

Perspectives of Collaboration between Large Firms and High-Tech SMEs Regarding Open Innovation (OI)

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ABSTRACT

This article aims to explore Open Innovation (OI) collaborations between high-tech small and medium-sized enterprises (SMEs) and large customers. The aim of the study is to add new perspectives regarding the specific and special way in which smaller companies initiate and develop relationships based on trust with larger customers in order to innovate and, at the same time, highlight the special contribution of customers in terms of the innovation process of SMEs. It presents perspectives regarding the way in which SMEs, by building trust, initiate and grow OI relationships with research clients but also with clients present in industry. According to the results, large customers, directly and indirectly, contributed significantly to the innovation processes of SMEs. The study focuses on SMEs aiming to adopt an OI strategy that involves enhancing legitimacy, building trust, and leveraging relationships with research institutions and larger clients. By investigating how SMEs develop partnerships with these entities, the study contributes to the existing OI literature by exploring how SMEs navigate the advantages and challenges associated with OI while fostering trust-based relationships.

KEYWORDS: *Open innovation practices, Customer collaboration, Building trust, Open innovation, SMEs, Trust*

JEL CLASSIFICATION: *D8, L1, M1, M16*

1. INTRODUCTION

In the modern global economy, innovation, research, knowledge transfer, and technological information represent success factors. Innovation could be the primary factor responsible for economic growth. In practical work, the implementation of innovations could allow new methods of approach in the field of human resources, optimisation of the business management system, net superior performance of more ecological production processes, as well as services or products with superior qualitative characteristics (Stanciu, 2018). While the notion of OI is not entirely novel (Trott & Hartmann, 2009), it draws upon well-established management theories (Christensen, Olesen & Kjær, 2005). These theories include the concept of transformational capacity (Garud & Nayyar, 1994), absorptive capacity (Cohen and Levinthal, 1990), dynamic capacity (Teece, Pisano & Shuen, 1997), and the theory of user innovation (von Hippel, 1986). Compared to large firms, they are less active in open innovation due to their individual characteristics, such as strategy, culture, or organisation. Open innovation (OI) represents the ability of organisations to train with external parties (partners, suppliers, customers) in order to generate and incorporate knowledge, intellectual property or various other inputs related to innovation (technology, for example) in order to enhance them the capacity necessary for the growth and development of competitive products (Chesbrough, 2003, 2009). Looking at the current economic situation as well as the opportunity for SMEs to obtain competitive advantages, they are forced to readjust their strategy to optimise economic performance and improve operational efficiency (Păunescu &

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Matyus, 2020). Current digital technologies directly influence existing businesses in all sectors of activity and cause companies to optimise their presence in the market (Onea, 2020). Within SMEs, for the promotion of open innovation, a high-performance and efficient way is represented by the creation of networks (Lee et al., 2010). Largely, for the implementation of their own strategies, SMEs depend on the resources held by their open innovation partners.

In this study, the aim is to explore OI within SMEs, based on four case studies of Romanian high-tech companies that operate and compete in global B2B markets. The analysis is focused on the way in which SMEs initiate and increase the collaboration of OI with larger clients. The efforts and efforts of SMEs are concentrated in the direction of building legitimacy and trust, essential aspects regarding the success of the IO collaboration. In addition, the study analyses the way in which customers define the ability to contribute to the innovation process, starting from the early initialisation of ideas and reaching the specific stage of commercialisation (input and output OI). In the case of SMEs that have a limited resource base, it becomes time-consuming and especially expensive to develop relationships with several large clients, so they must identify as clearly as possible OI partners (clients) who can support the entire innovation process and who at the same time have the ability to assume multiple roles.

This study clarifies the way in which clients have the capacity to contribute to the development of SMEs through OI in both phases, adding new perspectives on benefits and potential dynamics. The study is focused on two categories of customers, research customers, and industry customers. Research clients are clients represented by research institutions and universities, which use particularly advanced equipment from a technical point of view in order to carry out research projects. Companies that operate in various industries represent the customers present in the industry and that use advanced technology in their daily operations. Studies on research institutions that have a dual role as researchers and clients are relatively few. According to previous studies, the capacity of SMEs regarding the development of external relations with research institutions and with customers is crucial in order to improve innovation performance (Lasagni, 2012; Hadjimanolis, 2000). This study complements existing perspectives on the ways in which SMEs benefit from and manage OI relationships with the two representative customer groups.

The present study contributes to the existing literature in the following ways. It provides, first, specific information regarding the way in which SMEs manage OI challenges in collaboration with clients, with priority on the way to initiate and grow relationships with larger clients based on trust. In addition, secondly, the study provides a nuanced and new understanding of the indirect and direct roles of customers in the innovation process and at the same time highlights the dynamic relationships that are present between smaller firms and their larger customers. Moreover, this study provides specific managerial advice to SMEs that have decided to consider OI. The article is structured as follows. The theoretical background is presented in Section 2. The business cases and methodology are presented in Section 3 and the empirical findings are presented in Section 4. The findings are discussed in Section 5 and Section 6 highlights and concludes the theoretical contributions. A series of necessary directions for future research, limitations as well as practical aspects are discussed later in Sections 7 and 8 respectively.

2. THE THEORETICAL CONTEXT

2.1 SMEs and IOs

Lindegaard (2011, p. 5) defines OI as a two-way process where companies engage in both input and output mechanisms. The input mechanism allows companies to introduce essential resources such as technologies, ideas, or various other types of assets for their own business development. On the other hand, the output mechanism enables companies to sell their technologies, ideas, or resources, or acquire licenses for them. The term user innovation, co-design, or open innovation with customers refers to the development of a specific product for which customers are invited to actively get involved in the development of the desired product (Avasilcai & Bujor, 2018). According to Laursen and Salter (2006), the way in which, in their innovation processes, companies use knowledge and ideas from external actors, is located at the center of the OI model. Following the strengthening of their external relations, SMEs obtain special benefits necessary for involvement in specific OI practices but also for improving innovative performances (Nieto & Santamaría, 2010; Lasagni, 2012; Huizingh, 2011).

The existing barriers in the way of the adoption of OI represent present obstacles in the way of innovation (Borins, 2001). Within a company, the adoption of innovation is negatively influenced by this factor. According to Rogers (2003, p. 21), the adoption of innovation means the transformation (coercive and/or voluntary) that an organisation goes through starting from the first knowledge of a certain innovation, the creation of a certain attitude in relation to the innovation, until a resolution of assimilation or rejection, implementing the new idea, and confirming that decision. This mechanism recognises the fact that the assimilation of the innovation represents a process that begins with the knowledge and information of the organisation in relation to the innovation, the formation of the attitude, the resolution related to rejection or adoption, the implementation if it is adopted as well as the recognition of the new idea. Five main factors are able to influence innovation assimilation: observability, complexity, probability, compatibility, and relative advantage (Rogers, 2003).

2.2 Existing collaboration between clients and SMEs

For high-tech SMEs facing international competition, innovation performance is essential; they are constantly forced to bring new technologies to the market. According to Nieto and Santamaría, (2010), the propensity of SMEs to introduce innovations can be increased by OI and it could also accelerate market entry (Lasagni, 2012; Enkel et al., 2009). Consequently, according to Sandmeier et al. (2010), Lasagni (2012), in their innovation process it is crucial that high-tech SMEs collaborate as closely as possible with their external partners, such as customers. According to Van de Vrande et al. (2009), Berends et al. (2014), optimising the capabilities of SMEs in order to reduce the risk of market failure at the time of introducing new technologies, surpassing competitors and satisfying customer requirements can be improved by increasing collaboration with clients (Tether, 2002). Smaller firms can promote much closer collaboration within a certain sequence of innovation activities in order to increase innovation performance. Bianchi et al. (2010) argue that in the first specific phases of the innovation process, collaboration with clients offers SMEs the possibility of basing the process on ideas and also expanding the content of technological opportunities. Moreover, the success of the innovation process is, without a doubt, directly proportional to the success of the marketing of the products.

2.3 The development of trusting relationships and the closeness of collaboration partners

According to Vahter et al. (2014), Gruner and Homburg, (2000), recognising and approaching those "right" customers essential to collaboration is crucial for SMEs. Vahter et al. (2014), Lee et al. (2010) claim that the lack of networks and the necessary search capabilities in order to identify possible collaboration partners, as well as management and selection capabilities when a possible partner is identified adequately represents a real competition for SMEs (Nieto & Santamaría, 2010; Lichtenthaler, 2008). According to researchers, it is indispensable for companies to use a systemic approach in order to explore possible potential partners necessary for a technological collaboration (Yoon and Song, 2014). Some of the companies will not be able to ally with their most preferred partner due to the existing competition in the market of collaboration partners (Mindruta et al., 2016). In conclusion, it becomes reasonable for SME managers to develop a way by which the investment activity in capabilities and resources is able to reshape the attractiveness of potential partners for collaboration (Mindruta et al., 2016).

According to Nieto and Santamaría, (2010), from the moment a potential collaboration partner is identified, SMEs can face even greater barriers than those faced by larger companies in the process of building a relationship business formality. In a B2B relationship, this could be problematic considering the fact that solutions and new technologies are usually developed and developed in a context characterised by considerable complexity, extensive interaction, and interdependence between partners (La Rocca et al., 2016; Abu El-Ella et al., 2015). This requires the parties to have a relationship based on trust. Trust could be defined as the desire to support someone, based on trust based on "an expectation, a feeling or a belief about an exchange partner and which results from the intentionality, reliability and expertise of that partner" (Huang & Wilkinson, 2013, p. 455). Oakey (2012) claims that OI cannot be without potential disadvantages for SMEs; such an example is represented by the opportunistic behavior shown by the collaboration partners that can lead to the loss of knowledge. This thing, for small high-tech companies, can be a decisive one, because their products and technology represent the main strategic assets, and the entire openness could put the value of all these assets in real danger (Oakey, 2012).

2.4 Specific research questions and synthesis

In conclusion, previous research highlighted the fact that those high-tech SMEs that activate and compete in international B2B markets can benefit from involvement in OI. In general, SMEs lack those resources necessary for innovation in order to commercialise the technology. As a result, one way to stay ahead of global competition is to engage in OI collaboration with larger clients. Under these conditions, it becomes very possible for SMEs to face great challenges in the process of establishing and perpetuating external relationships, such as building long-term relationships based on trust with collaboration partners. Regarding the challenges of SMEs in this field, there is a limited volume of research, but researchers (such as Hossain, 2015; Abu El-Ella et al., 2015) requested additional research regarding the mechanisms used by SMEs in order to build as well as maintain trust in OI relations.

In conclusion, in the framework of the research, I formulate the following question:

RQ1. In what ways do SMEs initiate and develop reliable OI relationships with clients?

It also becomes interesting to explore the contribution made by customers to the intrinsic innovation process, starting from the initiation, growth, and development of the idea and going up to the commercialisation stage, more precisely within the inbound and outbound OI processes. The entry phase is defined by the stages characteristic of the growth and

development of the idea and concept, the realisation, and testing of the product. The output phase is defined as the stage necessary for the commercialisation of the entire innovation process (sales and marketing). According to research, SMEs can receive resources and improve their innovation performance through customer collaboration (Van de Vrande et al., 2009; Parida et al., 2012; Lasagni, 2012). During the phases of the innovation process, the contributions made by customers are strongly interconnected with the motivation of SMEs to invest the necessary technological and managerial resources in order to build trusting relationships with customers over time (RQ1). In these conditions, this study investigates this reciprocal process as well as its specific dynamics, uniting the use by SMEs of the technological and managerial resources necessary for the long-term building of an OI relationship (RQ1) with the gains of the various contributions brought by customers (RQ2) and vice versa. In conclusion, the following research question is proposed:

RQ2. How do customers contribute to OI processes within SMEs?

3. BUSINESS CONTEXT AND METHODOLOGY

3.1 Specific research approach

In order to explore OI practices within SMEs, researchers requested in-depth qualitative research (Van de Vrande et al., 2009; Freel and Robson, 2016). Following this request, the study assimilates a multiple case study project as well as a qualitative approach in order to examine the way in which SMEs carry out OI collaboration with clients. According to Yin (2009), a case study offers the possibility of researching the respective phenomena in a natural setting. Only in this way can we understand the questions like "why" and "how" in order to better realise the importance of the OI collaboration that exists between larger clients and SMEs. This research does not want to provide general answers in a statistical sense, but primarily wants to provide theoretical generalisations.

In order to select four cases of SMEs that are involved in the exploration of OI, the following selection criteria were employed:

1. Size: in order to avoid a possible bias of resources, these are small companies and have at most 40 employees each;
2. Innovation Need: they are companies that show a constant need for innovation capabilities, are competitively present in global markets, show a strong orientation towards research and development, and also have high technology products;
3. Leadership: in order to ensure a correct knowledge regarding the initial start-up stage of the company, the respective companies are managed by a CEO who at the same time holds the role of founder of the company;
4. Geographical Location: these companies are located in a geographically well-defined area in such a way as to be able to control possible biases related to the innovation differences between certain regions.

First, these cases were selected in order to develop and explore perspectives regarding SMEs and IOs, as well as to predict similar results. The study of these case companies - Novo Tech, Novo Trade, Prima Tech and RobotsNet - which are named with the help of fictitious names - is part of a more extensive research project on the internationalisation of SMEs. All these selected companies can be relatively special cases if we have in mind a certain strategy designed for a long term in order to develop OI relations with customers from research and industry, they have few employees (they are relatively small in size) and also show a orientation towards research, development, and high technology. In general, the

founders/managers of SMEs were selected as key informants as a priority because only they are able to provide data, information, detailed and, above all, complete knowledge. Right from the date of establishment of the companies, the owners/founders of these companies (in this analysis, being called general managers) occupied the specific management functions.

The initial interviews (2019), in order to obtain an in-depth understanding of the respective companies, had a process approach in the sense that in retrospect the informants explained and reflected the history of the respective companies starting from their start-ups, then passing through a diversity of topics related to networking, sales, marketing, technology development, ideation, internationalisation, and innovation. This approach made specific information about OI available to companies. The subsequent interviews (2020) were narrowed only to issues related to OI. In the last interview conducted with Prima Tech, I talked with a number of two informants (who are specialised in the fields of engineering and marketing). In order to improve the understanding of these OI themes, a research client who collaborated (to a certain extent) with the four interviewed companies was also interviewed. The interviews were based on a semi-structured interview guide focused on relevant topics. An extract of the interview guides can be found in the annex. The interviews were recorded, transcribed, lasted between 0.45 and 2 hours, and were continued with questions sent via e-mail. The initial data received were corroborated with other secondary data collected from external sources such as newspaper articles, clients' and companies' websites, and last but not least, specialised magazines from the industry. Certainly, this information has visibly improved the quality of this research and provided a broader perspective regarding OI within companies.

The examination of the received data was carried out in several stages. To begin with, the interviews conducted in the first round were coded using an approach based on the theory of theme identification based on the interview guide (presented in the Annex). Under these conditions, due to the questions presented in the interview guide (e.g.: What aspects can you present in relation to the history of this company? What were the details related to your business idea?), an open coding was used. Next, the second stage of the interviews was carried out, with special attention paid to the themes as well as the concepts of OI: customer collaboration, contributions but also their involvement in the different stages (inbound and outbound), the growth and development of relationships OI over time (the manner in which the companies acted). The informants were asked, during these interviews, to "validate" their first impressions related to OI in companies. The method of coding the respective data material, in a majority proportion, was carried out in accordance with the previously established codes. Going back and forth between the authors, the entire coding process was done manually. Also, for each individual case, an overall representation was made, by using a "narrative" way of writing in order to present the complexity and holism of the respective cases, with a special emphasis on the main questions of the research.

3.2 The companies subject to the case study

Novo Tech. Two founders who previously worked at another company founded Novo Tech in 1997. In 2018, the company had 32 employees. Novo Tech is a supplier of equipment for the oil industry, the metallurgical industry, and the chemical industry. More than 70% of the turnover comes from export. In 2007, a French multinational company bought 51% of its shares, and key employees hold the rest of the shares. Novo Tech promoted an increased commitment to export, with the new owner providing competence, international networks, and financial capital. More than 60% of employees work for technology development. Ever since its establishment, Novo Tech has focused primarily on collaboration with clients at the national level but also at the international level (mainly France, Germany, and the Netherlands).

Novo Trade. Four founders who previously worked within the same company founded Novo Trade in 1999. In 2018, Novo Trade had 37 employees (mostly researchers and engineers); half of the employees were directly involved in technology development. Novo Trade is a high-tech supplier for installations in the energy industry and the oil industry. Approximately 60% of Novo Trade's turnover is generated by export. Novo Trade highlights the continuous development of technology and products. More than 40% of Novo Trade employees work intensively for technological development. The stated goal of the company is to increase the turnover internationally. Ever since its establishment, Novo Trade has cooperated with research and industry clients.

Prima Tech. The company was founded in 2001 and in 2018 had 29 employees. Prima Tech's main market segments are represented by the food industry and the chemical industry. Approximately 30% of Prima Tech's turnover comes from exports. Prima Tech invests a lot of resources and a lot of time in order to adapt, perfect, and continuously develop the products in order to obtain competitive advantages within the chosen market segments. The company's central philosophy is based on research and development. In this sense, the company has a special research and development department responsible for the development of technology and new products.

RobotsNet. Three founders who previously worked in the same company founded RobotsNet in 1998. In 2018, the company had 25 employees. The company is dedicated to the modernisation of equipment for the car manufacturing industry. At least 50% of RobotsNet's turnover comes from export activity. In addition, over 50% of employees are involved in innovation, research, and product development activities. Table 1 provides a brief presentation of the four case companies.

Table 1. Presentation of the case companies

	Novo Tech	Novo Trade	Prima Tech	RobotsNet
The year the company was founded	1997	1999	2001	1998
Number of company employees (2018)	32	37	29	25
Market and product segments	Specialised operational services and products for the oil and gas industry, the metallurgical industry, and the chemical industry	Development of high technology equipment for the energy industry, oil and gas industry	High-performance systems/standardised products for the food industry, the chemical industry	The development of high-tech equipment dedicated to the car manufacturing industry
R&D	Over 60% of the company's employees are engaged in research, development, innovation	Over 40% of employees are involved in specific research and development activities	There is an entire R&D department specialised and dedicated to R&D activities	Over 50% of the total workforce is trained in innovation, research, and development activities

	Novo Tech	Novo Trade	Prima Tech	RobotsNet
Sales at an international level	70%	60%	30%	50%
Number of Interviews	4	3	2	3

Source: author research

4. EMPIRICAL FINDINGS

In this section, empirical data are illustrated that show the way in which the OI collaboration is achieved between SMEs and research clients, as well as those in industry. Using these four company cases, the questions needed in the research can be clarified, using quotes to illustrate the specific perceptions and experiences of these companies. Data obtained from a research client is included in order to add a perspective specific to that client.

4.1 Initiating and developing relationships with customers based on trust and attracting potential collaboration partners

In the process of identifying possible collaboration partners, the managers of the respective companies showed proactivity. The founders of Novo Tech and Novo Trade, initially in the start-up stage, contacted potential research and industry clients, clients who, according to their opinion, could have been interested and attracted by their ideas. From the desire to identify, the specific needs of customers, but also to reduce the risks that may appear during the product development and commercialisation stages, they targeted possible collaborations with their customers. According to the founders, if the customers can be able to influence the innovation process and thereby implicitly the final products, the collaboration can significantly increase the sales possibilities.

This is particularly important because they were developing and diversifying very new products on the market. When a new product is introduced, simultaneously with the development of that product, it is necessary to create a market for that product [...] First, the market for a product must be created, and, when that market exists, it acts as to himself (CEO Novo Trade, personal communication, 2022).

A whole series of potential research and industry clients quickly showed interest in what SMEs could offer and thus wanted to collaborate.

Novo Tech started a collaboration at the international and national level with research clients and industry clients, and Novo Trade started a collaboration only at the national level. These contracts were based on general information obtained from industry magazines and newspapers, from social network contacts from previous jobs, etc. According to those presented by Novo Trade:

One day in a magazine I read an article about this company accompanied by a photo of a production capacity projected on a specific mountain background. I immediately reacted to the thought that "there are real possibilities for us here". Afterwards, I quickly got in touch with an acquaintance who worked for that company, and they thought about the idea, but they did not know for sure how they could proceed. However, Novo Trade, with its competence and skill, could quickly "tell" them how to proceed. After this stage, Novo Trade initiated the collaboration with that company, which in turn quickly brought a financial contribution (CEO Novo Trade, personal communication, 2022).

During the first years, as part of its innovation process, Prima Tech did not have a special collaboration with customers, with the exception of a dialogue and customer feedback on the structure and composition of the products. During all this period, Prima Tech was limited only to selling a series of equipment to some research institutes. The founder/manager of Prima Tech realised that it could be extremely beneficial to establish a closer collaborative relationship with their research client because it is located in its field of activity at the technological forefront and in this way can consolidate the advantage technology of a smaller company. In conclusion, the respective manager made the decision to offer a good additional service to the research client in order to be "noticed" by him: When I became aware of what the research institute was doing, I quickly made the decision to continue working with them. We reorganised in order to provide particularly high-performing support and services [...]. At that moment, there, everything started (CEO Prima Tech, personal communication, 2022).

Such an approach generates success. The research client, being a client-oriented and particularly proactive supplier, gradually identified Prima Tech as a reputable and serious supplier and, therefore, it was interested in developing the collaboration and gradually involving it including in the innovation process, noting that Prima Tech's manager is really interested in this process of innovation and not just in obtaining a certain "profit".

Gradually and repeatedly, this happened; at a given moment, a series of equipment is purchased and in this way the development of a relationship takes place. Prima Tech offered a series of particularly reasonable conditions. If there had been someone else in her place, thinking only of quickly obtaining a profit in the shortest possible time, everything would have stopped much earlier, and such a special collaboration would not have been possible to develop close (research client).

When the researchers realised that we have the most suitable products, they quickly turned to us with many ideas. Many researchers have ideas all the time. However, most of the time, they lack the available time necessary to put these ideas into practice. Researchers constantly need partners for collaboration, and we, thanks to the supplier-client relationship developed with them, have taken over some of their ideas (CEO Prima Tech, personal communication, 2022).

Over a period of several years, the existing relationship between Prima Tech and the research client has become one of the most extensive. As a result, Prima Tech was included by the research client as one of the key partners in a special innovation center based on research. Within that network, Prima Tech was by far the smallest partner.

Both Novo Tech and Novo Trade pointed out the close ties achieved as well as the trust built with research clients and those present in the industry. They decided to work particularly with a set of clients and in this way demonstrated their commitment and competence over the long term. In this direction, Novo Tech had a very clear attitude. According to the informant, for a small company, it is particularly demanding from the perspective of the resources' availability to frequently initiate new relationships. Our desire is to be able to collaborate with clients for as long as possible, and from this point of view, we are looking to work with those clients willing to share this vision. Obviously, our preference is to work with the most well-known clients, respectively, with those companies that have developed and grown together with us (CEO, Novo Tech). After the trust of larger clients is won, it will become much easier to develop new projects, but especially the growth and development of ongoing OI projects: We are in permanent communication and collaboration with various research institutions and from

this, many times ideas for new products appear [...]. Alternatively, the details of unique needs may appear. In the end, we customise the new products for them (CEO Novo Tech, personal communication, 2022).

The specific processes of building and consolidating trust mark the two groups of clients. Novo Trade succeeded in obtaining a contract with a company for testing a technological concept within a pilot project. After this moment, another company quickly became interested in technology and the collaboration then evolved into a larger research project. Novo Trade has closely collaborated with certain departments specialised in research and development within various companies, and later they turned into pilot customers and purchased the technology. It is crucial that the building of solid professional relationships is always carried out with the "right people", present in the research and development departments, because they often act as real decision-makers and guardians in order to purchase new technologies. In that process, Novo Trade had to "educate" and convince the respective companies about the functionality of the new technologies, a process that was definitely a challenging one. During the entire research project, Novo Trade was able to demonstrate the effective functioning of the technology, and this undoubtedly optimised the position of a collaborative partner and reliable supplier: The most important way to the users within the companies is represented by the research centers. Internally, they are responsible for the commercialisation of the technology. According to the Novo Trade CEO, when there is even a single technological project with proven performance on the ground, all other subsequent projects will be carried out much more easily.

An aspect that is at least as important is that the SME employees managed to spend a lot of time with customers in the same field and this makes it easier to test the technology as well as get feedback about it. Moreover, trust and social relations are strengthened through collaboration. Also, small companies closely monitor customers to provide the best assistance and services in order to build trust and reputation. In this context, these activities become extremely demanding for companies from the point of view of resources.

There is a permanent dialogue with the clients, which becomes extremely consistent but at the same time resource-consuming, but following this dialogue, the clients can definitely get the consultancy they really need. There is good communication with clients even after the specific stages of project implementation, so that they can share their satisfaction, frustrations, as well as possible suggestions and ideas to facilitate further enhancement of their professional performance. Apparently, this is a time- and resource-consuming process. However, in this way, customers will definitely become more satisfied and send more orders (Engineer Prima Tech, personal communication, 2022).

Challenges of a different nature also arise, such as addressing the differences existing within various organisational cultures. The manager from Prima Tech analysed the most important issues from the point of view of the differences in organisational cultures existing between larger organisations and small companies, with priority towards customer research. He argued and highlighted the fact that specialised research institutions are different from smaller companies precisely because of their long-term focus on innovation, their focus on publications, but also through other issues. Due to these aspects, smaller companies are forced to be aware of cultural differences and to identify alternative approaches for a successful collaboration with the respective research institutions. I think that for us, the challenge is much greater than for research institutions, and this motivates and rewards because the result

fully justifies any form of effort. Even under these conditions, it is particularly important to explain to the employees how it works (CEO Prima Tech, personal communication, 2022).

Also, the research clients became aware of various challenges within the OI collaboration, noting in small companies a relatively limited number of essential people but also the consequences: You depend a lot on individuals and less on processes or systems. It does not represent a collaboration developed between systems, and for this reason you are overly dependent on the person you work with [...] Relationships can develop quickly; if your company becomes dependent on such types of (fragile) relationships (research client) you automatically become particularly vulnerable.

In general, the opinion of the informants is that they are more interested in the advantages conferred by OI compared to the potential risks presented by it. They (informants) are not afraid of the risk presented by opportunistic behavior on the part of larger clients, nor of the risk of losing valuable development and research knowledge following collaboration with these clients. From this point of view, the fact that you are a very small company and you are subject to repeated interactions with customers could be beneficial: Many of the customers exude sympathy for us; because we are so small, there is no risk of employees or ideas being stolen from us. Certainly, we have only advantages from this collaboration (CEO, Novo Trade). Even if long-term collaboration was the preferred collaboration option, Novo Tech underlines the fact that this preferred type of collaboration in the case of specific customers in the industry can really and obviously limit the possibilities of collaboration with others and can also represent a namely "blocking" effect. In fact, the company had to refuse particularly interesting requests from potential clients in the industry, because those clients turned out to be real competitors for the operator.

RobotsNet has over 23 years of experience in engineering and design solutions. Even if it is about new equipment or automation projects, the company presents the best solutions. The team's ambition and perseverance made RobotsNet accept challenges refused by other companies due to their high complexity. RobotsNet CEO: "The challenges given by complicated projects are always accepted. We do not give up until we get the expected results. We identify new ideas to improve production, together with our customers, and the solutions developed are solutions inspired by the beneficiaries. We treat each project with utmost seriousness, regardless of its size, because we respect our work and our clients. Every time, we pay attention to the safety offered to the transfer of equipment as well as to the completion of the project with excellent results. Collaboration with RobotsNet represents communication throughout the project implementation process. All specific needs or problems require tailor-made solutions".

4.2 Contributions made by clients to the OI process

Within the various specific stages of the innovation process, customers contributed. All of these ideas were generated by clients, SMEs or by actors together, for example, in a joint workshop. In the primary stages of an innovation process (idea and concept initiation), collaboration and dialogue visibly influenced the way in which the SME continuously pursued a certain idea. Novo Trade, for example, collaborated closely with certain companies in the exploration stage and in the creation stage of the technology development carried out in the first years. The finalisation of the work packages for the research was carried out in close collaboration with the companies, and in the stages that are important later in the process, the companies brought the knowledge, thus influencing the decisions regarding the subsequent technological trajectory.

According to the companies' point of view, during the testing stage, collaboration is particularly important in terms of the quality of the resulting products and implicitly the sale. This is mostly acceptable for products that are intended for industry, but also for products assigned to other industries, as well as those devoted to research clients. Sometimes research clients and SMEs worked together very closely at this stage for weeks, as company employees were allowed to test the technology in real situations: Every time the collaboration with the research client makes possible an "elevation" of the technology. If only the own developments had been carried out, a certain way of testing would have been necessary; otherwise, this is done free of charge thanks to the research client. Their missions can continue because they still want to purchase our technology (engineer Prima Tech, personal communication, 2022).

During the commercialisation stage (sales and marketing) of new products, both research and industry clients contributed. The most important client of Novo Trade, for example, being represented by a company present at the national level, contributed consistently and decisively to the distribution of Novo Trade technology at the international level through its main operating partners, and in this way succeeded in accelerating the process initially of the internationalisation of Novo Trade. In the case of conservative industries, it becomes extremely difficult for smaller firms to sell a new technology because most of the companies in those industries eloquently exemplify the principle of the technology that is proven. Even under these conditions, when Novo Trade succeeded in effectively selling the technology to a large company, other similar companies were less likely to buy the said technology. Moreover, through collaboration with various research clients, smaller firms received faster access to internationally developed networks, in the sense that other universities and research institutes were included in their list of active or potential clients and thereby opened up new international markets for their products. In this way, both research clients and those from industry have shown themselves to be real door openers and standard references for new clients: In the case of the research institutions or universities with which we currently collaborate, they frequently run extensive research projects, in which at least 35-40 foreign researchers participate. When the equipment is delivered to the university, most of the time you communicate with the respective actors and receive new projects and ideas through the connection with the respective university (CEO Novo Tech, personal communication, 2022).

In the opinion of the informants, a certain marketing effect from the specialised publications of the research clients was also found. Within the respective publications, their products were mentioned and highlighted, and through this, the legitimisation of SMEs at the international level was achieved. It is natural for researchers to communicate to others what they are studying. In this way, he communicates to others about the equipment used, the partial and final results obtained, about collaboration in general. In other words, tell colleagues about us too (CEO Prima Tech, personal communication, 2022).

When SMEs become more mature, collaboration with research clients becomes crucial, regardless of how extensive this collaboration is in relation to the total turnover of SMEs. According to the informants, the technology and products developed in partnership with research clients can be further developed, redesigned, and applied to other segments, so that they represent for the competition a veritable springboard to other market segments. Because the "main" users of the developed technology were the research clients, precisely they supported the technological privilege of SMEs. In order to acquire the knowledge related to the limit of technology and research necessary to maintain competitiveness, crucial for the development of advanced and "radical" products, collaboration was important, according to the informants.

Adjacent to the aspects related to the development of technology, the collaboration with research clients presented positive effects, according to the informants. According to the previously mentioned, it provided companies with easier access to extensive international networks, but also to international markets specific to their products. Reported to the recruitment was a positive thing. Novo Trade and Prima Tech had recruited masters and doctoral students who had worked with the companies during their research stages. The collaboration also seemed to increase the motivation of the internal workforce, as being part of a much larger network and working "together" with the researchers was particularly inspiring. Finally yet importantly, for the development of technology, it provided increased access to financial resources.

5. DEBATE

Related to the two research questions, the debate related to the empirical findings is also structured.

5.1 Increasing relationships with clients based on trust and co-opting partners for collaboration

Through various approaches, in a relatively systematic, proactive, and conscious manner, SME managers identified possible collaboration partners, from using existing social links to "market research" and in this way, they were able to identify and co-opt valuable partners. Thus, in an independent manner, SMEs identified IO partners from research and industry clients without the help of intermediaries, according to other research (Lee et al., 2010). According to this research, clients were interested in collaboration because they were looking for the benefits of advanced technology in order to carry out their activities competitively, while SMEs had the capacity and competence necessary to develop it in their collaboration with clients. Moreover, according to Huang and Wilkinson, (2013), through their knowledge and expertise, the managers of the companies certified an extensive industrial experience, an aspect that is very possible to have quickly facilitated the stage of obtaining acceptance.

In this research, the respective companies accepted a closer collaboration, over a longer timeframe, with the few clients in the portfolio. Clearly, using various mechanisms such as the demonstration over time of intentionality, reliability and expertise, these case firms have made substantial efforts in order to build and especially maintain trusting relationships with larger clients, maintaining over time the role of collaboration partners and that of suppliers. Contrary to prior research and its proponents (Wynarczyk et al., 2013; Nieto & Santamaría, 2010), SMEs purposefully adopted a specific approach centered around services and customers. This approach involved actively seeking ideas from customers, which they could then leverage to further develop and effectively address client needs. This behavior exemplifies the SMEs' notable absorption capacity in satisfying the requirements of their clients. One of the possible explanations could be that the mentioned case companies represent companies that show a strong orientation towards development and research, with a marked inclination towards high technology, in this way visibly reducing the more general problem related to the more limited levels of the present absorptive capacity in smaller companies. Moreover, SMEs are capable of adapting to the visible differences in organisational culture existing between larger clients and smaller firms, with priority towards research clients, an aspect that certainly facilitated, strengthened, and accelerated the specific relationship of IO. In the process of raising awareness and educating employees regarding cultural differences, but also for their learning necessary for their management, SME managers contributed to the construction and perpetuation of OI cultures with clients. Thus,

according to Van de Vrande et al. (2009), SMEs were able to overcome the inherent organisational challenges that appeared in the management of OI.

Over time, existing relationships between SMEs and their clients have moved towards a commitment between the parties, collaboration, and increased interdependence. This is fully highlighted by Prima Tech's relationship with OI. For the first time, this company engaged in a constant supplier-client relationship, a relationship that grew and permanently transformed into a comprehensive and formal IO relationship; in other words, while the company gained legitimacy and trust from its client by research, the OI process became more defined and articulated. The more the subsequent relations developed, the more faded the beginning of the collaboration projects; clients engaged SMEs and SMEs trained their clients. In other words, according to Chesbrough and Crowther (2006), the existing OI between customers and SMEs was developed in a clear direction of reciprocity. This finding is in obvious contrast with other studies (Nieto and Santamaría, 2010, for example), in which the problems that SMEs have in relation to the disproportionate balance of power and asymmetry are highlighted.

Compared to the collaborations highlighted in the previous descriptions of the study, the collaborations that SMEs have with research institutions would seem to differ and certainly warrant heightened focus. The findings of this study eloquently underline the fact that from the beginning the case firms proved to be extremely aware of the importance and value of research institutions and thus could initiate IO relationships. These findings confirm and, at the same time, contrast previous research. According to some researchers (Tether, 2002; López et al., 2015), within industry-university relationships, most of the time SMEs run into a series of barriers. In these conditions, in the opinion of Nieto and Santamaría, (2010), Lasagni, (2012), a series of innovative SMEs that operate within high technology industries and a high intensity of research and development is very possible to collaborate with research institutions. According to the data, companies' awareness of the intrinsic value of their collaboration with research clients becomes much higher, as OI collaboration evolves and companies mature. This finding is in true contrast with those of other previous studies related to the relationships that SMEs establish with research institutions.

The companies developed relationships because the research institutions represent customers and from this point of view these research institutions have a commitment both as customers and as supporters and indirect participants in the initiation and development of new technologies within the companies. These are the "main customers" who possess advanced knowledge and who generally have several assumed roles even beyond their main activities. Research institutions, in the traditional way, produce and deliver the technological and scientific knowledge necessary for the transfer of innovation through collaborations between the university and the company. In conclusion, the particularity and evolution of IO relationships relevant in this study can facilitate the development of complex and extensive relationships, making it easier to overcome the barriers present in the way of collaboration between research institutions and smaller companies.

According to the findings, in general, the behavior and attitudes of company managers represented a necessary condition for the realisation of OI within SMEs. Managers gave the impression that they were acting in a strategic manner regarding the establishment of partners for collaboration and had an overview of their companies because they were technological leaders capable of facing competition in international markets. Cultivating and promoting reliability and trust, compensating the inherent vulnerabilities of the relationship, being proactive in the process of initiating ideas and demonstrating strong efforts, the company's

managers initiated contacting customers. Compared to other research (Nieto and Santamaría, 2010, for example), there was no fear of managers regarding the somewhat higher costs specific to the coordination and management of the OI relationship. This research highlights very clearly the fact that even smaller companies can significantly increase their attractiveness with the help of various mechanisms such as orientation towards services and customers and the obvious demonstration of their value and competence as partners in collaboration. In this way, the current research brings new knowledge about the most useful mechanisms for managing IO relationships. Figure 1 exemplifies the way in which the respective case companies initiated and grew trusting OI relationships.

5.2 The contribution of customers to the innovation process of OI

According to the data analysis, directly and indirectly customers have made a significant contribution to the innovation process of SMEs in the specific entry and exit phases of OI. Within SMEs, OI practices become much more widespread, especially in the next stages of innovation, such as commercialisation. In the stages preceding the innovation, OI presents a similar importance, according to the results obtained.

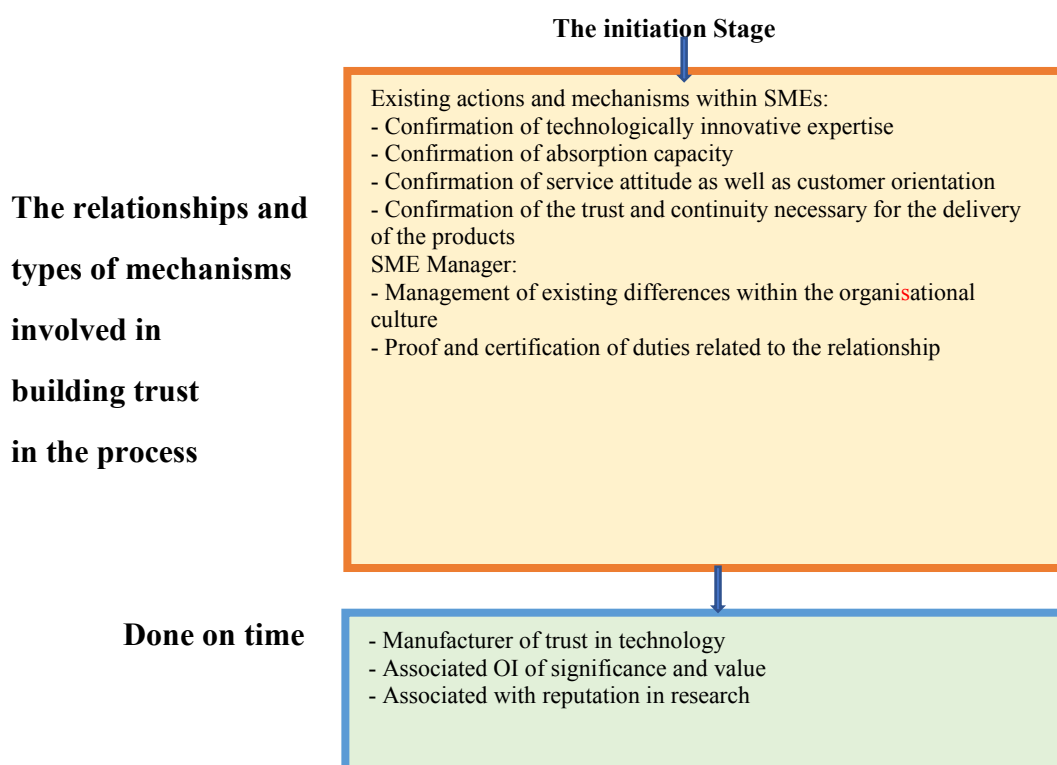


Figure 1. Initiation and growth of IO relationships based on trust by SMEs: actions and mechanisms involved in this process

Source: author research

According to the studies conducted by Nieto and Santamaría (2010) and Lasagni (2012), customers play a crucial role in enhancing and refining ideas. Through their feedback and input, customers contribute to the development of complementary facilities and skills, thereby advancing the ‘frontier technology’. Also, the research highlights a series of indirect positive effects brought by the contribution of research clients, such as the easy and extensive access to competence achieved with the help of the recruitment of future master's and doctoral students, but also through an appropriate and stimulating working environment for development and research. In general, small high-tech companies very much depend on their

potential to mobilise and attract the knowledge of their own employees and can also be identified, compared to larger companies, as much less attractive. In conclusion, compensation for the common disadvantage presented by SMEs in terms of access to skills and human capital should be achieved precisely by the collaboration of IOs.

Moreover, according to the analysis, in the commercialisation stage (respectively, the exit phase of the OI), directly but also indirectly, the customers had a special role. With regard to the direct effects, the collaboration with the customers significantly reduces the risk in the marketing stage considering the fact that the respective customers are engaged in buying the products and thus act as true pilot customers. This conclusion is in full agreement with that expressed by Van de Vrande et al. (2009). Moreover, the SMEs received credibility, legitimacy, and international networks from the clients. The clients reacted like true and important references, particularly important details for the success of SMEs in the international markets. As firms have matured, they have constantly optimised their work with research clients. This refers to the various contributions made to companies by research clients. Research clients, even to the extent that they were not crucial to SMEs in the process of achieving turnover, are gradually becoming imperatively necessary in the efforts of companies to maintain their technological advantage in global markets. In conclusion, SMEs can obtain "breaks" in emerging technologies and thereby remain competitive in dynamic international markets through OI relationships.

Naturally, SMEs show the tendency to remodel, redesign and reinterpret the technology that is developed in collaboration with research clients so that it can be adapted and destined later to other related segments of the market. This innovation practice can be referred to as being ambidextrous and balancing exploration and exploitation within an innovation cycle. This finding is in agreement with Prajogo et al. (2013), according to which innovation in the exploration stage is able to trigger many innovations in the exploitation stage. Under these conditions, first of all the collaboration of the OI with the research clients allows exploration activities (the contribution of the clients) and inherently triggers specific exploitation activities, activities to be followed later by the smaller companies. Table 2 presents all these findings.

In conclusion, for the respective case companies, the contributions made by the clients were extremely valuable because they provided reputation, legitimacy, international networks, as well as market and technological knowledge. In the innovation process, the contribution made by the customers was both direct and indirect. Compared to customers present in industry, research customers seemed to be much more involved in the innovation process. One of the plausible reasons may be that research institutes and universities are driven to increase the effective contribution to the transfer of technology and knowledge to the outside world, as well as the fact that they generally have a certain culture of open science. Moreover, since the research clients were defined as leading clients with advanced special needs, this led them to be much more interested in possible collaborations with SMEs.

6. RESEARCH CONCLUSIONS

Based on four case studies, this paper makes an additional contribution to the more substantial understanding of OI from the perspectives provided by SMEs. It further confirms the definite advantages of OI mentioned in previous studies (effective by Lee et al., 2010; Lasagni, 2012) and adds new perspectives. In order to compete on the global markets, the case companies want to become technological leaders, and for this reason they highlighted the positive effects

generated by the collaboration of the OI. As research clients have functioned both as research partners and as main clients, they have over time become particularly important for SMEs.

The present research contributes to previous research by highlighting the particularly critical role of SME managers in the process of initiating and developing OI-type relationships with the help of specific mechanisms for strengthening and increasing trust. The managers, in a proactive manner, initiated and developed OI-type collaborations, even if they have limited internal resources. Even under these conditions, since smaller firms are dependent on the availability and autonomy of clients for their involvement over time in the IO collaboration, they do not intrinsically show "control" over their own IO strategies. Therefore, it becomes fundamental to understand the way in which SME managers and founders are engaged in various activities in order to increase the trust and legitimacy absolutely necessary for the long-term qualification as an OI collaboration partner for larger client companies. The relationships were able to evolve into interdependence and reciprocity precisely thanks to such behavior.

Table 2. Presentation of customers' contribution to the innovation process

	The direct effects	Indirect effects
Entry stage	Stabilising the technological advantage gained by companies; Facilitating access to testing specific technology within the field; Making available the ideas necessary to obtain a more advanced technology; Delivery of information related to the needs expressed by users;	Openness provided for research funding; The recruitment of candidates with master's studies and doctoral studies ensured a definite and special access to competence; SME employees delivered a stimulating work environment for research and development;
Exit stage	Expanding reputation, credibility, and legitimacy; Publication of editorials that substantiate the functionality and efficiency of SME technology; Provides international customers with recommendations as well as international sales (intensive); Since they are pilot customers, it reduces market risk;	Facilitating technology redesign related to new and related market segments; Stabilisation of the competitive position in certain market segments

Source: author research

In addition, regarding customer contributions to the OI process, this research highlighted new nuances and insights. Regarding the contributions brought by customers to the innovation process, a certain dynamic and interaction is noted that concretely and pragmatically influences the customers' decision regarding the development of the SME or the decision of the SMEs regarding the investment of resources and time in the process of development of IO relations. The study successfully complements the knowledge of specialised literature regarding the evolving impulses as well as the concrete objectives of SMEs regarding OI in their life cycle, starting from reducing the inherent risk that exists in the start-up stage and reaching the achievement of strategic objectives long-term.

7. THE PRACTICAL IMPLICATIONS OF THE RESEARCH

The obtained discoveries present several practical implications. According to these cases, in the OI innovation process, managers have a particularly important role. To begin with, it is particularly important for SMEs to recognise the true benefits brought and presented by OI strategies regarding collaboration with clients, especially with those leading technology clients. Then, because most of the time SMEs do not have the necessary capacities to create networks, it becomes really necessary to collaborate with clients who have the potential and willingness to assume many more important roles in the commercialisation process, such as that of a provider of international networks as well as that of an innovation partner. Moreover, the collaboration with the research institutions could become extremely valuable, even if the respective institutions also have the role of clients, considering the fact that they present implications within the fundamental research process and therefore can become crucial for radical innovations. However, this requires managers to communicate and be able to build relationships based on trust with research institutions. Finally, but equally important, SME managers must be proactive and consciously and permanently identify new and suitable partners for collaboration, without giving up the initiative to clients or others.

8. FUTURE RESEARCH AND INHERENT LIMITATIONS OF THIS STUDY

Because it is based on four case companies located within a certain geographical region, this research presents a series of limitations. Therefore, generalising the conclusions is challenging. This qualitative methodology presents a series of obvious weaknesses, but it allowed the retrospective disclosure of in-depth qualitative data regarding the process of strengthening the trust invested in IO relationships. This methodology is more suitable for highlighting relationships that become increasingly intricate and reiterate the validity of the research. I propose further studies that use a process approach that is so necessary in order to develop new knowledge about OI within SMEs. Considering the fact that the IO process represents an interdependent and reciprocal process, it is necessary to encourage new research that highlights the dynamic relationship between partners. Moreover, on both sides of the relationship, it is crucial to understand the dynamics, the evolution of trust, as well as the related mechanisms of OI. In order to research this phenomenon of OI present between collaboration partners, the longitudinal approach can be adopted, according to the exploration of the supposed reciprocity as well as the dynamics involved.

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