



## A Critical Review of Open Innovation in SMEs: Implementation, Success Factors and Challenges

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### ABSTRACT

This literature review explores the Open Innovation of SME companies, their application, success factors, impact, and challenges. The theoretical framework is built starting from the definition, a critical pillar, and Open Innovation in SME companies. The main factor in the Open Innovation process stage is finding innovative ideas and establishing network access with the external environment. Balanced, systematic, and thorough collaboration is the key to this process. Although European scholars have done it quite a lot, the study of literature on Open Innovation in SMEs could continue to be developed. Several research results were found in studies conducted in developing countries such as China, Taiwan, and Korea, distinguishing them from similar studies in Europe.

## I. INTRODUCTION

Open Innovation has become a new paradigm in innovation and technology management since it was introduced by Chesbrough (2003). This topic has attracted many management scholars and industry practitioners. Many companies stimulate their employees to be more open and encourage them to interact with the external environment to get innovative ideas and combine them into platforms, systems and architectural products, processes, and services through a business model. This business model will take values from the external and internal environment and extract them as innovative internal values.

The concept of Open Innovation then developed. It is defined as the distribution of the innovation process that organizes companies to take advantage of the outflow of and into knowledge to increase their innovation's success (Chesbrough & Bogers, 2014; Chesbrough & Teece, 2009). Even though it is developing and very complex, the concept of Open Innovation still could continue to be developed. There are also challenges in comparing empirical findings because this often causes the Open Innovation literature to become fragmented (Dahlander & Gann, 2010). Because each review only examines a particular part of the Open Innovation literature, the developing paradigm has different perspectives over time (Bigliardi et al., 2020b). Therefore, a synthesis of literature from various

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aspects of Open Innovation needs to be further developed.

Many other studies have also emerged recently related to Open Innovation trends and challenges and their academic and practical implications. They show how both new and existing companies in both new and established industries can benefit from Open Innovation. They offer some beneficial concepts, frameworks, tools, and findings and inform research opportunities, practical implications, and future Open Innovation policies.

Research related to Open Innovation has extended to its application in various companies such as SME, large medium industry and non-profit organisations to public policy (Bogers et al., 2017). Despite many significant success cases, many companies fail to understand Open Innovation values and fail to involve external actors (Dahlander & Piezunka, 2014; Salter et al., 2014). What is surprising is that this related research may have expanded to other disciplines such as engineering, policy studies, health and medicine, chemistry, physics, computer science, psychology and even astronomy (Bigliardi et al., 2020a). The government sector has also begun to link its policy framework with Open Innovation (West et al., 2014). Therefore, much of the focus of Open Innovation studies leads to opportunities and challenges facing organisations involving external contributors to the innovation process (Felin & Zenger, 2014).

Open Innovation was initially assumed by Chesbrough (2003) to preserve large companies. The initial research on Open Innovation only involved high-tech multinational companies such as IBM and Adidas (Piller & Walcher, 2006). It tended to research with a qualitative approach such as interviews and case studies. In the last ten years, research on Open Innovation has also penetrated the level of small and medium enterprises (SMEs), as was done by (Bianchi et al., 2011), (Lee et al., 2010) and (Wynarczyk, 2013). However, there are still few empirical studies related to Open Innovation at the SME company level. Many SMEs are seen as the primary source of technology introduction, innovation, and new product types in a developed

economy structure. Therefore, identifying Open Innovation practices that will help develop and improve SMEs' competitiveness at the national and international levels is crucial.

A study by (Bigliardi et al., 2020b) synthesised 1772 articles related to Open Innovation in 2003-2018. It releases nine clusters and nine descriptive terms that are most used in Open Innovation (OI) research. The top three were labelled with "External search for OI", "Context-dependency of OI", and "Technology". Meanwhile, the bottom three descriptive terms are labelled with "Organisational dimension of OI", "OI in SMEs" and "OI in the pharmaceutical industry".

Several studies also reveal some of the obstacles and limitations of SME companies' Open Innovation process, resulting in limited Open Innovation practices in SME. However, these constraints and limitations often provide benefits and advantages in OI practice, such as maintaining collaborative networks and enforcing intellectual property rights (Barney & Clark, 2007; Gassmann & Keupp, 2007).

This paper is structured to take advantage of the clustering results of (Bigliardi et al., 2020b) and confines this study to one of the lowest clusters in the least investigated descriptive term, namely "OI in SMEs". This paper explored the development of the SME enterprise Open Innovation experience, how it is implemented, the factors that make it successful, how it impacts the company's innovation process and the challenges it faces during the process.

The structure of this paper provided the background and motivation of the study in the first section. The second section described the methods applied to answer the study objectives. The third section provided an overview of the Open Innovation literature in SMEs. The discussion was described in the fourth section. The final section concludes this paper.

## **II. INNOVATION AND OPEN INNOVATION IN SMES**

SMEs play an important role as the majority of businesses worldwide (about 90%). It creates seven out of ten formal jobs and drives the global

economy. In developing countries SMEs contribute on average to 40% of the country's GDP (<https://www.ifac.org/>) and about 55% of GDP in developed countries (<https://www.worldbank.org/>). Thus, SMEs have become a priority program for almost all governments around the world.

Some of the literature on innovation, including its models, predates the study of Open Innovation. However, there is little research on innovation models related to SMEs. Much of this literature has limited studies on entrepreneurship and minor on SMEs' innovation (Hoffman et al., 1998; Panicia, 1998; Shaw, 1998). Large companies are not statistically proven to be better than SME companies in introducing innovations to the market. Even SMEs may have radical abilities to innovate (Laursen & Salter, 2004). Although SMEs appear flexible and specific in innovating, not many SMEs can manage and implement innovations independently. That is what encourages SMEs to collaborate with other SMEs to implement innovation (Edwards et al., 2005).

Many debates assess innovation in SMEs as constrained by resources and capabilities. However, many also prove that SMEs tend to be more productive and varied in their R&D activities than large companies (Audretsch & Vivarelli, 1996). Apart from this explanation, the evidence for SMEs' growth and role in the UK is clear in stimulating local, regional and national economic development (Jones & Tilley, 2003). Furthermore, it is crucial to find a way that facilitates SMEs in the innovation process, including finding the success factors in implementing innovation in SMEs.

The main driving factor for innovation in the form of technology is quite complex. It is quite a challenge for SMEs with their capabilities to be able to do this alone without involving other companies because some knowledge is not concentrated in one area. Therefore, a collaboration between companies is considered essential to achieve innovation success (Lee et al., 2010). The general collaboration mode for SMEs is usually described as a network of two firms or an alliance between companies, as demonstrated by (Mangematin et al., 2003), who exemplified biotechnology SMEs that collaborated to make contracts with large industries.

Collaboration like this is important and allows SMEs to streamline external relationships and networks and catch up with large companies (Narula, 2004; Rothwell & Dodgson, 1994). The external network determines a company's competitive ability compared to its size (Mytelka, 1991). Using external resources like this is proven to accelerate SME companies' innovation process and can minimise risks and operational costs (Hagedoorn, 1993).

Innovation in SMEs will undoubtedly be different from large companies because of the process and complexity (Vossen, 1998). The context of Open Innovation in SMEs has not been fully implemented and developed (West & Gallagher, 2006). Therefore, the focus of innovation studies in SMEs is becoming increasingly important, especially in understanding the nature of SMEs' innovation and how it is implemented in companies.

SME companies are at risk of being quite vulnerable to structural constraints such as managerial capacity, finance, and information access. They have internal limitations in mastering new products and innovations and the ability to compete. R&D investment, cutting-edge managerial techniques and opportunities to compete internationally are challenges in expanding through innovation (Bianchi et al., 2010; Van de Vrande et al., 2009; Wynarczyk & Raine, 2005). R&D is seen as being established in development and economic growth. R&D investments are a significant asset in accessing and utilising external knowledge and technology. Even the concept of "absorption capacity" has also been formally introduced by (Cohen & Levinthal, 1990) and (Chesbrough, 2006).

Chesbrough (2003) states that Open Innovation can remove the boundaries of location, human resources, technology, and a company's financial capabilities. Open Innovation can also direct SMEs to access new information and technology and even R&D investment information which they often find difficult to access independently (Lichtenthaler, 2011). However, R&D capacity is not the only thing that influences Open Innovation and involves the accumulation of intra and extra organisational factors (Wynarczyk, 2013).

Open management and organisational innovation become more complex and involve more managerial layers than innovations that traditionally only involve R&D organisations (Van de Vrande et al., 2009). A study conducted by Wynarczyk (2010) shows that SME innovation will develop more rapidly in more structured management with extra expertise. From the existing innovation studies, the focus of research on the contribution of R&D capacity in Open Innovation studies is covered, on the other hand, the focus on internal managerial structure and competencies is slightly sidelined.

In the last decade, Open Innovation has gained more attention because of its economic productivity, especially in knowledge-based economic activities. The SME sector's policy direction has focused on enhancing its role in encouraging product innovation and penetration of new technologies. More than 20 million SMEs exist in Europe which represents 98 per cent of enterprises in Europe and provides jobs for more than 75 million people in Europe. Thus, SMEs play an essential role in national and international economic development (Wynarczyk et al., 2013).

Studies on Open Innovation shows that only a tiny proportion of SMEs play a role in new product innovation, R&D, export and employment and copyright (Basile, 2001; Leiponen & Byma, 2009; Oura et al., 2016; Wynarczyk, 2013). Only a tiny proportion of these companies have the will, capacity and dare to seize opportunities to catch up and diversify externally. The emerging SMEs, for example, generally have internal structural limitations in terms of managerial and capability and external structural limitations in terms of access to knowledge and finance. These companies will seek to develop their products, invest and seek opportunities in R&D and external collaboration activities (Bianchi et al., 2011; Van de Vrande et al., 2009; Wynarczyk, 2013; Wynarczyk & Raine, 2005).

The adaptation of Open Innovation in SMEs is different from that of large companies, because of the character of its size. Not in terms of economic and financial size, but rather in terms of limited resources, primarily managerial and uncertainty challenges that hinder their growth

(Batterink et al., 2010). However, Open Innovation provides an opportunity for certainty that SMEs can access external resources between companies at low cost and help overcome internal and external structural constraints. Open Innovation also guarantees good access to ICT and R & D facilities, which often take years and are high cost if the SMEs access them (Chesbrough, 2006; Chesbrough, 2003; Teresko, 2004; Wynarczyk, 2013).

Initial research on Open Innovation was focused on large or multinational companies. However, recently, many studies have identified Open Innovation in the SME sector. Apart from their role in economic development, a collaboration between UKM and universities is also a concern. The university is seen as a primary centre in innovation discovery concerning R&D and business knowledge, indispensable in innovation (Huggins et al., 2008). Therefore, the collaboration between UKM and universities is needed to transfer innovative new knowledge and channel it with adequate commercial knowledge (Lambert, 2003).

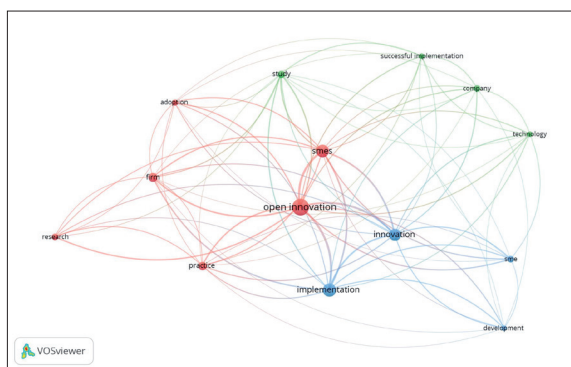
Many initiatives and policies regarding industrial and university collaboration have been introduced. The aim, among others, is to commercialise research results and connect universities with business (Wynarczyk, 2013). However, there is still little involvement of SMEs in that process. There are still many challenges for universities in channelling science and research that produce new technology, although few universities carry out the commercialisation of their inventions. In fact, by assessing the knowledge transferred by the university, SMEs gain many advantages in translating the results of the transfer of knowledge into new products or services that they can market (Bruneel et al., 2010; Fontana et al., 2006). Therefore, it is necessary to encourage and prioritise policies from the government in R&D investment and encourage strong collaboration between SMEs and higher education.

### III. METHODOLOGY

Writing this paper begins with a preliminary simple bibliometric analysis process by tracing articles using the keyword “implementation;

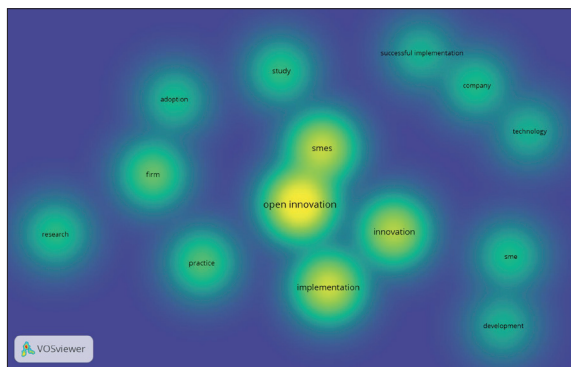


Open Innovation; SME”, the research year 2005–2021, and limiting 100 articles (75 of them have a citation range of 80–2500). The network visualisation shows the close relationship between Open Innovation and its implementation in SME companies (as shown in Figure 1). Meanwhile, the density visualisation shows that study and research in terms of adoption, practice, successful implementation, and development of Open Innovations in SME still have a reasonably low incidence rate (as shown in Figure 2). Thus there are wide open opportunities to expand studies and research in this field. We hope that this study will contribute to enriching the related literature.



Source: output of VOSviewer

**Figure 1.** Network visualisation of the bibliometric analysis



Source: output of VOSviewer

**Figure 2.** Density visualisation of the bibliometric analysis

This research was a literature study using a meta-synthetic approach. Literature reviews were carried out in Scopus, Web of Science, Elsevier, Wiley, Taylor and Francis, Springer, Emerald and Sage pub. The search term or keyword used is “implementation; Open Innovation; SME.”

The search limitation is English articles and the limit for publication or study year is 2005–2021. After the most relevant articles are found, article extraction was carried out to answer the study objectives. The theoretical framework was built starting from the definition developed in Open Innovation, the critical pillars of Open Innovation, and the core of this study, namely Open Innovation in SME companies.

## IV. DISCUSSION

### A. Open Innovation Success Factors in SMEs

#### 1) Network Access and Search Strategy

Network access and search strategies are essential in the early stages of Open Innovation in SME. At this stage, SME formulates strategies concerning new knowledge, ideas, partners and markets. A search strategy was introduced and proven to have a significant impact on the success of Open Innovation in SME. This strategy was classified into five clusters according to the ability to characterise knowledge sources, all of which have different characteristics (Brunswicker & Vrande, 2014). This cluster explains how SMEs will be involved in knowledge transfer and how the innovation partners (customers, suppliers, research institutions, IPR experts, and network partners) interacted with each other in accessing external knowledge.

The relationship between SMEs and network partners in the Open Innovation process resulted in a collaboration that allows SMEs to realise strategic steps. Significant progress will also be made by SMEs when introducing various developments in their internal bodies to the external environment they are expected to transfer (Colombo et al., 2014; Henkel, 2006). The search strategy provides SMEs with fewer advantages than large firms. Newcomer SMEs were usually quicker to adopt transparency than existing players. Therefore, it is imperative for SMEs to focus on selecting the strategies mentioned above and with whom they will partner in realising that openness (Lecocq & Demil, 2006; Lee et al., 2010; Spithoven et al., 2013; Teirlinck & Spithoven, 2013; Theyel, 2013).

The network's selection and profile were essential for the success of Open Innovation in SMEs (Xiaobao et al., 2013). According to (Van Hemert et al., 2013), horizontal networks were more suitable for Open Innovation than vertical networks. Network length also affects innovation performance in SMEs. There is a positive relationship between network distance and SMEs' innovation performance (Pullen et al., 2012). For example, several types of organisations, including universities and research centres, provided considerable benefits in innovation networks. Even research institutions at universities have more connections than research institutions that are not from universities or higher education. They were also more adequate in facilitating SMEs' knowledge needs (Roper & Hewitt-Dundas, 2013).

## **2) Collaboration**

To achieve Open Innovation, SMEs collaborated with partners or networks. Finding suitable collaborative partners helped SMEs increase their chances of introducing the product or service they want to market. This also distinguishes it from large companies that do not need collaboration when introducing new products or additional products to the market. Collaboration is about science and technology and shows partnerships in the value chain that present a new knowledge source that will be easily absorbed due to this partnership (Spithoven et al., 2013).

Vertical collaboration was usually suitable for more radical innovations, while horizontal collaboration is more applicable for additional innovations (Parida et al., 2012). SMEs tended to collaborate to introduce new products in Open Innovation, whereas in closed innovation, SMEs tended to collaborate for gradual product change (Wynarczyk, 2013).

Several studies have shown that collaboration for SMEs' innovation was aimed more at the commercialisation stage than at the initial step. In general, SMEs experience constraints for commercialisation purposes, so they tend to collaborate with suppliers for product development and collaborate with customers for process development.

However, this collaboration factor was also influenced by the size of the SME company. The level of collaboration was related to the size of the company. The smaller the size of the UKM, the smaller the level of collaboration. Evidence in the field also showed that small and medium enterprises were more involved in Open Innovation than micro-companies (Teirlinck & Spithoven, 2013; Theyel, 2013; Van de Vrande et al., 2009; Van Hemert et al., 2013).

## **3) Capacity and Capability**

Absorptive and desorption capacities had a strategic role in collaborative interactions with potential partners. Absorptive capacity showed its sensitivity and ability to assimilate and apply new knowledge in innovation activities. Meanwhile, the desorption capacity related to the exploitation of new knowledge from outside (Braun et al., 2012; Lichtenthaler, 2007). However, this absorption power had different components. According to (Grimaldi et al., 2013), R & D institutions' capacity were insufficient to measure this absorption capacity. Therefore, SMEs need to have proper managerial skills integrated with the Open Innovation system (Brunswick & Ehrenmann, 2013).

SME companies generally had limited absorption capacity. Therefore they needed technological mediation. (Spithoven et al., 2010) found that about half of company budgets were deployed in R&D activities, a crucial element in absorption capacity. Internal absorption capacity was also crucial for R&D collaboration with external parties. Its purpose is to complement internal R&D resources. Besides, managerial skills were also needed in this collaboration (Teirlinck & Spithoven, 2013).

SMEs with strong capabilities tend to develop themselves with Open Innovation. In the innovation process, this capability was explored dynamically (Grimaldi et al., 2013). Vertical and horizontal cooperation with equal partners such as customers and suppliers had a more important role than vertical cooperation with R & D institutions, universities or state institutions (Zeng et al., 2010). Several factors accelerated the capacity of SMEs in developing an Open

Innovation system, including the size of the SME, the stage of the organisation, the ability to partner, and the capacity for managing Open Innovation (Gurău & Lasch, 2011). A solid knowledge base helped SMEs strengthen their capabilities (Heger & Boman, 2015).

## **B. Open Innovation Impact on SMEs Performance**

The implementation of Open Innovation in SMEs had different characteristics from the implementation in large companies. Open Innovation activities in SME companies were also more intense than large companies. The scale of performance measurement for the Open Innovation is also different. In general, SMEs had a less formal R & D character that distinguishes them from large companies and their networks (Spithoven et al., 2013).

Huang & Rice (2013) found a significant relationship that mediates organisational inertia and business model innovation and a positive relationship with SME companies' performance in Taiwan. Company performance was also influenced by technology sourcing for the effects of radical innovation and technology scouting for incremental innovation (Parida et al., 2012). SMEs' innovation performance, such as studies in China, was also influenced by a network approach to product development, including collaboration between organisations with partners within and between networks and support from government or other public institutions (Zeng et al., 2010).

External ideas were well assimilated by internal R&D human resources due to collaboration between SMEs (Teirlinck & Spithoven, 2013). Technology acquisition that is part of this R&D collaboration also increased the success of SME innovation. External search, however, must be done carefully because if this search opens up too many channels, it could negatively impact its original goal (Laursen & Salter, 2006). This condition was represented by an inverted U curve that connects broad and deep external search to innovation performance. (Kim & Park, 2010) stated that external ideas could negatively affect, even external knowledge may not impact SME innovation performance.

The adoption of Open Innovation in SME companies has indeed been shown to affect SMEs' innovation performance (Fu, 2012; Parida et al., 2012). However, the wide adoption of Open Innovation does not always provide direct benefits and positively impacts SME companies' innovation performance. (Kim & Park, 2010) have suggested that external innovation activities may not positively impact SMEs' innovation performance, as they found in their study in Korea. Nevertheless, according to (Theyel, 2013), at least Open Innovation exploited by SMEs can provide indirect benefits in terms of reputation, connectivity and the internal awareness of SMEs, all of which are indirect and intangible.

## **C. Open Innovation Challenges in SMEs**

In facing the challenge of Open Innovation, SME companies are unique and tend to be weaker than large companies (Hossain, 2015; Hossain & Kauranen, 2016; Kim & Park, 2010). Resources, coordination, complexity, and access were considered significant challenges in implementing Open Innovation in SMEs (Abouzeedan et al., 2013).

Resources related to R&D activities and knowledge transfer among SMEs. It should be remembered that although the transfer of knowledge of SMEs to external parties had a positive impact, it will only provide benefits in the long term (Andries & Faems, 2013). Knowledge transfer plays a significant role in Open Innovation for SMEs. In this stage, SMEs must be careful in developing their knowledge capacity through R&D collaborations (Kim & Park, 2010). In this knowledge development, collaboration, social skills and creativity in the external environment were also needed (Bocken et al., 2014; Padilla-Meléndez et al., 2012).

Concerning other organisations and larger incumbents, SMEs generally have weaknesses related to ties between networks or partners. Such interactions were of particular complexity and sometimes high cost (Christensen et al., 2005). The challenges related to organisational and cultural issues connecting SMEs with external parties were also raised by (Van de Vrande et al., 2009).

The implementation of Open Innovation in SMEs is different in each country. For example, in developing countries, SMEs who want to start innovation activities needed more government involvement, direct access to innovation institutions, and connecting them with investors (Vrgovic et al., 2012). Even so, to be able to compete globally, SMEs must independently needed internal advantages in the form of R&D capacity and managerial competence, have external advantages in the form of the ability to apply Open Innovation, and the ability to obtain government grants related to R&D and technology (Wynarczyk, 2013).

Despite facing many challenges and obstacles, SMEs practiced this Open Innovation widely. This capability was at least supported by the proper initial steps in identifying suitable partners to start the innovation stage as well as other complementary forces such as a management paradigm that was more open to the external environment (Abouzeedan et al., 2013; Laursen & Salter, 2006; Pullen et al., 2012).

Although SMEs are known to have limitations in terms of resources, implementing Open Innovation, must also focus on which limitations needed development and not continue to sink into those limitations. R&D activities may not be easily realized in SMEs, mainly because of the cost and time consumption. However, SMEs can develop social skills and creativity independently without requiring much financial support. It is the initial capital in acquiring knowledge transfer, expanding networks and partnerships, and initiating collaboration.

Not as well established as SMEs in developed countries, SMEs in developing countries have a greater chance of getting significant support from national and local governments, considering that even in the whole world, the development of SMEs had become a priority program of the government. In addition to providing financial support and training, the government also opened access to good partnerships with fellow SMEs and investors. In addition, SMEs were connected with innovation institutions that will assist them in developing and disseminating research and innovation.

Well-established managerial abilities and competencies had proven to be substantial capital in building and developing businesses from the internal side of the company. It was the main foundation in building a company and helped SMEs connect with the external environment to access networks, seek partnerships and engage in various government programs. It is not impossible that mastering the success factors and overcoming the challenges we mentioned earlier will make Open Innovation much easier.

## V. CONCLUSION

This paper had outlined the main problems in Open Innovation in SME, the implementation of Open Innovation so far, how certain factors lead to success in Open Innovation and what challenges may be faced by SME companies in the process of Open Innovation. Although studies on Open Innovation in SME were widely carried out, especially by European scholars, literature studies on Open Innovation in SMEs should continue to be developed. Several variations in the study results were found in studies conducted in developing countries such as China, Taiwan, and Korea, distinguishing them from similar studies in Europe.

Research on Open Innovation in SMEs began with studies that used simple statistical analysis, which then developed into a more complex panel data analysis. There is an opportunity to increase the impact by conducting research using primary data or longitudinal studies to provide more in-depth research results.

The primary and earliest factors in the Open Innovation process stage were finding innovative ideas and building network access with the external environment. Although there were many opportunities to take advantage of the external environment to generate ideas and gain knowledge, this search must be undertaken cautiously. Because there is a concern that it will have negative impacts. Balance, systematic, careful, and thorough collaboration is the key in this process.

Open Innovation in SME has a unique character that distinguishes it from large companies. However, some key points are believed to strengthen SME companies because they are



likely to be more successful than large companies. Collaborating with other suitable SMEs companies makes them more likely to introduce new products or services to markets where large established companies do not collaborate.

The capacity and capability of the SMEs company have a strategic role in the Open Innovation process. These two things determine the company's ability to accumulate the results of collaborative knowledge and new ideas into the Open Innovation process, especially if this capacity and capability have been integrated with the Open Innovation system from the start. One of the urgencies that must be considered is technology, in which SME companies experience quite a lot of obstacles. However, the ability of technology to mediate the success of Open Innovation is very well established. Both vertical and horizontal cooperation with other parties will help overcome this obstacle.

Challenges in terms of R&D activities and knowledge transfer require a great deal of attention. Of course, internal resources must be considered before directly engaging in this activity. Internal skills and social capital are beneficial in this process because when dealing with the external environment, there will be knowledge exchange and social interaction between actors to strengthen the network's solidarity. This interaction is quite complex. Therefore, it will be very beneficial if the SME company's internal body already has more open management basics.

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