

Why do SMEs Implement Open Innovation? The Case of Portugal

Jorge Julião, Inês Ferreira, and Marcelo Gaspar

Abstract—The concept of open innovation is gaining popularity in both the world of engineering and management. However, despite this growing interest, most existing studies tend to focus mainly on large companies. Thus, the purpose of this paper is to explore the drivers of the implementation of the open innovation concept in SMEs. This study uses a survey carried out through an online questionnaire that was sent to some Portuguese SMEs. The results show that there is a high level of receptivity to implement open innovation. The findings also suggest the existence of a positive relationship between the application of open innovation and the level of satisfaction with the R&D unit's performance. 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 reputation. Moreover, findings also demonstrate that the main drivers for the adoption of open innovation vary along with company size. 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 whilst medium-sized enterprises are mainly driven to monitor market trends and improve their innovation process.

Index Terms—Innovation, open innovation, innovation implementation, innovation drivers, innovation benefits, SMEs.

I. INTRODUCTION

In a world characterized by rapid technological change, reduced product lifecycles, and increasingly global competition, companies need to find new strategies to innovate and ensure their long-term survival. Open innovation is one of these strategies that companies may follow to remain competitive.

Since it was coined in 2003 [1], the concept of open innovation has gathered increasing attention. Despite the growing interest in the concept of open innovation, most existing studies focus on large companies. However, given the particularities that differentiate small and medium-sized enterprises (SMEs), it is necessary to extend existing studies on open innovation to these types of enterprises, as the results obtained for large enterprises may not be mirrored in SMEs [1], [2]. Open innovation is particularly important for SMEs since it is a way for these companies to overcome limitations resulting from their size and thus be able to adapt and prosper in an increasingly turbulent environment [3]. Moreover,

although SMEs make up approximately 99% of all existing companies in the European Union [4], there is a gap in the open innovation literature regarding its application in this type of business. According to several authors [1], [4], [5], existing literature fails to address the application of the concept of open innovation in SMEs. Therefore, the purpose of this research is to analyze the current level of receptivity to open innovation by Portuguese SMEs. It aims to identify the level of knowledge concerning the open innovation concept, and the drivers behind its implementation.

II. THE ECONOMIC ROLE OF INNOVATION

The concept of innovation was initially introduced by Schumpeter in 1934 [6], who understood it as a new combination of preexisting knowledge and competencies. Although the concept itself has evolved, the idea that innovation is a fundamental inducer of economic development has remained [7]. Innovation thus proves to be an important factor not only at a micro-level for companies, as it is a key element in obtaining competitive advantages, but also at a macro-level, creating benefits for society in general [8].

Innovation management, namely the management of the R&D process, has always been a subject central to the debate and considered an area of high complexity without simple and definitive answers [9]. The innovation management models have changed according to the economic environment, which is dynamic. The first models, known as technology-pushed, were a consequence of the industrial expansion, and characterized by a linear process from scientific discoveries to the arrival of a new product to the market. Intensification of competition brought changes to the R&D process and the innovation model began to be more focused on market requirements – market pulled. Demand stagnation and high inflation in the 70s forced companies to have increased control of the innovation process and the reduction of costs, demanding a more general process of interaction between technological capacity and market needs - coupling models [10]. In the 80s, the increase of competition brought with the success of the Japanese companies, introduced into the innovation management model the networking dimension and the speed to market.

Currently, as a consequence of increased global competition, rapid technological developments, and the need to share high R&D costs, external partnerships are gaining greater importance, making it necessary to open up R&D to to benefit from external know-how. Moreover, the increasing complexity of the innovation process makes the internal knowledge base of companies scarce and inadequate to

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control all aspects of the innovation process [11]. In addition, the process of developing new products has become an act of global collaboration and involves numerous teams spread around the world [12]. Consequently, companies are becoming increasingly aware of the need to open up the innovation process to benefit from the skills and knowledge distributed by different companies and institutions.

III. OPEN INNOVATION PARADIGM

The concept of open innovation was coined in 2003 by Henry Chesbrough [1] to describe the inability of organizations to develop their innovation process internally and without any external support [13]. This concept arises as a consequence of the evolution of several socio-economic factors, transforming what was once an essentially closed and internal environment into a more open one [14]. An example of this is the growing division of labor as a consequence of globalization and the emergence of new information technologies that facilitate collaboration and coordination of remote work [15].

The open innovation approach can be seen as the antithesis of the traditional vertical integration R&D model – the closed innovation paradigm – in which products were developed entirely by a single company [16]. The idea at the heart of the concept of open innovation is that organizations cannot innovate alone, as they need to collaborate with different types of partners to acquire new ideas and resources in order to stay competitive [17]. In this new paradigm of open innovation, projects can have several sources of knowledge and technology, both internal and external, and these can enter the process in their different phases [18]. Moreover, since open innovation aims to make intentional use of internal and external knowledge flows, intellectual property gains a prominent role in this approach [19]. This results in a different approach to intellectual property management when compared to closed innovation, whose patent management purpose was mainly to prevent the use of new ideas by competitors [20]. In this new context, intellectual property turns out to be an important asset for the company, not only because it can become an additional source of revenue [21], but also because it is a means of fostering its business model and making the internal research mechanism more agile [20].

Open innovation brings increased mobility to an already highly skilled workforce, which allows for the dissemination of knowledge previously limited to the R&D laboratories of certain companies. Open innovation also increases the use of venture capital, which formerly only allowed start-ups to be financed that were based on innovations placed aside by others [1].

IV. OPEN INNOVATION IN SMEs

According to van de Vrande *et al.* [22], the literature on open innovation overlooks studies on SMEs, as the conclusions drawn from large companies may not be seen in these types of enterprises. This is the result of the various factors that differentiate SMEs from larger companies.

On the one hand, SMEs are usually less bureaucratic and

more risk-responsive [23], have a higher level of expertise, and a faster reaction to market changes [24]. Their flexibility, agility, and focus on a particular product, service, or technology allow them to innovate faster [25]. On the other hand, given their small size, SMEs usually have limited financial resources, do not have a multidisciplinary skills base, and use poorly structured innovation processes, which as a whole constitutes a restriction on their ability to innovate and become competitive [26]. Therefore, open innovation can be a possible way for SMEs to adapt and thrive in an increasingly competitive and turbulent environment [27], and to overcome their limitations and increase their profitability [28].

If SMEs succeed in applying open innovation, they will be able to compensate for their scarcity of internal resources and skills, by using external resources to develop new technologies and by taking advantage of market opportunities [25]. In particular, technology licensing may be of greater importance for SMEs, not only because it will allow them to feed and accelerate the internal innovation process, but also to fill existing technological gaps internally. Since R&D requires substantial capital, time, and investment in human resources, which are scarce in SMEs, they can benefit greatly from technology licensing. Moreover, an increased focus on the internal innovation process limits the flexibility and speed of companies' responsiveness to emerging opportunities, which is one of the most significant advantages of SMEs. Additionally, with the application of open innovation, SMEs gain access to knowledge that they could not otherwise obtain, reduce R&D costs, and share the risks of the innovation projects [22].

However, existing studies on open innovation in SMEs have shown that this type of company has more difficulty in developing mechanisms capable of effectively implementing open innovation as a consequence of its size [29]. In particular, even if they are more flexible and adaptable, SMEs lack the resources and skills to develop a culture of constant innovation and open innovation [27]. In particular, the scarcity of human resources with the skills required to understand, absorb and explore scientific discoveries, translates into a weak absorptive capacity of SMEs, which consequently hinders the monitoring and integration of external knowledge into the internal innovation process [26].

A few studies addressing open innovation in SMEs suggest that both financial and innovative performance benefit greatly from the implementation of this strategy [30]. However, its impact will be less than in larger companies, given the increased difficulty in detecting, absorbing, and integrating external knowledge [26].

V. METHODOLOGY

A survey strategy was applied to address the research problem. Considering the nature of this study and the related practical aspects, such as the available information sources, the survey strategy was found to be the most suitable. Moreover, surveys are traditionally used in exploratory studies because they allow both quantitative and qualitative data on people, events, or situations to be assessed [31]. Data was collected using an online questionnaire. Questionnaires

are one of the most commonly used methods to collect data and information, mainly due to their ease of construction, versatility and because they are a unique way to gather large amounts of information quickly and are easily processed [32]. As they involve a method of self-completion, one of the major benefits results from the fact that the researcher is removed from the process, thus avoiding any possible influence on the respondent [33]. Nonetheless, online questionnaires tend to have a low response rate when compared to others within the survey strategy [31]. Thus, to increase participation, all companies that received the online questionnaire were contacted via telephone beforehand.

A. Questionnaire Design

Considering the objectives defined for the study, the questionnaire was organized into two different sections. The first section establishes the company's profile and aims to collect basic information such as activity sector, economic activity code, number of employees, ownership of a dedicated R&D unit, and its level of adequacy to the company's current innovation needs. The number of employees was collected to confirm that all the companies surveyed met the SME criterion, following Commission Recommendation 2003/361/EC, which recognizes the number of employees as the main criterion for defining micro, small and medium-sized enterprises.

To assess the adequacy level of the company's internal R&D unit to its current innovation needs a dedicated scale was identified and applied [34]. A scale from 1 to 4 was defined to assess the level of adequacy, in which 1 = "Inadequate" and 4 = "Completely adequate". This Likert scale was used to prevent respondents from selecting the middle option and thus avoiding making a real choice [32]. This question aims to analyze the level of satisfaction of companies with their R&D unit and establishes a relationship between the level of adequacy of the R&D unit and the open innovation implementation. The second section of the questionnaire aims at obtaining information related to why SMEs use open innovation, as well as their perception of the main benefits resulting from its implementation. Therefore, two questions were designed, one dedicated to the drivers behind the implementation of open innovation and the other to the benefits obtained from it. Both close and open questions were used, *i.e.*, respondents were given the chance of choosing defined options or contributing to their answers.

B. Data Collection

Given the impossibility of studying the entire population, current research used a sample, constituted in a non-random manner. Even though all the companies in this study have been randomly selected from a database from the Portuguese Accreditation Institute, they were selected based on two main criteria: first, as they are an SME, and second, as they are accredited under the Portuguese Standard 4457:2007. This standard establishes the requirements for the effective use of R&D. The questionnaires were sent by email to the managers of these companies. From a sample of 100 companies, only 67 valid questionnaires were considered. Regarding the activity sector, most of the surveyed companies fall in the tertiary sector (58.2%), followed by the secondary sector (32.8%) and the primary sector (9%). Based on the number of employees

indicated, 46.3% are medium-sized, 28.4% small and 25.4% micro-enterprises.

VI. RESULTS AND ANALYSIS

The survey results show that 76.1% of the surveyed companies claim to have a unit dedicated to the R&D process, whilst 20.9% mention not having any unit for such purpose. The remaining (3%) refer to not having any functional organic unit to such end but that at least one staff member has been allocated to this function.

To assess the level of the company's satisfaction with the performance of their R&D unit, respondents were asked to classify the level of adequacy of their internal R&D unit to the company's current innovation needs. The results show that only 34.3% of the respondents consider their R&D unit fully adequate (Fig. 1). This may suggest that the majority of these SMEs lack the means to completely fulfill their innovation process.

Results also indicate that a large majority (79.1%) of the companies in this survey are aware of the open innovation concept. Nevertheless, although they mention that they are familiar with the concept, 38.8% of these companies referred to not applying open innovation (Fig. 2). Some of the companies that referred to being aware of the concept of open innovation, but not applying it in their process, did however still identify some of the practices related to open innovation, denoting that they implicitly apply the concept.

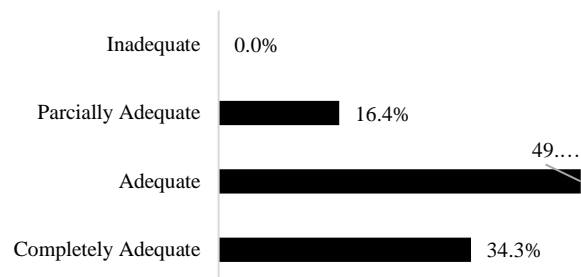


Fig. 1. Satisfaction with the performance of the R&D unit.

The correlation of data shows that open innovation is most used by medium-sized companies of the tertiary sector. Moreover, it suggests that there is greater satisfaction with the performance of the R&D unit in companies that implemented open innovation practices.

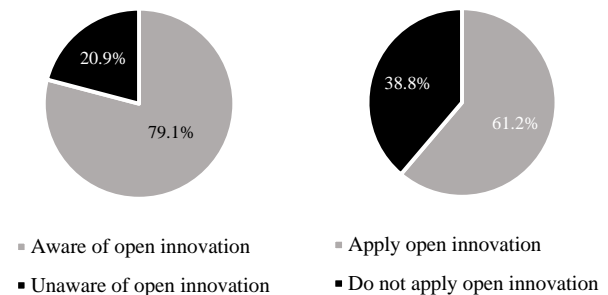


Fig. 2. Level of knowledge and application of open innovation.

Additionally, 83% of the companies that classified their R&D unit as 'fully adequate', apply open innovation. On the other hand, from the companies that classified their R&D unit as 'partially adequate', 64% claim that they do not apply

open innovation. This may suggest that the innovation process in these companies could benefit from the implementation of open innovation practices.

Fig. 3 shows the drivers of open innovation in SMEs. The global results indicate that the surveyed SMEs place less importance on aspects that are related to resources (e.g., innovation costs, innovation risks, company image, amongst others). Contrarily, having an efficient innovation process that allows the development of products according to market trends, seems to be the main reason for adopting open innovation.

The distribution of reasons to apply open innovation according to the company type demonstrates that these drivers vary along with company size. In particular, for micro-sized enterprises, the main drivers are the improvement of the innovation process and the ability to complement internal competencies. This is aligned with the suggestion that open innovation can emerge as a way to overcome certain limitations resulting from the size of enterprises.

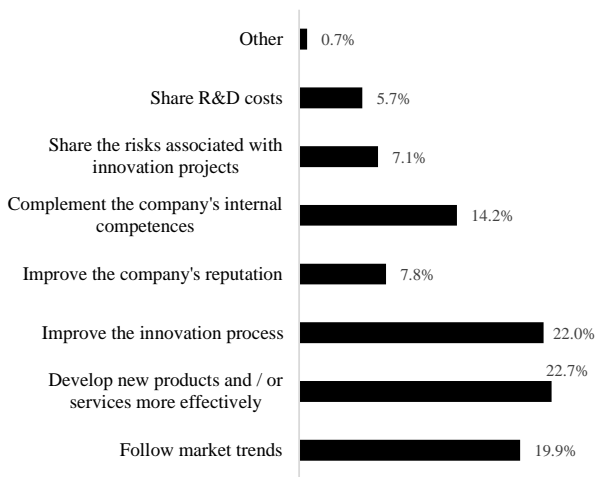


Fig. 3. Drivers of the adoption of open innovation.

When it comes to small-sized enterprises, they mention being driven to adopt open innovation practices to develop new products and/or services more effectively. It suggests that these companies are particularly aiming to incorporate new technologies and additional knowledge into their products and services. Medium-sized enterprises are more concerned with monitoring market trends and improving innovation. It is important to note that improving its reputation is a reason that is virtually exclusive to this type of company.

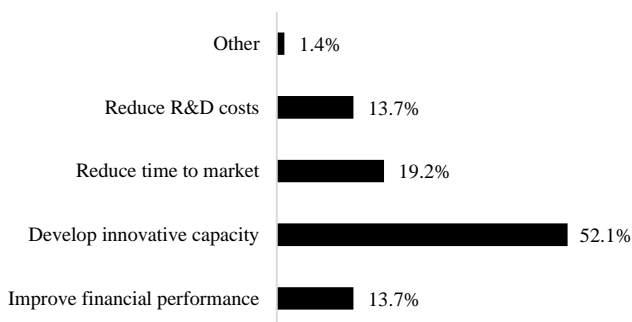


Fig. 4. Expected benefits from open innovation implementation.

To cross-validate the drivers for adopting open innovation, companies that claimed to be familiar with the open innovation concept, were also asked about the benefits they expected from its implementation (Fig. 4).

Regardless of company size, the majority of companies expect to develop their innovation capacity with the implementation of open innovation. The benefits related to financial performance and the reduction of R&D costs were essentially indicated by medium-sized enterprises. This may be because R&D investments usually consist of large expenses, with significant impacts on smaller-sized companies. Thus, even if open innovation represents a significant improvement in the company's financial performance and the reduction of R&D costs, it will always be implemented to a lesser degree in smaller companies.

To complete the study, the companies that do not apply open innovation were invited to indicate the main reasons that prevent their adoption (Fig. 5). Respondents were provided with a list of reasons, which were selected from previous research [22], [27], [29], [24], [30]. Although the results may not be conclusive, lack of trust in external partners and the inexistence of external innovation projects suitable for their business, seem to have a low influence on the reasons to not apply open innovation. Company culture and the difficulty in finding suitable partners, appear to have a higher impact on the non-application of open innovation. Moreover, these results indicate that company size appears not to have any influence on the type of reason for not applying open innovation.

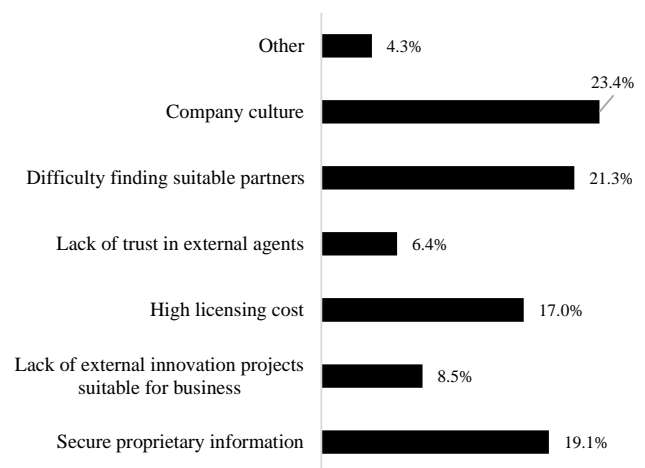


Fig. 5. Reasons to not adopt open innovation.

SMEs that claimed not to apply the open innovation concept were also asked if they were thinking of doing so in the near future. The results show that most of these SMEs (77%), are motivated to implement open innovation.

VII. DISCUSSION AND CONCLUSIONS

The paper explores the drivers of the implementation of the open innovation concept in SMEs. The survey of some randomly selected Portuguese SMEs shows that there is a high level of receptivity to implement open innovation. Most of the companies claim to apply the concept. The findings also indicate that the vast majority of the companies that

apply the concept belong to the category of medium-sized enterprises. This result concurs with findings in literature as it is argued that larger-sized enterprises have a more structured and professional innovation process, which is more favorable to the application of open innovation (14).

The study also identifies a positive relationship between the level of satisfaction with the R&D units and the application of open innovation. A large majority of the companies (82.6%) that mentioned applying the open innovation concept, referred to being more satisfied with the performance of their R&D units. This conclusion is also supported by the other survey results, which indicate that the most highly rated benefit expected due to the implementation of open innovation, is increased innovative capacity.

Overall, SMEs seem to be more driven to apply open innovation to improve the innovation process and capacity, rather than to reduce costs, share innovation risks, or improve reputation. These results are aligned with previous studies, which concluded that the reduction of R&D costs was only a secondary driver for the application of open innovation [35].

The distribution of drivers according to the company type, demonstrates that the main drivers for the adoption of open innovation vary along with company size. For micro-enterprises the main driver is to complement internal skills, small enterprises are looking for the most effective way to develop new products and services and medium-sized enterprises are driven by monitoring market trends and improving the innovation process.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: Jorge Julião; data collection: Inês Ferreira; analysis and interpretation of results: Marcelo Gaspar; All authors reviewed the results and approved the final version of the manuscript.

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