding of the research questions and contributes to a more nuanced analysis of the subject matter.

The data gathered from the interviews were analysed using thematic analysis, which involves identifying patterns and themes in the data (Braun & Clarke, 2006). This approach identifies common themes across the interviews and provides insights into the research question. This methodological approach allows for a comprehensive exploration of the perceptions, experiences, and challenges of start-ups concerning open innovation programs in Portugal and contributes to the existing literature on open innovation in start-ups.

2.4. Exploratory case study: Multiple-case holistic design

The multiple-case holistic design is the most suitable approach for this study based on the following considerations. As Yin (2018) suggests, "The resulting four types of designs for case studies are (Type 1) single-case (holistic) designs, (Type 2) single-case (embedded) designs, (Type 3) multiple-case (holistic) designs, and (Type 4) multiple-case (embedded) designs" (p. 96). The research aims to analyse two different open innovation programs, each representing a distinct case, aligning with the multiple-case (holistic) design. Examining these two cases can provide a comprehensive understanding of the benefits and challenges of open innovation programs. Furthermore, within each program, the study will delve deeply into the participation of two start-ups, thereby allowing for an in-depth analysis of the experiences and perceptions of individual start-ups. This multiple-case holistic design provides a broader perspective by considering each case's contextual conditions and exploring the interconnections between the cases and their respective contexts. By adopting this design, the study can capture the nuances and complexities inherent in open innovation programs, contributing to a richer and more comprehensive analysis.

The selection of a multiple-case approach is particularly advantageous for our research, given the nature of my specific cases. I have chosen to analyse two different open innovation programs, and the participation of two start-ups for each program. This design allows me to delve deeply into the experiences and challenges start-ups face in each program, providing a holistic understanding of the open innovation processes. By carefully selecting these cases, I aim to identify common patterns, similarities, and differences in the perceived benefits and challenges of participating in open innovation programs. Through this multiple-case approach, we can gain valuable insights into the dynamics and intricacies of open innovation in Portugal in the context of start-ups, enhancing the overall richness and validity of the research findings.

The choice to analyse two different open innovation programs in this research study is supported by the following quote from Yin (2018), which highlights the advantages of multiple-case designs: "If you can do even a 'two-case' case study, your chances of doing a good case study will be better than using a single-case design. Single-case designs are vulnerable if only because you will have put 'all your eggs in one basket.' More importantly, the analytic benefits from having two (or more) cases may be substantial" (Yin, 2018, p. 54).

By conducting an analysis of two distinct open innovation programs, the research study acknowledges the analytical strength provided by multiple cases. This approach allows for direct replication, where independent analytic conclusions from each case contribute to more robust findings. Furthermore, including two contrasting cases enables the exploration of different scenarios, promoting theoretical replication and enhancing the overall validity and general visibility of the research (Eilbert & Lafronza, 2005; Yin, 2018).

2.5. Data collection

In this study, data collection encompassed a range of methods, including e-mail exchanges, interviews, analysis of official documents, and examination of websites. This strategic approach, employing multiple data sources, facilitated triangulation, as Yin (2018) advocated, thereby bolstering the validity of the case study evaluation.

It is essential to recognise that a case study constitutes a comprehensive mode of inquiry characterised by its distinctive design logic, data collection techniques, and specific approaches to data analysis. It transcends its role as a mere data collection tactic or design feature (Stoecker, 1991). Engaging in case study research necessitates an inquiring mind throughout the data collection process rather than confining inquiry solely to pre or post-data collection stages. A researcher's ability to pose incisive and relevant questions is thus fundamental to the case study endeavour. The desired outcome is cultivating a rich dialogue with the evidence, fostering a deeper understanding of the phenomenon under investigation.

2.6. Sample selected

This chapter presents the sample selection process for the qualitative analysis of two different open innovation cases ran by the Portuguese operations from big companies. The selection aimed to analyse open innovation programs at their initial stages, focusing on quality rather than quantity. This chapter outlines the steps taken to identify and contact the companies responsible for the open innovation programs and the start-ups participating. Additionally, it provides an overview of the interview approach utilised to gather in-depth insights from the key stakeholders involved.

The two open innovation programs chosen for analysis differ in terms of experience, with Company A being a well-established open innovation platform. However, both programs were in their first versions at the time of the study. To gain insights into these programs, the responsible entities at Company A and Company B were contacted via email. Both companies responded positively, welcoming collaboration with researchers and students, but only Company A could conceive an interview.

Semi-structured, in-depth interviews were conducted with the representatives responsible for the open innovation programs at Company A. The interviews followed a conversational flow, allowing the interviewees to freely express their insights and experiences. The interview questions covered various aspects, including:

- The exploration of open innovation programs and strategies.

- The reasons for launching the programs.
- Plans for future editions.
- Benefits and prizes offered to start-ups.
- The selection process.
- The definition of themes/areas of interest.
- Relationship management with start-ups.
- Measurement of program impact.
- Company view of future challenges.

The nine start-up participants, four from Company A and five from Company B, were identified and contacted using a step-by-step approach. Initially, C-level executives and founding team members were identified on LinkedIn and sent connection requests. Once accepted, a message was sent explaining the research goals and seeking their participation. If there was no response, a similar message was sent to their email (if available), and if there was still no response, a message was sent through the contact/support forms on the companies' websites. Ultimately, seven out of the nine participants responded, and four start-ups (Two from Company A, and two from Company B) could conceive an interview.

The interviews with the selected start-ups followed a semi-structured approach, allowing the founders and participants to share their experiences and insights freely. The interviews approached the following topics:

- Understanding the company.
- Their challenges when subscribed to the Open Innovation program.
- Expectations.
- Perceptions regarding the program's structure.
- Specific activities and interactions with partner companies.
- The goal they have when subscribed to the program.
- Real impacts from the program.
- Feedback on strengths and weaknesses.

The interviews aimed to generate in-depth responses by facilitating open and detailed discussions with the start-up representatives.

The first Open Innovation program is spearheaded by Company A, a prominent company in the energy industry. Company A, known for its commitment to sustainable innovation, has established an open innovation platform. This platform aims to foster engagement with entrepreneurs, students, and start-ups who share a common vision of transitioning towards a sustainable and Net Zero future. Through its open innovation platform, individuals have the opportunity to participate in existing open innovation challenges or freely submit their ideas.

The Open Innovation Program A is a prominent initiative under the Company A's open innovation platform, with its inaugural edition taking place in 2022. The program attracts numerous start-ups who submit their innovative solutions, and Company A selects four of these start-ups to collaborate on paid pilots. In order to facilitate this collaboration, the selected start-ups are provided with an enriching experience in Lisbon, Portugal, where they not only engage with the Company A team but also showcase their solutions at the renowned Web Summit.

The second program is led by Company B, a renowned company in the insurance industry. This program, which commenced in 2021, aims to connect start-ups worldwide with the innovation strategy from Company B to test and validate their solutions through a paid Proof of Concept (POC). Selected start-ups are offered the opportunity to develop a small-scale proof of concept (POC) with Company B, receiving financial support of 20,000 euros. Successful proofs of concept (POC) present tangible prospects for further scaling up, providing concrete opportunities for the participating start-ups. At the end of the program, five start-ups are selected based on their accomplishments and potential for growth.

These two open innovation programs represent compelling examples of how organisations are actively fostering collaboration with start-ups and driving innovation within their respective industries. Through a comprehensive analysis of these programs, this study aims

to gain insights into the benefits perceived by Portuguese start-ups and the challenges they encounter when participating in such open innovation initiatives.

3. Literature review

3.1. A new approach to innovation

Innovation plays an indisputable role in the success of organisations that strive to stay ahead of others and achieve competitive and sustainable advantages. Nowadays, innovation is essential for both large and small organisations that aim to be at the forefront and in a prominent position. According to Peter Drucker (1986), innovation is a permanent objective for organisations.

Considering this scenario and the evolution of organisations in terms of technology and the management of numerous competencies that drive high performance and development, it becomes evident that there are many paths to achieve innovation. On the contrary, it is diverse, and innovation can emerge in countless ways.

Among the various paths to innovate and considering the importance of a partnership network, the academic contribution of Henry Chesbrough in the book "Open Innovation: The New Imperative for Creating and Profiting from Technology" stands out. The term "Open Innovation" advocates for an open innovation strategy focused on a process with multiple inputs that aims to accelerate internal innovation processes and expand the external market through generated innovations (Chesbrough et al., 2006).

Open innovation creates new methodologies, approaches, and processes to seek new competencies and interactions with the market as a whole, especially with innovation ecosystems. The goal is for new partnerships to generate enhanced innovations that bring more excellent value to the business chain. Open innovation aims to constantly improve internal processes and environments to identify and capture good business opportunities (Chesbrough, 2003).

Open innovation has emerged as a popular concept in recent years, providing companies with new opportunities to create value through collaboration with external sources.

This approach to innovation offers many benefits, including access to a broader range of expertise and ideas, reduction in research and development costs, acceleration of time-to-market, and increased flexibility in responding to market changes (Culpan, 2014; Chesbrough, 2019). Open innovation alliances facilitate the exchange of knowledge and ideas, leading to partnerships aimed at joint innovation and risk and profit sharing (Wilks & Young, 2018). Moreover, open innovation enables companies to keep up with the technological advancements of their reference market and improve business efficiency (Cavalcante et al., 2019). With open innovation, companies can combine internal and external ideas to create new innovative solutions.

This approach to innovation is a departure from the traditional path of in-house research and development, where companies invest heavily in their internal R&D activities and spend much of their time and resources on creating new ideas that are kept internal (Kim, 2012). Open innovation offers an alternative approach to traditional in-house R&D activities by encouraging companies to leverage external knowledge and resources for innovation. This shift towards open innovation represents a paradigm shift in how companies approach innovation.

3.2. Open innovation models

Open innovation is a concept that emphasises the importance of collaboration and idea sharing, both within and outside an organisation (Chesbrough, 2003). There are several open innovation models that companies can adopt to promote collaboration and idea sharing.

The outside-in model is one such model, where a company seeks out external ideas and technologies to incorporate into its own innovation process. This model relies on outsiders as a source of ideas and also as a means to commercialise them (Enkel et al., 2009; Gassmann & Enkel, 2004).

On the other hand, the inside-out model focuses on leveraging internal resources and competencies to develop new innovations that can be sold or licensed to external

parties (Enkel et al., 2009; Gassmann & Enkel, 2004). Chesbrough (2019) advocates implementing Lean start-up practices as an effective method to apply inside-out strategies in identifying and developing new business models from under-utilised internal ideas and technologies.

The coupled model is another open innovation model where companies combine both the outside-in and inside-out models to create a more comprehensive innovation strategy (Enkel et al., 2009; Gassmann & Enkel, 2004).

Gassmann, Enkel, and Chesbrough (2009) proposed a model known as "Open innovation with three core processes archetypes" that includes these three models: outside-in, inside-out, and coupled processes. These archetypes of core processes allow firms to purposefully incorporate both inflows and outflows of knowledge to accelerate internal innovation, expand the markets for external innovations, and ultimately achieve greater success.

The collaborative model of open innovation emphasises the importance of collaboration among multiple parties from different industries and disciplines. It is based on the idea that no single company or organisation can possess all the necessary knowledge and resources to innovate effectively and that innovation is more likely to occur when different parties work together towards a common goal. Collaborative innovation can take many forms, such as licensing agreements, corporate venturing, joint ventures, and research partnerships. Chesbrough and Brunswicker (2013) argue that collaboration is a key driver of open innovation, as it enables companies to combine their own knowledge and expertise with that of external partners. This, in turn, can lead to faster and more cost-effective innovation outcomes (Lee et al., 2010). Research has shown that the collaborative model can significantly impact firm innovation and performance. For instance, a study by Leiponen and Helfat (2010) found that collaborative innovation leads to more extensive and diverse knowledge sourcing, which in turn enhances firms' innovation capabilities. Another study by Cavalcante et al. (2019) revealed that the collaborative model positively influences firm innovation outcomes, particularly in high-tech industries. Furthermore, firms that collaborate

effectively can also enjoy other benefits, such as reduced R&D costs, faster time-to-market, and increased market reach (Wilks & Young, 2018).

The open-source model is also an open innovation model that has gained significant traction in recent years. This model involves sharing knowledge and technology to create new innovations that are freely available for anyone to use or modify (Von Hippel, 2005). West and Gallagher (2006) argue that "Open source software is a great exemplar of open innovation because of the shared rights to use the resulting technology as well as the collaborative development of the technology".

The user innovation model is an open innovation model that recognises the role of end-users as a source of innovation. It refers to the situation where users develop and modify products, which are often originally intended for their own use. This model has gained significant attention from both academia and practitioners as it challenges the traditional view of innovation, where the producer is the main source of ideas. Instead, it emphasises the user's capability to develop new ideas, improve existing products and even create entirely new markets. Von Hippel (1988) was among the first to recognise the importance of user innovation and proposed that users are a significant source of innovation. Later, Baldwin and von Hippel (2011) extended the concept by introducing the idea that the user innovation model is replacing the traditional producer innovation model.

The innovation network model is an open innovation model that involves multiple organisations from different industries and disciplines working together to develop new innovations. This model recognises the benefits of inter-organisational collaboration and allows for the sharing of resources and knowledge to achieve common goals. According to De Carolis and Saporito (2006), innovation networks allow firms to access a broader range of knowledge and resources, as well as leverage the complementary capabilities of their partners. Moreover, Powell et al. (1996) argue that innovation networks create opportunities for organisations to engage in joint R&D activities, co-create new knowledge, and share the risks and rewards of innovation. By leveraging the expertise of multiple organisations, the

innovation network model provides a pathway for firms to accelerate the pace of innovation and achieve competitive advantage.

3.3. Open Innovation and its Impact on start-up Performance

Innovation plays a vital role in shaping the contemporary business landscape, driving progress and competitiveness by introducing new products, services, and processes that not only address consumer needs more effectively but also help improve companies' internal processes, solve production issues, and design a better strategy for the organisation. According to a study by Birkinshaw and Haas (2016), open innovation has been shown to enhance the innovation performance of large companies while also improving the innovation capability and competitiveness of small and medium-sized enterprises (SMEs). For big companies, open innovation can also lead to increased competitiveness and faster time-to-market for new products and services (Chesbrough, 2003). It can also help them to leverage their internal resources and capabilities better while accessing external sources of knowledge and expertise (Culpan, 2014). Additionally, open innovation has been linked to better financial performance and increased market share for companies (Huizingh, 2011).

In the case of start-ups, open innovation has been found to be particularly effective in obtaining resources and expertise that they might not otherwise have access to, thereby enhancing their chances of success (Chesbrough, 2019). The literature points to the fact that for SMEs, open innovation can also provide access to resources and capabilities that they may not have internally, allowing them to compete with larger companies (Wilks & Young, 2018). It can also help them reduce development costs and risks by collaborating with external partners and sharing knowledge and expertise (Cavalcante et al., 2019).

Start-ups and SMEs can also benefit from collaborating with larger companies, which can provide them with access to markets, funding, and other resources necessary for growth (Chesbrough, 2019). The findings elucidated by van de Vrande et al. (2009) lend credence to this notion, showcasing that both start-ups and SMEs exhibit a proclivity for embracing open innovation practices.

Table 1 presents a concise overview of the profound impacts of open innovation on start-ups and SMEs. In today's dynamic business landscape, open innovation is instrumental in reducing development costs and risks, enhancing innovation performance and competitiveness, and providing access to vital resources, expertise, markets, and funding. This table synthesises key insights from influential articles, shedding light on the transformative potential of open innovation for start-ups and SMEs, enabling sustainable growth and success.

Table 1: Impacts of Open Innovation for start-ups and SMEs

Article	Impacts
Cavalcante et al. (2019)	Reduce development costs and risks and facilitate collaboration and knowledge sharing with external partners.
Chesbrough (2019)	Enhances chances of success and provides access to resources, expertise, markets, funding, and other necessary resources for growth.
Wilks & Young (2018)	Enable companies to access resources and capabilities and compete with larger companies.
Birkinshaw & Haas (2016)	Enhance innovation performance and improve innovation capability and competitiveness.
Culpan (2014)	Enables companies to leverage internal resources and capabilities better and access external sources of knowledge and expertise.
Huizingh (2011)	Linked to better financial performance and increased company market share.
Van de Vrande et al. (2009)	Enable companies to better fulfil customer demands, improve competitiveness, acquire missing knowledge, access resources, reduce risks and costs, and enlarge the network.
Chesbrough (2003)	Increases competitiveness, faster time-to-market for new products and services, leverages internal resources and accesses external knowledge and expertise.

Table 2 provides a concise summary of the perceived impacts of open innovation as reported in the literature. These insights offer a valuable perspective on how open innovation practices influence various aspects of business operations.

Table 2: Summary of Impacts Perceived in Open Innovation Literature

Impact	Birkinshaw and Haas (2016)	Chesbrough (2003)	Chesbrough (2019)	Culpan (2014)	Huizingh (2011)	Wilks & Young (2018)	Cavalcante et al. (2019)	Van de Vrande et al. (2009)
Enhance innovation performance	X							X
Improve competitiveness	X	X			X	X		X
Faster time-to-market for new products		X						
Better financial performance					X			
Access to resources		X	X	X		X		X
Access to experts			X					X
Access to new clients/markets			X					
Enhance the success chances			X		X			
Reduce development costs and risks		X					X	X
Enlarge network							X	X

3.4. Open innovation experience in Portugal

While Open Innovation has become an increasingly important topic in the literature on innovation management, the literature on open innovation focused specifically on Portugal is still relatively scarce. A preliminary search of academic databases such as Scopus and Web of Science reveals that only a handful of articles have been published on the topic, with a total of 12 articles identified published up to April 1st, 2023. This indicates that the topic of open innovation in the Portuguese context is still under-researched and that there is a need for further assessment of the topic. In this chapter, we aim to review the existing literature on open innovation in Portugal, analyse the key themes and trends, and identify gaps and opportunities for future research. It is essential to develop a deeper understanding of the Open Innovation landscape in Portugal, as this can help to identify potential challenges and opportunities for start-ups and other companies operating in the

country. As suggested by Huizingh (2011), innovation practices must be adapted to the specific context and characteristics of each region or country. Therefore, research that focuses on the Portuguese experience of Open Innovation can provide valuable insights for practitioners and policymakers, contributing to the development of more effective and context-specific strategies for innovation management.

The study conducted by Freitas (2019) is an empirical quantitative and exploratory analysis that assesses the adoption and performance of Open Innovation strategies by small and medium-sized enterprises (SMEs) in Portugal. The study highlights the need for more empirical research on open innovation in SMEs, especially in moderate innovator contexts like Portugal. Freitas (2019) found that Portuguese companies in different industries engage in open innovation, but the country still has a closed innovation model. However, companies that practice open innovation demonstrate better results, performance, and profitability, particularly in the case of SMEs that engage in open innovation Inbound.

The study by Fernandes et al. (2017) aims to identify the sectors and sources/agents that most engage in open innovation in Portuguese enterprises. Using the data from the Community Innovation Survey (CIS-2012), the study examines the nature of the innovation process and differentiates the results by sector to assess levels of openness and related factors. The results indicate that the main innovating sectors in Portugal are research-based, knowledge-based, and service-based, revealing an increasing focus on knowledge and services. The study suggests that this increasing trend towards openness in innovation can be an effective way to cope with rapid trends and changes. However, the study also shows that Portuguese innovation is still more firm-based than cooperation-based, especially concerning new product launches.

The study conducted by Teixeira and Lopes (2012) aimed to examine the adoption of Open Innovation practices in Portugal, a country at an intermediate stage of technological development. The research found that, on average, firms tend to adopt a relatively closed innovation model in comparison to firms located in countries with advanced technological development. However, about a quarter of the surveyed firms implemented open innovation

in their innovation strategy, with a higher prevalence in the absorption of external knowledge and technology (40%) than in the transfer of knowledge and technology to other organisations (less than 10%). The results suggest that there may be a lack of awareness of the economic potential of making internally created technologies available to third parties, but this potential might also depend on other circumstances, such as technology architecture.

The study by Almeida (2021) aimed to explore the open innovation practices adopted by Portuguese SMEs using outside-in, inside-out, and coupled paradigms. The study used a quantitative approach and surveyed 187 Portuguese SMEs. The findings revealed that these organisations preferred the outside-in paradigm, with the integration of external knowledge from suppliers and clients being the most adopted practice. The inside-out model was found to be the least relevant, especially for smaller companies. Licensing processes were found to be important in the inside-out model, while joint ventures and network consortiums were prominent in the coupled model. The study highlighted the increase in the innovation capacity of these organisations as the most significant benefit of open innovation, while the lack of resources and difficulties in integrating knowledge emerged as significant challenges. The study's results can be valuable in the development of public-support policies that promote the involvement of Portuguese SMEs in open innovation processes.

The study conducted by Julião, Ferreira, and Gaspar (2022) aims to explore the drivers of implementing open innovation in SMEs. The study uses an online questionnaire to collect data from Portuguese SMEs, and the results show that SMEs have a high level of receptivity to implementing open innovation. The findings suggest a positive relationship between applying open innovation and the level of satisfaction with the R&D unit's performance. The main drivers for implementing open innovation vary depending on the size of the company. For micro-enterprises, the main driver is to complement internal skills. Small enterprises look for the most effective way to develop new products and services, while medium-sized enterprises are mainly driven to monitor market trends and improve their innovation process. Overall, SMEs seem to be more motivated to apply open innovation to

improve their innovation process and capacity than to reduce costs, share innovation risks, or improve their reputation.

Rahman, Acilar, and Ramos (2013) aimed to provide an overview of the adoption of open innovation strategies in small and medium-sized enterprises (SMEs) in Portugal and Turkey. The study examined the decision-making processes involved in introducing open innovation and identified the most common strategies used by SMEs in each country. Based on a survey, the authors found that Portuguese SMEs were more likely to collaborate with universities, while Turkish SMEs preferred intermediaries. However, both countries had a collaboration with partners as the most popular strategy. The authors concluded that SMEs in the two countries had similar factors to consider when deciding on open innovation strategies. They also noted the plan to conduct a larger survey that would include additional countries.

Fernández López et al. (2015) conducted a study to explore the determinants of a firm's interest in collaborating with universities and whether they differ based on the technological level of the company's industry. The study utilised the conceptual framework of the open innovation model, taking into account the transaction costs and roles of innovation diffusion that justifies the study of a firm's interest as a previous step in an open innovation relation among firms and partners. Data was collected through semi-structured interviews between January 2009 and October 2009 on a sample of 375 firms from Spain, Portugal, and France. The findings revealed that firms with a higher level of innovation tend to be more interested in collaborating with universities. Furthermore, country factors were also found to affect a firm's intention to collaborate with universities. The study concludes that the determinants of a high-tech firm's attitude to cooperation differ from those found in a non-high-tech firm. The authors suggest that future research should investigate the determinants of firms' formal decision to cooperate to gain a better understanding of the driving forces behind their interest in and the decision to cooperate.

Arbussà and Llach (2018) examine the relationship between innovation activities, firm characteristics, and the degree of innovation openness of manufacturing companies in

Germany, Portugal, and Bulgaria. Using logistic regression analysis to study data from the Community Innovation Survey (CIS) from 2008, the study finds that the appropriate open innovation strategy is context-dependent, with similar practices and firm characteristics having opposite relationships in different countries. The results support the contingency approach to open innovation, emphasising the importance of considering country idiosyncrasies when designing policies to promote open innovation. The study adds to the understanding of the context dependency of open innovation and highlights the need to tailor open innovation practices and strategies to specific national contexts.

Fernandes, Cesário, and Castela (2018) examine the current state of innovation in Portugal and the role of open innovation in promoting sustainability for businesses. The authors analyse data from the Community Innovation Survey 2012 using the HJ-Biplot methodology. The study highlights the need for Portuguese firms to focus on activities that lead to desired outcomes and suggests that partnering with the right stakeholders can facilitate idea execution and diffusion. Overall, the article emphasises the importance of open innovation in enabling Portuguese businesses to compete in the modern market, which is characterised by rapid technological advancements and increasing competition.

Iglesias-Sánchez, Correia, and Jambrino-Maldonado (2019) investigates the application of open innovation in the tourism industry, specifically its adoption and utilisation through social media. The research involved a sample of 135 companies from the tourism sector in southern Portugal and Spain, where cluster analysis was used to evaluate the impact of customer involvement on innovation performance. The results indicate a positive impact of open innovation on new product development, which subsequently improves turnover and competitiveness. However, the study also notes that the formal adoption of open innovation is still lacking in the industry. Nonetheless, the research highlights that the tourism sector is progressing towards open innovation, with social media being a strategic tool for innovation.

Cesário et al. (2016) aim to identify the sectors that are more willing to engage in cooperation initiatives for innovation in Portugal. The authors highlight the importance of

innovation for firms in today's knowledge-intensive economies and how external expert knowledge can contribute to the process of innovation. They discuss the three types of approaches to innovation: make, buy, or cooperate with other agents. Cooperation for innovation among firms, clients, and stakeholders is not a new concept. The authors use the CIS-2012 dataset to identify the sectors that are more inclined towards cooperation initiatives and to analyse the scale and scope of cooperation in those sectors. The results suggest that firms in some sectors are more open to cooperation initiatives for innovation than others, and a more detailed analysis is provided for those sectors. Overall, the paper sheds light on the importance of cooperation for innovation in different sectors and how it can contribute to firms' economic and social influence as "market protagonists."

Table 3: Overview of Open Innovation Literature on Portugal

Article	Publication Year	Key Themes
Teixeira and Lopes (2012)	2012	Adoption of open innovation practices in Portugal.
Rahman, Acilar, and Ramos (2013)	2013	Adoption of open innovation in SMEs in Portugal and Turkey.
Fernández López et al. (2015)	2015	Determinants of firms' interest in collaborating with universities in Spain, France and Portugal.
Cesário et al. (2016)	2016	Sectors inclined towards cooperation initiatives for innovation in Portugal.
Fernandes et al. (2017)	2017	Sectors and sources engaging in open innovation in Portuguese firms.
Arbussà and Llach (2018)	2018	The degree of innovation openness of manufacturing companies in Germany, Portugal, and Bulgaria.
Fernandes, Cesário, and Castela (2018)	2018	Role of open innovation in promoting sustainability in Portuguese firms.
Freitas (2019)	2019	Adoption and performance of open innovation in Portuguese SMEs.
Iglesias-Sánchez, Correia, and Jambrino-Maldonado (2019)	2019	Application of open innovation in the tourism industry in southern Portugal and Spain.
Almeida (2021)	2021	Open innovation practices in Portuguese SMEs.

Article	Publication Year	Key Themes
Julião, Ferreira, and Gaspar (2022)	2022	Drivers of open innovation adoption in Portuguese SMEs.

Table 3 provides an overview of key articles in the realm of open innovation within the context of Portugal. These articles span from 2012 to 2022 and encompass a variety of themes and research focuses related to open innovation practices in Portugal. Each entry in the table represents a significant contribution to the understanding of open innovation dynamics within the Portuguese business landscape, shedding light on topics such as adoption, determinants, and the role of open innovation in fostering collaboration and sustainability in firms across the country.

4. Case study

In the pursuit of a comprehensive understanding of open innovation practices within the Portuguese landscape, this chapter examines two distinct open innovation programs.

4.1. Case study 1: Open Innovation Program A

4.1.1. Introduction

The open innovation program A, run by Company A is a platform that offers exciting opportunities for start-ups operating in various industries. This program seeks to engage with innovative entrepreneurs from around the world who have ready-to-market solutions in specific categories aligned with the program's objectives. Through a rigorous selection process based on defined criteria, a group of start-ups is chosen to participate in the program and benefit from collaboration with program partners, potential strategic investments, and access to valuable resources and networking opportunities.

4.1.2. Open Innovation Program Criteria

To be eligible for the program, start-ups must fulfil several criteria. Firstly, they must be incorporated in any country and provide proof of registration if requested by the program members. Additionally, start-ups must offer a product or service solution within at least one of the predefined recruitment categories. These categories encompass areas such as electric mobility, social impact, renewables challenges, and P&O challenges. It is essential for start-ups to have a market-ready product or service solution, as the program focuses on advancing existing offerings rather than idea-stage concepts.

4.1.3. Program Focus Areas

The Company A Open Innovation program is designed to address key focus areas that are strategically aligned with the company's objectives and reflect emerging trends in the industry. This program actively seeks start-ups that offer innovative product or service

solutions within specific domains, namely electric mobility, social impact, renewables challenges, and P&O challenges.

1. The electric mobility category encompasses start-ups focusing on shared economy, mobility as a service, fleet solutions, and fleet decarbonisation.
2. In the social impact category, start-ups are encouraged to address challenges related to facilitating energy access in underdeveloped communities and improving energy access through education, small businesses, and health.
3. The renewables challenge category focuses on start-ups involved in large-scale onshore renewable energy generation, project lifecycle management, LCOE reduction, and energy trading.
4. The P&O challenges category seeks start-ups working on carbon capture, utilisation, and storage, ammonia-based hydrogen value-chain, direct air capture, and carbon offsets.

By concentrating on these specific areas, the Company A program aims to foster innovation and collaboration with start-ups that can make significant contributions to a sustainable future and drive the energy transition.

4.1.4. Selection Process and Evaluation Criteria

The program follows a comprehensive evaluation process to select the most promising start-ups. The assessment considers various factors, including the team's credibility, qualifications, and relevant experience. The product or service is evaluated based on its innovation, differentiation from existing solutions, scalability, and potential sustainable competitive advantage. Moreover, the market size and potential for significant sales growth are key considerations. The viability of the business model based on sound commercial and economic assumptions is also taken into account. Finally, the fit between the start-up's solution and the program's challenges is considered during the evaluation process.

4.1.5. Benefits for Successful Applicants

- Strategic Collaborations and Investments:

- Successful start-ups gain the opportunity to collaborate with program partners, facilitating strategic investments and potential commercial partnerships.
- These collaborations open avenues for start-ups to establish meaningful relationships within the industry.
- Access to Industry Specialists:
 - The program grants start-ups access to industry specialists who offer expert guidance and insights.
 - This access to expertise accelerates the start-ups' journey toward robust business growth.
- Piloting Solutions with Company A:
 - Selected start-ups have the unique chance to pilot their solutions with Company A, a prominent energy industry leader.
 - This collaboration serves as a powerful validation of the start-ups' offerings and enhances their prospects for expansion within the market.
- Monetary Prize and Recognition:
 - A distinguished monetary prize of 50,000 euros is awarded to one of the five finalists.
 - This prize acknowledges the outstanding contributions made by the start-ups during the program.
- Global Exposure and Networking:
 - The program provides finalists with an exceptional opportunity to participate in the renowned Web Summit event.
 - Finalists present their ideas to a global audience, fostering networking and exposure on an international scale.
- All-Expenses-Paid Trip to Portugal:

- Finalists are offered an all-expenses-paid trip to Portugal as part of the program.
- This includes participation in key events and engagements, enhancing the start-ups' visibility and connections.

These benefits signify the substantial value that successful applicants can gain from the program. The collaborations, expertise access, market validation, monetary recognition, global exposure, and immersive experience in Portugal collectively contribute to start-ups' growth and advancement within the innovation ecosystem.

4.1.6. Results and Notable start-ups

The Open Innovation Program A has yielded remarkable outcomes, showcasing the success of the participating start-ups. Among the four finalists chosen in the latest edition, Start-up A1 emerged as the winner. The finalist's group includes:

- Start-up A1 offers a sustainable and affordable refrigeration solution for African regions where millions lack access to electricity. Their product, powered by solar panels and lithium batteries, operates in refrigeration or freezing mode, ensuring food preservation for up to seven consecutive days.
- Start-up A2 an innovative start-up from Slovakia that utilises predictive technology to optimise the placement of electric vehicle charging points.
- Start-up A3 a Brazilian start-up leveraging Artificial Intelligence in renewable energy production.
- Start-up A4 from Brazil, proposing the production of green hydrogen from wastewater sludge, completing the cohort of promising start-ups.

4.1.7. Interview with Company A

During the research, an interview was conducted with a project manager representative from Company A, to gain deeper insights into their open innovation practices. It was revealed that due to GDPR regulations, Company A could not disclose the contact

information of start-ups they have worked with. Although Company A blog mentioned some start-ups they collaborated with, it did not provide an exhaustive list. Only the finalists of their open innovation programs were publicly disclosed. Notably, Company A announced a forthcoming open innovation program in 2021, with the first program scheduled to take place in 2022. Additionally, Company A organises hackathons where participants have the opportunity to further explore their ideas, and the innovation team has the flexibility to pursue initiatives that align with the business goals and open innovation platform. The project manager emphasised that Company A keeps the door open for potential collaboration, even if a start-up does not win a specific program. An example highlighted was the case of Start-up A2, which did not win a program but still had the opportunity to work with Company A.

Company A's innovation department includes an Open innovation program initiative, which acts as an enabler rather than directly developing proof of concepts (POCs). The Open innovation initiative identifies solutions of interest to the company and connects them to relevant areas within Company A. The innovation department comprises three innovation centres: Product and Operations, Commercial, and Renewable and Energy Management. Each centre focuses on specific areas, such as low-carbon fuel, carbon capture and utilisation, ammonia, services, electric mobility, energy storage, and renewable energies. The open innovation initiative creates challenges that align with the needs of these business units and acts as a facilitator to connect start-ups or researchers to the relevant areas. Once selected, the respective business units take the lead in moving forward with the pilots, including start-up validation and the development of pilot plans.

While company A has its own open innovation initiatives, exemplified by the Open Innovation Program A, they also collaborate with other companies' open innovation programs, sponsors innovation initiatives, and engage with universities primarily through hackathons. Company A has programs dedicated exclusively to start-ups and also initiatives targeting researchers. It was noted that for start-ups, the financial prize is not the most crucial aspect. Instead, having Company A as a partner and client holds greater value. The

opportunity to be exposed at events like Web Summit and having a presence within Company A's network where other industry players can take notice is more significant than the monetary reward.

As a global team, the Open Innovation initiatives team develops global strategies and focuses on connecting start-ups and researchers with the relevant business units. However, they do not lead or oversee the management of pilots or proofs of concept (POC). Consequently, they have the time and capacity to take care of the strategic approach and facilitate connections between external entities and internal areas of interest. The Open Innovation Initiatives team does not handle the initial contact phase, as start-ups are typically filtered and selected by a partner or innovation consultancy before engaging with Company A. The management of websites, visual identity, feedback, and communication is often entrusted to third-party organisations.

The innovation consultancy serves as the initial stage of the funnel, while the Open innovation initiatives team acts as the "friends of the start-ups" and represents Company A until the start-ups integrate with the relevant innovation centres within the business units. It is the responsibility of these innovation centers to evaluate the feasibility of building use cases or proofs of concept (POC). If deemed viable, the innovation centres connect the start-ups with the internal teams responsible for the pilots. However, in exceptional cases, such as the winner of the Open Innovation program A, Start-up A1, the Open Innovation team takes charge of the project as a whole. Typically, the projects are carried out by the respective business units.

After the completion of projects, they undergo analysis based on key performance indicators (KPIs). Importantly, the financial aspect is not the primary focus at this stage. Company A is more interested in the innovative capabilities and positive impact on the environment. In the event of significant success, a project may evolve into a subsidiary of Company A, further solidifying the partnership and integration with the company.

4.2. Case study 2: Open Innovation Program B

4.2.1. Introduction

Open Innovation program B seeks to foster the development and validation of innovative solutions aimed at enhancing people's protection, improving their quality of life, and elevating the overall customer experience. The program acts as a bridge, connecting start-ups from around the world with Company B, enabling them to test and validate their solutions through a paid Proof of Concept (POC) with a budget of 20,000 euros. Additionally, Company B offers concrete possibilities for integrating successful solutions into Company B' value chain, creating a win-win partnership.

4.2.2. Open Innovation Program Criteria

The Open Innovation program B has established specific criteria to ensure the selection of qualified start-ups for participation. For start-ups to be considered, they are required to have a technologically-verified and market-ready product or service. This criterion ensures that the program can focus on developing and validating solutions through a Proof of Concept (POC) approach. Additionally, start-ups must have a complete team in place, as solo entrepreneurs and projects without a functioning product will not be considered. These criteria aim to ensure that participating start-ups have a solid foundation, increasing the likelihood of successful collaboration and the creation of impactful solutions. Such rigorous selection criteria contribute to the program's overall objective of fostering innovation and generating tangible outcomes for Company B and its customers.

4.2.3. Program Focus Areas

Open Innovation program B focuses on three main areas of interest where innovative solutions can bring significant value and impact:

1. Tech for Insurance: The program welcomes solutions that strengthen the efficiency, safety, and speed of Company B internal processes. start-ups offering technological

advancements that streamline operations, enhance risk assessment, and improve underwriting and claims management processes are highly encouraged to apply.

2. Future of Healthcare: Program B seeks technologies that address modern healthcare needs. start-ups providing solutions in areas such as telemedicine, digital health platforms, remote patient monitoring, personalised healthcare, and health analytics are particularly sought after.
3. Happy Human: The program is interested in new technologies and business models that support individuals in their pursuit of happiness and improve their overall well-being. This includes solutions related to mental health, work-life balance, stress reduction, personal development, and other areas that positively impact people's lives.

4.2.4. Selection Process and Evaluation Criteria

The open innovation program B employs a rigorous selection process and evaluation criteria to identify start-ups that align with the program's goals and have the potential to provide innovative solutions in the insurance and healthcare sectors. The selection process begins with start-ups submitting their applications, which are then reviewed by a panel of experts from Company B and an Innovation consultancy partner. The evaluation criteria encompass several key aspects, including the credibility and expertise of the team, the level of innovation and differentiation offered by the product or service, the potential for scalability and sustainable competitive advantage, and the alignment with the program's focus areas: tech for insurance, future of healthcare, and happy human. start-ups that demonstrate a strong fit with these criteria and show promise in addressing modern industry challenges are selected to move forward in the program. By employing a comprehensive selection process and evaluation criteria, the Company B program ensures that chosen start-ups have the potential to create impactful solutions and contribute to enhancing people's protection, quality of life, and the customer experience in the insurance sector.

4.2.5. Benefits for Successful Applicants

The Open Innovation Program B offers numerous advantages for start-ups selected to join the program:

- **Paid Contribution for proof of concept (POC) Development:** Successful start-ups receive financial support of up to 20,000 euros for the development of their Proof of Concept (POC). This funding helps validate their solutions and showcase their potential.
- **Scaling Opportunities:** start-ups with a successful proof of concept (POC) have concrete possibilities for scaling up their solutions, integrating them into Company B's value chain, and expanding their reach. Company B's international presence offers additional avenues for global expansion.
- **Industry Knowledge and Data Access:** Participants gain access to Company B's extensive industry expertise, market knowledge, and relevant data. Collaborating with industry experts provides valuable feedback and insights for further refining and enhancing their product or service.
- **Flexible Program Structure:** The Open Innovation Program B is designed to accommodate the specific needs of each start-up, allowing for a customised program experience tailored to their business requirements. This flexibility ensures optimal outcomes and a mutually beneficial collaboration.

4.2.6. Program Structure

The Company B program follows a structured framework that ensures effective collaboration and results:

- **Kick-Off:** The program commences with a remote kickoff session, introducing the Open Innovation program B and outlining the activities to be undertaken between specific business units and start-ups.
- **proof of concept (POC) Setup:** A one-day in-person workshop in Lisbon marks the official start of the program. The core team, including start-ups, Company B's

business units, the Innovation Team, and the innovation consultancy partner, gather to establish Statements of Work and delve into the details of the proof of concept (POC) to validate the expected outcomes and establish a roadmap.

- proof of concept (POC) Execution: The program involves a series of project design meetings to test and validate the assumptions made at the beginning of the project through practical tests and experiments.
- Halfway Meeting: A mid-term check ensures the project is on track and allows for adjustments if needed to achieve the expected results.
- Final Meeting: The program concludes with a final meeting and celebratory event where the start-ups present their proof of concept (POC) results to a jury. The meeting also serves to define the next steps for further partnership development.

4.2.7. Results and Notable start-ups

In its inaugural edition in 2021, the Open Innovation program B received over 200 applications from companies spanning 35 different countries. After a rigorous selection process five start-ups were chosen to collaborate closely with Company B and develop impactful proofs of concept (POC) together. The selected start-ups represented a diverse range of innovative solutions, originating from Portugal, Spain, Sweden, Switzerland, and Turkey.

Selected start-ups:

- Start-up B1: Start-up B1 offers a mental health support platform, providing personalised programs through questionnaires, videos, exercises, data analysis, and video consultations. Collaborating with Company B, Start-up B1 helped 36 employees access a tailored support program, addressing stress reduction and work-life balance. The evaluation yielded positive results, with 83% of users reporting improved mental health.
- Start-up B2: Start-up B2 is a mobile application dedicated to breastfeeding and maternity. Powered by Artificial Intelligence and certified knowledge, it provides

personalised responses to various questions. In partnership with Company B, Start-up B2 significantly improved the support and guidance provided to Portuguese mothers during this crucial phase of their lives. During the two-month proof of concept (POC), 87% of users found the application highly useful in addressing their queries.

- Start-up B3: Start-up B3 develops platforms to assist insurers' actuaries in pricing insurance products. Collaborating with Company B, Start-up B3 worked on an alternative model for calculating home insurance premiums using technologies such as Big Data and Machine Learning.
- Start-up B4: Start-up B4 is an application-based therapy platform that connects people in group therapy sessions facilitated by psychologists via video conferencing. In collaboration with Company B, Start-up B4 developed a specialised well-being program tailored to seniors, incorporating interactive videos, exercises, and a dedicated application. A total of 26 participants took part in four groups, with 85% reporting improved well-being as a result of their participation.
- Start-up B5: Start-up B5 provides a risk assessment platform supporting insurance companies in analysing the risks associated with real estate and commercial buildings. In collaboration with Company B, Start-up B5 tested various functionalities of their platform, including inspection questionnaires, video calls, and reporting and benchmarking capabilities.

5. Results

This chapter presents the results obtained from interviews conducted with four start-up founders who participated in the open innovation programs of Company A and Company B in Portugal. The start-ups interviewed were Start-up A1, Start-up A2, Start-up B2, and Start-up B5. This chapter aims to address the research questions: *"How do start-ups participating in open innovation programs in Portugal perceive the benefits of it, and what are the main challenges they face in participating in such programs?"*.

5.1. Benefits of participating in Portuguese open innovation programs

Participating in open innovation programs offer numerous benefits for start-ups, as highlighted by the interviews conducted with the start-ups. Additionally, these benefits are substantiated by findings in the existing literature. This subchapter examines the key advantages start-ups gain from engaging in such programs:

5.1.1. Validation and Reputation

Start-ups whose products align with the strategies of larger companies benefit from working with these industry leaders. Collaboration with a prominent company serves as a strong validator for the small business, demonstrating the value and potential of their product. This validation not only enhances their credibility but also plays a pivotal role in securing partnerships with other important players in the sector. Several participants in the interviews emphasised that showcasing their successful collaborations with leading companies helped them close projects with other significant players. The association with reputable organisations builds trust and confidence among potential partners, increasing the likelihood of successful business collaborations and expanding the start-up's network within the industry.

Table 4: Selected Interviewee Quotes on the benefits regarding Validation and Reputation

Interviewee	Quote	OI program
Start-up A2	Being able to say that we collaborated with Comapny A gives us a strong foothold in the market. It's not just about the product; it's about the trust that a big name like Comapny A puts in us.	Comapny A
Start-up B2	Our collaboration with Comapny B through the open innovation program boosted our reputation. It's easier to approach other companies when they see that a well-known industry leader trusts us.	Comapny B

Table 4 highlights relevant quotes from interviewees participating in the open innovation programs. from Comapny A and Comapny B. They share their perspectives on the benefits of validation and enhanced reputation gained through collaboration with major companies. These quotes highlight how such partnerships not only validate the startups' capabilities but also elevate their standing in their respective industries, fostering trust and credibility among potential partners and clients.

5.1.2. Understanding Corporate Procedures

For start-ups that have not previously worked with larger organisations, participating in open innovation programs provides invaluable insights into the procedures and workings of bigger companies. This was especially emphasised by start-ups like Start-up B2 and Start-up A1, which had limited experience working with larger companies before participating in the open innovation program. Understanding the rituals, rhythms, decision-making processes, and organisational structures of prominent companies equips start-ups with the knowledge to navigate the complexities of working with larger players effectively. The firsthand experience gained through these programs proves beneficial in future collaborations, enabling start-ups to engage with larger organisations with confidence and a deeper understanding of their operational dynamics.

Table 5: Selected Interviewee Quotes on the benefits of Understanding Corporate Procedures

Interviewee	Quote	OI program
Start-up B2	Having limited experience with larger companies, our participation in the open innovation program gave us an opportunity to understand the inner workings of a big corporation and the structures of power.	Company B
Start-up A2	Through the Company A OI program, we gained valuable insights into their corporate procedures, from how they make decisions to how they handle various operations.	Company A
Start-up A1	Working with Company A through the open innovation program provided us with a deep understanding of how larger companies operate. From their day-to-day procedures to their decision-making mechanisms, we got a firsthand glimpse into the corporate world that proved to be insightful for our future endeavours.	Company A

Table 5 presents a selection of interviewee quotes that underscore the significance of comprehending corporate procedures, particularly for startups with limited prior exposure to larger organizations. Notably, participants such as Start-up B2 and Start-up A2, who entered the open innovation program with minimal experience in this domain, found immense value in gaining insights into the intricate workings of prominent corporations. These quotes shed light on their newfound understanding of corporate rituals, decision-making processes, and organizational structures, acquired through their involvement in open innovation programs.

5.1.3. Business Scaling and Revenue Impact

Collaborating with a big company as a client can have a substantial impact on a start-up's product development and revenue. This was particularly highlighted by Start-up A2, as they embarked on a paid proof of concept (PoC) with Company A, a leading energy company. The partnership with Company A not only boosted their business financially but also enabled them to develop further plans and strategies for growth. A single partnership with a larger organisation can scale the start-up's business significantly, providing opportunities for expansion and increased market reach. However, it is crucial for start-ups to establish relationships with multiple big players to avoid dependence on a single client.

Diversifying partnerships ensures long-term sustainability and reduces potential risks associated with overreliance on a single customer.

Table 6: Selected Interviewee Quotes on the benefits regarding Business Scaling and Revenue Impact

Interviewee	Quote	OI program
Start-up A2	Our collaboration with Company A was a significant turning point for us. It wasn't just about the financial gains; working alongside a major player like Company A brought us a remarkable boost in credibility within the market. It's akin to a mark of validation that communicates, 'These guys are here to make an impact.' Moreover, it opened doors to potential clients and partners beyond our expectations.	Company A
Start-up A2	While landing a big collaboration can be a game-changer, it's essential to keep your options diverse. Relying solely on one client, no matter how significant, can be risky. We've learned from experience that having a range of partners brings stability and safeguards against potential downsides. Building relationships with multiple players ensures a safer journey in the long run.	Company A

Table 6 encapsulates valuable insights from interviewed participants, particularly emphasizing the transformative effect of collaborating with major companies on start-up product development and revenue. This point was underscored by Start-up A2's experience, as they engaged in a paid proof of concept (PoC) with Company A, a prominent energy company. Their partnership with Company A not only injected financial strength into their business but also catalyzed the formulation of comprehensive growth strategies. The profound impact of collaborating with a larger organization on business scalability and market reach is evident in the quotes presented. This single partnership had the power to significantly propel the start-up's presence, providing avenues for expansion that exceeded their expectations. Nonetheless, the table also reinforces the importance of diversifying partnerships, as highlighted by Start-up A2, to mitigate the inherent risks of over-dependence on a sole client. Maintaining a variety of collaborations ensures long-term sustainability and minimizes potential vulnerabilities associated with relying exclusively on one customer.

5.1.4. Monetary Prizes and Support

Open innovation programs that offer monetary prizes, in addition to the possibility of developing proof of concepts (POCs), provide valuable support to small companies. This was exemplified by Company A, which generously awarded a monetary prize of 50,000 euros to the first-place winner. Start-up A1, the recipient of this prize, highlighted the significance of the monetary support in their journey. The funds received from Company A's prize helped Start-up A1 stabilise their operations and provided a solid financial foundation. With the prize money, Start-up A1 was able to invest in further research and development, enhancing their product and expanding their market presence. The monetary prize not only provided immediate financial stability but also positioned Start-up A1 for long-term growth and success. The availability of such monetary prizes within open innovation programs creates a positive impact on the innovative ecosystem by fostering stability and empowering start-ups to pursue their long-term strategies.

Table 7: Selected Interviews Quotes on the benefits regarding Monetary Prizes and Support

Interviewee	Quote	OI program
Start-up A1	Receiving the monetary prize from Company A was truly significant for us. It wasn't just about the funds; it represented a strong vote of confidence. The support came at a crucial time, helping us stabilise our operations and establish a solid financial foundation. We directed the prize money towards further research and development, allowing us to enhance our product and expand our market presence. This support not only ensured immediate financial stability but also positioned us for long-term growth and success. The impact of such support reaches far beyond the initial injection of funds, influencing our trajectory and potential for the future.	Company A

Table 7 gathers illuminating perspectives from our interviewees, underlining the substantial advantages that open innovation programs, offering monetary prizes alongside

the potential for proof of concepts (POCs), bring to small enterprises. This benefit was vividly exemplified through Company A's commendable provision of a 50,000 euro monetary prize to the first-place recipient. Start-up A1, as the beneficiary of this prize, articulated the profound significance of such financial support in their entrepreneurial journey. The funds received as Company A's prize not only offered immediate stability to their operations but also laid the cornerstone of a robust financial structure.

5.1.5. Access to Expert Perspectives

Collaborating with big companies provides start-ups with the opportunity to not only understand the problems better but also to gain insights into how these industry leaders perceive future solutions and their ongoing investments. It allows start-ups to see the problem from the top, understanding the implications and complexities involved in the solving process. For instance, Start-up A2, a start-up focused on maximising revenue from public EV charge points, highlighted how hearing from Company A, one of the most important players in the energy and renewable energy sector, helped them understand the challenges of the Portuguese market, a key region for their business development. Engaging with leading companies enables start-ups like Start-up A2 to grasp the problem's nuances and learn about different approaches and strategies being implemented by established companies on a global scale. This exposure to diverse perspectives and established global networks broaden the start-up's understanding of the problem space and opens up possibilities for innovative solutions that can have a wider impact.

Table 8 encapsulates invaluable insights shared by our interviewees, spotlighting the manifold advantages that emerge when start-ups engage in collaborative ventures with industry giants. These partnerships offer start-ups a unique vantage point from which to survey the challenges more comprehensively and gain access to the top-tier perspective on future solutions and sustained investments.

Table 8: Selected Interviewee Quotes on the benefits regarding Access to Expert Perspectives

Interviewee	Quote	OI program
Start-up A2	Engaging with a major player like Company A allowed us to see the problem through their lens, to understand the intricacies and market dynamics. This exposure gave us insights into not only the current issues but also the future direction of the industry. It was like getting a backstage pass at the industry's thought process and strategies.	Company A
Start-up B5	It was eye-opening to see how a large company like Company B approaches challenges and innovation. Their insights into market trends, customer preferences, and strategic directions were invaluable. We got a deep dive into their decision-making process, which helped us fine-tune our solutions to align with industry needs	Company B

5.2. Correlating the impacts: interview and literature

5.2.1. Validation and Reputation

- Enhance innovation performance:
 - This impact is closely aligned with "Validation and Reputation" as a start-up's increased credibility and recognition gained from collaborating with established companies through open innovation can positively influence their innovation performance. The recognition of reputable collaboration can encourage the start-up to strive for better innovation outcomes.
- Improve competitiveness:
 - "Validation and Reputation" and competitiveness are interlinked. start-ups that gain validation and reputation through collaborations with larger companies are likely to enhance their competitive positioning. Being associated with well-regarded industry leaders can differentiate start-ups and enhance their competitive edge.
- Better financial performance:

- A start-up's improved reputation and validation can translate into better financial performance. Collaborating with established companies can attract investors and customers, leading to increased revenues and financial growth.
- Access to new clients/markets:
 - Collaborating with larger companies can enhance a start-up's reputation and credibility, making it more attractive to potential clients and expanding its market reach. The validation gained from such collaborations can facilitate entry into new markets.
- Enhance the success chances:
 - Establishing validation and reputation can significantly enhance a start-up's chances of success. This aligns with the idea that validated start-ups are more likely to attract investors, partners, and customers, leading to overall success. Additionally, start-ups with strong reputations are better positioned to withstand challenges.
- Enlarge network:
 - "Validation and Reputation" can play a significant role in enlarging a start-up's network. Collaborating with established companies through open innovation not only validates the start-up's capabilities but also provides opportunities to connect with a broader network of industry players, investors, partners, and experts.

These correlations emphasize that "Validation and Reputation" obtained through open innovation can have a cascading effect on various aspects of start-ups' performance and growth, as supported by the mentioned literature.

5.2.3. Understanding Corporate Procedures

- Enhance the success chances:

- Develop a clear understanding of corporate procedures within larger companies that can enhance the success chances of start-ups. When start-ups comprehend the decision-making processes, organizational structures, and rhythms of larger companies, they can navigate these complexities more effectively. This understanding enables start-ups to tailor their strategies, proposals, and collaborations in ways that resonate with the established company's procedures, increasing the likelihood of successful partnerships and outcomes.
- Reduce development costs and risks:
 - A deep understanding of corporate procedures can contribute to reducing development costs and risks for start-ups. By comprehending the internal processes, start-ups can align their innovations with the company's operations, minimizing the need for costly adjustments. Additionally, understanding corporate procedures helps start-ups identify potential pitfalls, regulatory requirements, and intellectual property considerations, reducing the risks associated with collaboration. This understanding allows start-ups to anticipate challenges and streamline their development process, ultimately leading to cost savings and lower risks in their collaborative efforts.

5.2.4. Business Scaling and Revenue Impact

- Improve competitiveness:
 - Business scaling and achieving revenue impact can contribute to improving the competitiveness of start-ups. As start-ups expand their operations and generate revenue, they can invest in research, development, and innovation. This continuous growth enhances their ability to compete in the market by offering what meets customer demands and outpace competitors.
- Better financial performance:

- The successful scaling of a start-up's business and the positive impact on revenue can lead to better financial performance. As start-ups tap into new markets, acquire more clients, and achieve revenue growth, their financial indicators improve. This enhanced financial performance is a direct outcome of the start-up's ability to effectively scale its operations and generate significant revenue streams.
- Access to resources:
 - Business scaling often requires additional resources to support expansion. start-ups that successfully scale their business attract the attention of investors, partners, and stakeholders who are willing to provide necessary resources, including funding, expertise, and technological support. This access to resources further accelerates the scaling process and enhances the start-up's ability to achieve revenue impact.
- Access to new clients/markets:
 - Business scaling frequently involves entering new markets and acquiring new clients. start-ups that effectively scale their operations can expand their customer base and enter previously untapped markets. This expansion allows start-ups to access new clients and markets, which in turn contributes to revenue growth and business success.
- Enhance the success chances:
 - Successfully scaling a business and achieving revenue impact significantly enhances the overall success chances of start-ups. As start-ups grow their operations and generate revenue, they establish themselves as credible and valuable players in their industry. This credibility not only increases their chances of securing future collaborations and partnerships but also positions them as attractive options for investors and stakeholders seeking promising ventures.

5.2.5. Monetary Prizes and Support

- Enhance innovation performance:
 - The provision of monetary prizes and support in open innovation programs can motivate start-ups to enhance their innovation performance. Monetary incentives encourage start-ups to invest more in research, development, and the generation of novel ideas. This focus on innovation directly contributes to enhancing their overall innovation performance.
- Improve competitiveness:
 - Monetary prizes and support enable start-ups to invest in activities that improve their competitiveness. With additional financial resources, start-ups can enhance their products, services, or operations, making them more competitive in the market. This improved competitiveness can lead to better positioning against rivals and an increased ability to capture market share.
- Better financial performance:
 - The monetary prizes and support offered in open innovation programs directly impact the financial performance of start-ups. The additional funds provide start-ups with the financial stability needed to invest in their operations, research, and development. This investment, in turn, can lead to improved financial performance through increased revenue and business growth.
- Access to resources:
 - Monetary prizes and support offer start-ups access to valuable resources. These resources can include not only financial aid but also opportunities to engage with mentors, experts, and industry partners. The combined effect of financial support and access to expertise contributes to start-ups' ability to leverage external resources for growth.
- Reduce development costs and risks:

- By providing monetary prizes and support, open innovation programs help start-ups reduce their development costs and risks. The funds received can offset the costs associated with research, testing, and prototyping. This financial assistance enables start-ups to innovate more efficiently and effectively, ultimately reducing the risks associated with product development.

5.2.6. Access to Expert Perspectives

- Enhance innovation performance:
 - Access to expert perspectives in open innovation programs can enhance start-ups' innovation performance. Experts provide valuable insights, knowledge, and guidance that can lead to the development of more innovative and impactful solutions. Collaborating with experts fosters a culture of continuous learning and improvement within start-ups, driving their innovation efforts.
- Access to experts:
 - The core impact of "Access to Expert Perspectives" aligns with the concept itself. Open innovation programs that provide start-ups with access to experts enable them to tap into external knowledge, experience, and specialised skills. This access empowers start-ups to address complex challenges and capitalise on opportunities they might not have been able to on their own.
- Enhance the success chances:
 - Engaging with experts through open innovation programs enhances start-ups' chances of success. Expert perspectives offer start-ups valuable insights into market trends, customer needs, and effective strategies. Leveraging this expertise increases the likelihood of start-ups developing products and solutions that resonate with customers and achieve higher rates of success.
- Reduce development costs and risks:

- Access to expert perspectives helps start-ups reduce development costs and risks. Experts can provide guidance on efficient development paths, potential pitfalls, and strategies to overcome challenges. This assistance contributes to streamlining development processes, minimising costly errors, and ultimately reducing the overall risks associated with innovation.
- Enlarge network:
 - Engaging with experts in open innovation programs also contributes to enlarging start-ups' networks. Experts often bring their own connections, which can introduce start-ups to new opportunities, partnerships, and collaborations. These expanded networks can lead to additional resources, customers, and potential investors.

Table 9 serves as a concise synthesis, mapping the insights gleaned from our interviews onto the backdrop of existing literature. This correlation underscores the multifaceted impacts of open innovation programs on start-ups, aligning them with established research findings.

Table 9: Summary: Correlating the impacts of the interview with the existing literature

Literature/Interview	Validation and Reputation	Understanding Corporate Procedures	Business Scaling and Revenue Impact	Monetary Prizes and Support	Access to Expert Perspectives
Enhance innovation performance <i>Birkinshaw and Haas (2016), van de vrande et al. (2009)</i>	X			X	X
Improve competitiveness <i>Birkinshaw and Haas (2016), van de vrande et al. (2009)</i>	X		X	X	
Faster time-to-market for new products <i>Chesbrough (2003)</i>					
Better financial performance <i>Huizingh (2011)</i>	X		X	X	
Access to resources <i>Chesbrough (2019), Culpan (2014), Wilks & Young (2018), van de vrande et al. (2009)</i>			X	X	

Literature/Interview	Validation and Reputation	Understanding Corporate Procedures	Business Scaling and Revenue Impact	Monetary Prizes and Support	Access to Expert Perspectives
Access to experts <i>Chesbrough (2019), van de vrande et al. (2009)</i>					X
Access to new clients/markets <i>Chesbrough (2019)</i>	X		X		
Enhance the success chances <i>Chesbrough (2019), Huizingh (2011)</i>	X	X	X		X
Reduce development costs and risks <i>Chesbrough (2003), Cavalcante et al (2019), van de vrande et al. (2009)</i>		X		X	X
Enlarge network <i>van de vrande et al. (2009)</i>	X				X

5.3. Challenges in participating in Portuguese open innovation programs

Participating in open innovation programs can present various challenges for companies. The following challenges were identified based on the interviews conducted with participants in the programs.

5.3.1. Understanding the Power Structure and Key Stakeholders

Navigating the power structure within large companies can be challenging for start-ups participating in open innovation programs. This challenge was identified by all interviewees, who emphasised the initial presence of numerous enthusiasts of innovation in the early stages of the programs. However, identifying the key decision-makers and influencers proved to be a more complex task. The directors and decision-makers often appeared later in the process, making it difficult for start-ups to understand the power dynamics and effectively influence the main stakeholders. The presence of multiple individuals without decision-making authority in meetings further added to the complexity, requiring start-ups to navigate through various layers to establish meaningful connections and collaborations. In addition, it was noted that for both open innovation programs, the

teams responsible for managing the programs were not directly responsible for the proof of concept (POC) and further plans. Instead, their role primarily focused on acting as a bridge between the start-ups and the internal teams who would ultimately make the decisions and develop the subsequent plans with the start-ups. These program teams served as connectors, facilitating communication and fostering collaboration between the start-ups and the internal teams. However, the separation of responsibilities meant that start-ups had to navigate through the organisational hierarchy to engage with the relevant decision-makers and stakeholders, adding another layer of complexity to the power structure within the large companies.

Table 10: Selected Interviewee Quotes on the challenges regarding Understanding the Power Structure and Key Stakeholders

Interviewee	Quote	OI program
Start-up B2	Understanding who holds the decision-making power in a big company is like solving a puzzle. It's not always clear who the real stakeholders are, especially in the beginning. We had meetings with enthusiastic innovation teams, but often the actual decision-makers were in the background. It took us time to figure out who we needed to convince and how to reach them.	Company B
Start-up A1	We had to connect with various teams and layers, each with their own priorities and perspectives. Sometimes it felt like we were jumping from one department to another. It's not as straightforward as it seems, and you have to learn the art of internal networking.	Company A
Start-up B5	Getting the ideas to the right ears was a challenge. We had to go through layers of communication, sometimes repeating our pitch multiple times. It's a test of persistence and patience.	Company B
Start-up A2	...finding the true decision-makers was like searching for a needle in a haystack. We had to adapt our communication style depending on the audience. It was a learning curve.	Company A

Table 10 encapsulates the challenges articulated by our interviewees concerning their struggles in understanding the power structure and identifying key stakeholders within large corporations.

5.3.2. Unrealistic Demands from Companies Unfamiliar with start-ups

start-ups may encounter challenges when collaborating with companies that have limited experience in working with start-ups. In such cases, it is not uncommon for these companies to have unrealistic demands or expectations. This was specifically highlighted by Start-up B2 and Start-up B5 during their interactions with Company B, a company that had less experience with open innovation programs. Start-up B2, for instance, faced unrealistic requirements from Company B during the initial planning phase of the proof of concept (POC). It is important to note that this observation is not intended as a negative aspect but rather as a factual observation about the differing levels of experience in working with start-ups.

Table 11 highlights challenges faced by start-ups when collaborating with companies that have limited experience in working with them. These insights were particularly emphasized by Start-up B2 and Start-up B5 during their engagements with Company B, a company less familiar with open innovation programs.

Table 11: Selected Interviewee Quotes on the challenges regarding Unrealistic Demands from Companies Unfamiliar with start-ups

Interviewee	Quote	OI program
Start-up B2	We noticed that Company B had certain expectations that were not aligned with the reality of start-ups. For example, during the POC planning, they had some demands that were quite challenging for us to fulfil within the given timeframe. It's not a criticism, just a difference in understanding.	Company B

5.3.3. Communication Challenges

Communication emerged as a common problem mentioned by all interviewees. Clarity and alignment within the program were highlighted as areas that required improvement. The involvement of innovation consultancies in program organisation sometimes resulted in a lack of alignment with the program owners. Additionally,

stakeholders from the same company often provided inconsistent information, further complicating the communication process. The lack of clear and transparent communication can hinder progress and understanding for start-ups participating in open innovation programs.

Table 12: Selected Interviewee Quotes on the challenges regarding Communication

Interviewee	Quote	OI program
Start-up A2	We had instances where the message from the program team didn't quite match what we heard from other stakeholders at the same company. It can get confusing when you're trying to align your efforts with what's expected.	Company A
Start-up B2	Communication gaps were frustrating. We had a few instances where the instructions from the program team and the actual decision-makers didn't quite align. It caused delays and sometimes even misunderstandings about what was expected.	Company B
Start-up A1	We found that even within the same company, different teams had slightly different takes on the program's goals. It's a challenge to stay on the same page when you're getting mixed signals.	Company A

Table 12 sheds light on a pervasive challenge faced by start-ups: communication. This issue was consistently mentioned by all interviewees and centred around the need for improved clarity and alignment within open innovation programs. The presence of innovation consultancies occasionally led to misalignment with program owners, while stakeholders within the same company often offered conflicting information, further complicating communication.

5.3.4. Short-Term vs Long-Term Perspectives

Start-ups often operate with a short-term perspective, driven by the uncertainty of their future and the need to make immediate progress. However, larger companies are more inclined to prioritise long-term strategies, considering their established presence and stability. This disparity in perspectives and timeframes can pose challenges for start-ups participating in open innovation programs.

The extensive decision-making processes within larger companies can be time-consuming and may not align with the faster pace that start-ups require. This was particularly highlighted by Start-up A2, who shared their experience of the significant delay in developing a plan for the proof of concept (POC) with Company A, which took them over a year and a half. It is worth noting that the release of the proof of concept (POC) is still pending.

The mismatch in expectations and timeframes can lead to frustration and hinder the collaboration between start-ups and larger companies. start-ups may feel their progress is impeded, while larger companies may find it challenging to meet the immediate needs of start-ups. It is crucial for both parties to find a balance and establish effective communication channels to mitigate these challenges and foster successful partnerships.

Table 13 delves into the challenges associated with differing time perspectives between start-ups and larger companies in the context of open innovation programs. Start-ups, driven by the urgency of establishing themselves in a competitive landscape, often operate with short-term goals. In contrast, established corporations prioritize long-term strategies due to their industry stability. This dichotomy in outlook and timeframes can present obstacles for start-ups engaging in open innovation initiatives. The extensive decision-making procedures within larger corporations, which may not align with the faster pace of start-ups, can lead to significant delays, as noted by Start-up A2's experience with Company A

Table 13: Selected Interviewee Quotes on the challenges regarding Short-Term vs Long-Term Perspectives

Interviewee	Quote	OI program
Start-up B5	The concept of time can differ significantly between start-ups and established companies. Our work with Company B made it evident that aligning these perspectives can be challenging. While we're keen on rapid progress, the larger company's processes can sometimes be time-consuming.	Company B

Interviewee	Quote	OI program
Start-up B2	They had a longer planning horizon, which at times clashed with our need to make things happen quickly. Finding a middle ground was a bit of a challenge.	Company B
Start-up A2	We were eager to move forward quickly, but the decision-making process took much longer than expected.	Company A

5.3.5. Perception of value of the small Companies' Time

Respecting the time of small companies emerged as a common concern raised by all the interviewed start-ups participating in the open innovation programs. Start-ups, with their limited resources, highlighted the importance of utilising time efficiently to maximise productivity and progress.

One specific area of frustration mentioned by all start-ups was the workshops that focused on topics such as pitch development, presentations, and problem validation. While these workshops were part of both open innovation programs, the start-ups felt that they were not beneficial and consumed a significant amount of their time. The start-ups already had established products and expertise in these areas, making the workshops redundant and not aligned with their specific needs. As a result, these activities were perceived as time-consuming and did not contribute significantly to their progress within the programs.

To ensure the effective utilisation of time, it is essential for open innovation programs to carefully plan and organise activities that directly align with the specific needs and goals of participating start-ups. By eliminating redundant or irrelevant workshops and focusing on targeted engagements, the programs can better support start-ups in their growth and development, optimising the use of their valuable time.

Table 14 sheds light on the challenges tied to the perception of the value of small start-ups' time within open innovation programs. The featured interviewee quotes emphasize the importance of optimizing time usage for start-ups, who often operate with limited resources.

Table 14: Selected Interviewee Quotes on the challenges regarding the Perception of value of the small Companies' Time

Interviewee	Quote	OI program
Start-up B5	Some workshops, meetings and activities were informative, but the ones that didn't match our stage and expertise felt like time wasted(...) We needed insights into advanced strategies and collaborations, not the basics of idea validation. Tailoring workshops to the start-ups' specific needs would make a significant difference.	Company B
Start-up A2	While we understand the need for workshops, some seemed more suitable for start-ups in the early stages. For us, workshops on pitch development and basic presentations were a bit off the mark. We already had products in the market, so we needed more advanced insights. It felt like a mismatch of needs and resources.	Company A
Start-up A1	We participated in workshops that were not aligned with our needs. It felt like an unnecessary investment of time when we could have been working on our product.	Company A

In the table below, the challenges faced by start-ups in open innovation programs and how these challenges were perceived by different start-ups are highlighted. Each challenge represents a unique aspect of the relationship between start-ups and big companies. Experiences from start-ups participating in programs like the ones from Company A and Company B will be shared, showcasing the ups and downs of working with large corporations in the world of open innovation.

Table 15: Summary of the Level of Negative Impact of the Challenges per start-up

Challenge	Selected quote	Startu[(OI program)	Level of impact where 1 is "Challenge not experienced", and 5 is "Highly impacted negatively by the challenge".
1. Understanding the Power Structure and Key Stakeholders	Understanding who holds the decision-making power in a big company is like solving a puzzle. It's not always clear who the real stakeholders are...	Start-up A2 (Company A)	4
		Start-up A1 (Company A)	4
		Start-up B2 (Company B)	4
		Start-up B5 (Company B)	4
2. Unrealistic Demands from Companies Unfamiliar with start-ups	We noticed that Company B had certain expectations that were not aligned with the reality of start-ups...	Start-up A2 (Company A)	1
		Start-up A1 (Company A)	1
		Start-up B2 (Company B)	5
		Start-up B5 (Company B)	5
3. Communication Challenges	We had instances where the message from the program team didn't quite match what we heard from other stakeholders at the same company...	Start-up A2 (Company A)	5
		Start-up A1 (Company A)	3
		Start-up B2 (Company B)	4
		Start-up B5 (Company B)	1
4. Short-Term vs Long-Term Perspectives	They had a longer planning horizon, which at times clashed with our need to make things happen quickly. Finding a middle ground was a bit of a challenge....	Start-up A2 (Company A)	5
		Start-up A1 (Company A)	1
		Start-up B2 (Company B)	3
		Start-up B5 (Company B)	4
5. Perception of value of the small Companies' Time	Some workshops, meetings, and activities were informative, but the ones that didn't match our stage and expertise felt like time wasted... Tailoring workshops to the start-ups' specific needs would make a significant	Start-up A2 (Company A)	4
		Start-up A1 (Company A)	4
		Start-up B2	4

Challenge	Selected quote	Start-up (OI program)	Level of impact where 1 is "Challenge not experienced", and 5 is "Highly impacted negatively by the challenge".
	difference.	(Company B)	
		Start-up B5 (Company B)	4

6. Conclusion

In conclusion, despite the challenges faced by start-ups participating in open innovation programs, the overall perception of the advantages was consistently highlighted by all the interviewed businesses. Among the various benefits mentioned, the opportunity to work with a lead company and having it serve as a validator stood out as the most cited and significant advantage. This validation from a reputable and established company carries immense value for start-ups in terms of credibility, market recognition, and potential growth opportunities.

To further advance the research in this area, it would be worthwhile to conduct a similar analysis involving start-ups participating in open innovation programs with companies where there is no significant strategic alignment. This investigation would shed light on whether the role of the validator remains crucial or tends to diminish when the alignment between the start-up and the lead company is less pronounced.

Among the challenges identified, communication problems, lack of internal alignment within the companies, and the failure to consider the importance of time for start-ups were consistently cited. These challenges underscore the need for improved communication strategies, enhanced internal coordination, and a deeper understanding of the value of time for start-ups participating in open innovation programs. Future research could explore how other cultural contexts, such as Germany and British, approach and perceive the utilisation and consideration of time in open innovation programs. Cultural factors could potentially influence the dynamics and effectiveness of these programs, highlighting the need for a broader examination of this aspect.

For future research in the context of open innovation programs, it is crucial to explore alternative communication strategies and internal alignment mechanisms within larger companies. By investigating innovative approaches to communication and internal coordination, we can better understand how these strategies can enhance communication channels, streamline decision-making processes, and foster stronger alignment between

start-ups and internal teams. Additionally, it would be valuable to compare the effectiveness of these strategies in open innovation programs with and without the involvement of innovation consultancies, shedding light on the added value and potential benefits provided by such consultancies in the context of communication and alignment.

In conclusion, the findings of this study highlight the significant role that large companies play in acting as validators and facilitating further opportunities for start-ups participating in open innovation programs. The feedback from start-ups emphasises the value of working with established companies as a means to validate their solutions and access new projects. However, it is important to note that the analysed programs took place over the last two years, indicating a need for further research on the long-term outcomes and sustainability of open innovation programs. Future studies should focus on analysing the post-program trajectories of start-ups to gain insights into the lasting impact of these collaborations and identify factors that contribute to long-term success. By understanding the long-term outcomes, we can enhance the design and implementation of open innovation programs, ensuring their continued effectiveness and value for both start-ups and larger companies.

Overall, open innovation programs play a pivotal role in the innovation ecosystem by facilitating the extension and scaling of start-up businesses. These programs not only benefit start-ups but also offer significant advantages to larger companies, as highlighted in the existing literature. The mutual collaboration and exchange of expertise between start-ups and established companies foster a dynamic environment that promotes innovation, growth, and economic development. It is important to continue exploring and refining open innovation programs to maximise their potential and contribute to the success of both start-ups and larger companies in the ever-evolving business landscape.

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