

## THE ROLE OF TRUST IN OPEN INNOVATION COLLABORATION: THE EXPERIENCE OF POLISH MEDIUM-HIGH-TECH SMES

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**Abstract:** *This paper contributes to an emerging debate on open innovation ecosystems and knowledge sharing in the innovation environment, by sharing insights on the role of trust in open innovation collaboration. Systematization of the state of art literature on the innovation networks show that trust is crucial for improving competition among Polish companies, yet its seems to have not an important place in the innovation environment. The main purpose of the research is to determine the role of personal traits, including trust, in the initiation of the potential open innovation collaboration. The study applies the qualitative survey method and shares up-to-date empirical evidence from Polish high- and high-mid-tech small and medium-sized enterprises (SMEs). The study was conducted using the computer-assisted telephone interviewing (CATI) method, in collaboration with the ARC Rynek i Opinia company, from January to April 2021. The study covers 100 SMEs active in advanced technology industries. The results reflect the opinions of middle- to high level managers. The study findings show that there is a need for a deeper understanding of the factors behind trust-embedded open innovation collaboration, and the perception of open innovation as a win-win game for all the partners. Better understanding of these factors will ensure more effective communication in developing an open innovation environment in Polish SMEs. The study findings also indicate the need for an active role of key stakeholders and intermediary agents in facilitating formal and informal networks stimulating mutual trust, as well as the importance to build the educational system enabling the strengthening of the creativity, and the diffusion of innovations.*

**Keywords:** Poland, SMEs, open innovation, industry-academia partnerships, trust, geographical proximity.

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## Introduction

We live in a highly competitive and constantly changing world where knowledge transfers and access to up-to-date information are critical. Openness and collaboration are among the key facilitators of modern innovation processes. An “open attitude” approach allows a free flow of knowledge and therefore supports the innovativeness of firms (Paallysaho, Kuusisto, 2011). The concept of open innovation introduced by Henry Chesbrough (2003) is a paradigm that means that enterprises can and should use both external and internal ideas in their innovation processes as well as internal and external paths for introducing innovations to the market. As the author puts it, “open innovation” is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively” (Chesbrough et al., 2003: 1). Open innovations can take the form of licences, patents or the purchase of know-how. Other options include the implementation of R&D contracts, cooperation with universities (both formal and informal) in the introduction and implementation of new solutions, and the purchase of university spin-offs (Runiewicz-Wardyn, 2022). As a result, companies and research institutions introducing open innovation practices make better use of their innovation potential (i.e. R&D processes and learning outcomes), increase the productivity of teams, and stimulate innovation and technological progress, especially in areas that are at an early stage of the technological life cycle. Moreover, as many researchers of the medium-tech and high-technology sector note, other important features are the short life cycle of products and technologies, the high innovativeness of enterprises, fast diffusion of innovation, a high level of rotation of equipment, substantial investment expenditures, increasing demand for highly qualified staff, a high investment risk, and a growing number of patents and licences (Korpus, Banach 2017; Hagedoorn 1993; Powell, Koput, Smith-Doerr, 1996). Many large, well-known companies are successfully experimenting with the open innovation model. Examples include Philips, Nokia, Cisco, and Boeing. But open innovation is not only a solution for large companies. Knowledge-intensive companies are also the world’s most innovative companies. An innovative company is capable of both creating and absorbing absolute innovations. Such companies also demonstrate a great ability to adapt quickly to changing environments and aim to achieve market leadership through innovative technology.

The open innovation model shows how important the SME sector and universities are in technology transfer. The driving force for companies to adopt the open innovation model is their propensity to establish a competitive advantage and to be able to maintain innovation leadership by using valuable know-how, ideas, practices, and experience coming from both inside and outside the company. In the open innovation model, new forms of cooperation between industry and universities are of exceptional importance. Thanks to cooperation with public and private universities, labs, and R&D centres, companies gain access not only to tacit knowledge but also to the results of research studies containing codified knowledge that have not yet been published. This gives them the opportunity to obtain a competitive advantage that is difficult to imitate by competitors (Oltra et al., 2018; Cassiman et al., 2008; Fabrizio, 2009; Fleming, Sorenson, 2004). Despite the wide acknowledgment that open innovation is the key to future business success, it is not yet vastly adopted in terms of company structure and approach (Bertello et al., 2021; Bigliardi et al., 2020). Moreover, being “too open” is not necessarily interpreted as a benefit for the firm’s long-term innovation performance (Drechsler, Natter, 2012; Coras, Tantau, 2014). In addition, the fear of knowledge spillovers may lead firms to internalise their R&D process even if internal research is less productive than external research (Arora, Merges, 2004). Nowak & Taplin (2010) argue that the lack of openness among enterprises stems from barriers such as fear of delays in deliveries, fear of failure to meet the terms of the contract, fear of changes in terms of cooperation (without prior arrangements), and the fear of not revealing full information to the partner. For this reason, this study approaches the open innovation process from a different angle, but builds on other studies that have analysed small enterprises and their approach to innovation in general (see Pysz, 2022). The latest literature in the field seems to give little attention to the relationship between trust and an open collaborative environment. The study adds the factor of trust as the crucial feature in improving the general business environment, market competition and above all open innovation collaboration between various key stakeholders. Open innovation is more than a concept or framework. It is above all an organisational mindset that needs another key factor, trust, in order to develop. This research focuses on areas of management by applying general economic theories

including systemic, behavioural and institutional approaches to tests the following two hypotheses: H1. The organizational and social relationships are critical for potential open innovation partnerships and network formation in Polish small high-tech firms; H2. Personal traits, including the degree of trust, is the main facilitator of open innovation collaboration among SMSs enterprises in Poland.

The paper aims to determine the role of trust in the open innovation collaboration initiatives. It addressed two key questions. First, what is the role of open innovation in the innovation collaboration process of Polish high- and medium-high-tech SMEs? Second, what is the role of trust in the partner selection process in open forms of innovation collaboration? The study represents the fragmented findings of the bigger research outcome published in the monograph of Runiewicz-Wardyn (2022). The paper is divided into four sections. The introduction is followed by a presentation of the conceptual context (definitions and concepts of the open innovation model and the open innovation process), selected research methodology, and finally research findings. The paper ends with a discussion of the research conclusions, limitations, and implications.

### **Evolution of innovation framework models: from linear to networked innovation**

Roy Rothwell, who is widely regarded as one of the pioneers in industrial innovation, introduced the descriptive model of five generations of innovations, starting from the 1950s onwards (1994). The classical, linear model of innovation (from the 1950s to mid-1960s), covers several successive phases: basic research, applied research, development phase, production, and diffusion. The model assumes that individual companies develop innovative ideas as part of their R&D activities (Janasz et al., 2001: 195).

In the 1960s and 1970s, the new first- and second-generation innovation models were developed. Those linear models were characterized by a dynamic in which the technology pushes and the market pulls innovation. The first-generation model considered the technological abilities of the enterprise, whereas the second-generation model emphasized the importance of buyers and their needs (Rothwell, 1992). The early 1980s marked the beginning of third-generation innovation models. These models concentrate on the effects of feedback that was gathered between phases of market research and previous linear models as well as the involvement of the suppliers and customers in product development. The Japanese automobile industry and electrical products introduced fourth-generation models in the early 1990s. The models defined the innovation process as various activities run by different internal departments, in addition to integrated suppliers, customers, and partners as part of the development process. The relationships in the fourth-generation models are based on complex iterations, feedback loops and reciprocal relationships. In all these models, innovation is generated based on the companies' own resources and skills, and thus requires high R&D investments, which may be ineffective if the problem they aimed to solve has already been solved by other research or business entities. The rapid technological advancement and the increasing process of technological convergence proved that the innovative process rarely follows a linear model. It is rather multi-sequential, with the interdependence of its different phases (Kozioł, 2007: 37). Therefore, in the early 1990s, the fifth-generation (open) models have replaced the linear models. The open innovation models are complex, non-linear, networked, or parallel, integrating the R&D activities from both, internal and external stakeholders, at all stages of the innovation process (Truskolaski, 2014; Kozioł-Nadolna, 2013; Szymura-Tyc, 2015; Bessant, Tidd 2011; Rothwell, 1994). Thus, innovation has become a collective, collaborative-creative and cross-functional process, requiring a combination of generic knowledge and specific competencies (Marinova, Phillimore, 2003: 50–51; Boschma, Frederick, 2010). In such complex and highly interactive innovation environments, Chesbrough (2003) introduced the open innovation paradigm, which assumes the use of purposive inflows and outflows of knowledge to accelerate internal innovation. Finally, sixth-generation innovation models see innovation as a process that involves a number of different entities, including suppliers, public R&D facilities, business (external and internal) R&D facilities, and customers with varying degrees of intensity (Barbieri, Alvares, 2016; Lewandowska, 2018; Kozioł-Nadolna, 2013; Weresa, 2014). Understanding the innovation process under the paradigm of the open innovation model requires to consider the general innovative product development process and its specific phases: 1) idea generation, 2) definition, 3) prototyping, 4) design, 5) validation and testing, and 6) commercialisation (Bruiyian, Nadia, 2011; Kahn, Kenneth, 2012). The key to successful

innovative output is the integration of various sources of knowledge and efforts in each specific phase (Runiewicz-Wardyn, 2022). For example, the idea generation phase (1) requires the brainstorming of a new concept or idea, and the definition and development phases (2) require collaboration with the end users in order to understand their needs and expectations. Similarly, collaboration during the prototype, design and testing phases requires feedback from both end users and engineers (3, 4 and 5) in order to ensure that prototype works as planned. Finally, the phase of commercialisation, determining and implementing the operationalisation processes, selected modes, and commercialisation strategies (6) requires partners to closely collaborate to manage the flows of products and services along the whole value-added chain. This means that the open innovation model constantly integrates its own knowledge and resources with those from other partner organisations. It is a constant learning system. The approach towards innovation has evolved over the years. Companies are no longer benefitting from keeping their research results a secret. By implementing the open innovation approach and becoming more transparent, the economy of research during the Schumpeterian invention, innovation, diffusion phases is changing. Analysis of this problem would be an interesting extension of the research presented in this paper. Further consideration is required of the impact of the open and collaborative innovation process on the profitability of industry clusters. Including the methodology of measuring the type and extent of social capital created by the collaborative approach of SMEs would help measure the impact and further analyse the relationships which are the subject of this article.

### **Role of trust in ‘open’ collaborative innovation process**

Trust is defined as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer et al., 1995: 712). This is related to the willingness of a trustor to be vulnerable to the actions of a trustee based on the expectation that the trustee will perform a specific action (Mayer et al., 1995). Another definition of trust perceives “the mutual confidence that no party to an exchange will exploit another’s vulnerabilities” (Parkhe, 1998: 221). Based on the extensive existing literature, trust can be perceived at an individual level, interpersonal level, between individuals and organisations, between organisations (inter-organisational) as well as between individuals and information systems (Fawcett et al., 2012; Gulati, Sych, 2008; Mayer et al., 1995; Schoorman et al., 2007). The authors argue that “relational” trust is related to collaborative innovation. Collaborative innovation is the implementation of an open innovation strategy focusing on building long-lasting relationships based on the commonly perceived value. In the context of these collaborative frameworks, trust has important embedded psychological, sociological, and economic properties (Parkhe, 1998). The partnership is the result of lasting ties based on mutual trust and the commitment of entities. Both the commitment and mutual trust of enterprises are enhanced if they provide the benefits of a long-term competitive advantage. It is important that ties with partners who share similar values are shaped in such a way that both sides refrain from taking advantage of the partner. The partnership means renouncing immediate benefits for the synergy of long-term alignment of independent companies (Kwon, Suh, 2004; Morgan, Hunt, 1994). According to Wilding & Humphries (2006), the success of innovative collaboration in the long term depends on the following process of events: collaborative communication (dialogue, information sharing); the quality of cooperation (creating a win-win situation); investment in cooperation (promoting quality), and above all credibility (building trust) and the durability of cooperation (increasing trust). For Brito & Costa de Silva (2009), trust is one of the most important pillars of effective innovation collaboration, next to common interests, sharing resources, and coordination of activities. Polish sociologist Piotr Sztompka emphasises that trust motivates cooperation, entrepreneurship, and investment. It brings people closer, stimulates openness and the spontaneity of contacts, stimulates innovative behaviour, and reduces transaction costs related to controlling the partner’s activities (Sztompka, 2007: 28). Similarly, Nowak (2012) concludes that trust, openness, and honesty towards the contractor are on the list of the most important factors of collaboration success (the author identifies four groups of factors determining the success of cooperative ventures: behavioural, financial, process, and technological factors). With respect to the process of collaboration, Van Beers & Zand (2014) argue that the enterprise needs to acquire two types of abilities: the ability to cooperate and the ability to innovate. Acquiring the ability to cooperate results in an increased level



of trust between partners, reduces transaction costs, and, as a result, positively influences innovation collaboration and better use of knowledge sources in innovation processes (Lhuillery, Pfister, 2009).

Nevertheless, not all studies in this area agree on the key importance of trust. Trust is not always perceived as the most important factor in the success of innovation (Molina-Morales et al., 2011; Danik, Żukowska, 2011; Bidault, Castello, 2010). Bidault and Castello (2010) note that excessive trust may negatively affect innovation and demonstrate it by carrying out an experiment involving 364 players: executive MBA students with employment experience in various industries. The researchers proved that trust between partners promotes innovation, but if it exceeds a certain optimal level, it begins to negatively affect innovation and efficiency. Similarly, Molina-Morales and Martínez-Fernández (2009) emphasise that an excessively low level of trust between partners may cause conflict related to the relationship, but too high a level of trust reduces the conflicts, which results in a lack of discussion and too quick acceptance of the partner's ideas. Furthermore, since the motives for joining the cooperation are changing, the common goals of such cooperation must be modified. Changes within the organisation itself change the relations between partners, including the level of their mutual trust, which further affects such cooperation (Harrigan, 1988; Nooteboom, 1999; Tuusjärvi, Möller, 2009). For example, Danik & Żukowska (2011), after researching Polish enterprises in various industries, concluded that one of the most important factors of successful cooperation (across all analysed industries) is the correct selection of partners, clear and realistic goals adopted by all partners as well as the complementarity of the partners' resources. Meanwhile, Bartczak (2023) points to the lack of trust, cybercrime and imitation as potential barriers to the development of digital technology platforms.

### **Trust and spatial proximity of innovation partners**

Geographical proximity used to be seen as a necessary condition to share tacit knowledge and to enhance trust between innovators (Porter, 1990; Isaksen 2001; Dahl, Pedersen, 2004). Yet, some recent literature on collaborative and collective innovation challenges this approach by questioning the need to conduct face-to-face meetings (Torre, 2008; Gust-Bardon, 2012). The authors argue that as the cooperation proceeds the trust between the partners grows, which may naturally reduce the need to maintain direct contact. Fitjar & Rodríguez-Pose (2013) examined more than 1,600 localised enterprises around five large cities in Norway and found that the dominance of regional trust led to the establishment of more local than supra-local (cross-regional) connections (inter-firm innovation interactions). Interesting findings on the cooperation of Polish enterprises with foreign partners are contained in a report on enterprises from Poland's central Mazovia region (Powiązania kooperacyjne, 2014). Based on a survey of 785 enterprises, 384 companies were identified that participated in cooperation networks. According to the report, companies that have acquired knowledge and innovation from foreign partners are not interested in sharing it with other companies in the region. This is mainly due to a low level of mutual trust. This translates into a low level of cooperation in the region itself, especially in developing new ideas. Therefore, knowledge obtained from foreign partners is not passed on, and the diffusion inhibition process deepens. Other Polish researchers, such as Nowak (2010), Stanisławski & Trębska (2017) and Łobacz et al. (2016) also reported a low level of trust in Polish enterprises.

### **Trust and industry-academia partnerships**

Various studies show that, in the initial stage of development of a given industry, knowledge from institutional partners contributes to the success of the innovation process, fosters more radical innovation and the application of already existing technology in a new way or the creation of completely new solutions (Arvanitis et al., 2008; Dewick, Miozzo, 2004; Tether, Swann, 2003; Monjon, Waelbroeck, 2003). Strong trust is not easily built in relationship between as different stakeholders as industry and academia. Researchers from industry and researchers from academia work in different cultures and follow different cognitive norms. The academic reward to scientists for their scientific discovery resulting in a form of a high-quality publication is strictly individualised. In contrast, industry researchers are salaried as contributors to a team or group efforts (Runiewicz-Wardyn, 2020). Thus, academic science researchers do not routinely operate with levels of collaborative interaction and cross-disciplinary teamwork environments. In addition, the knowledge of research institutions is by its very nature distant from the market, and its proper transfer requires close cooperation of entities, which facilitates its flow,

reduces the risk of information noise, and at the same time fosters trust building. This inconsistency of goals can lead to an increase in the opportunistic behaviour of partners and reduce the likelihood of success of joint ventures (Deeds, Hill, 1999).

### **Research methodology**

The study uses the qualitative survey research method. This methodology clearly shows the relationship between the core innovation and open innovation environments and identifies the key drivers and limitations of open innovation processes. The study was conducted using the computer-assisted telephone interviewing (CATI) method, in collaboration with the ARC Rynek i Opinia company, from January to April 2021. The COVID-19 pandemic extended the initially planned timeline for the study. The results reflect the opinions of middle- to high-level managers in small and medium-sized enterprises (SMEs). The study covered 100 companies active in advanced technology industries (Wegner, 2021) identified by the Polish Classification of Business Activities (PKD): (21) manufacturing of basic pharmaceutical substances and other pharmaceutical products; (26) manufacturing of computers, electronic and optical goods; (27) manufacturing of electric motors, generators and transformers; (20) chemical industry and production of chemical products; (18) publishing, printing and media services; (62) computer programming activities, computer consultancy, and other activity; (72) scientific research and development; (74) other professional, scientific and technical activities. The main purpose of this study was to identify inbound and outbound open innovative practices, together with the major drivers and barriers in engaging in open innovation collaboration, including the role of psychological and individual factors such as trust at the inter-organisational level. The research applied a pilot study to try out and refine survey questions with a small sample of hi-tech SMEs in Poland, before sending the formal questionnaire to a larger sample. During the pilot study, five telephone interviews were conducted with company managers in early 2021. After obtaining feedback and comments from a small number of firms tested, in the form of a pilot survey, some modifications were introduced to the questionnaire. The final questionnaire was divided into five categories: (1) the general structure of R&D and participation in open innovation collaboration; (2) factors influencing open innovation collaboration; (3) advantages and drivers in engaging in the open innovation collaboration process, with firms and academia; (4) the disadvantages and barriers to engaging in the open innovation collaboration process with other firms and academia; (5) future plans regarding open or closed innovation collaboration. Each section contained a mix of open and closed questions. The authors contacted more than 1,100 companies, of which only 152 showed an interest and 100 actually committed to the study. With such a large group, it was impossible to obtain individual opinions, especially as the average interview time was 19 minutes and 41 seconds. The study can therefore be described as a pilot study with implications for future research into high- and medium-tech SMEs. With regard to potential econometric tools to be applied in research in general, 40 is the estimated minimum number of respondents needed to produce a reasonable prediction based on one study (for quantitative usability studies). In our case, 100 respondents split into five high-tech and knowledge-intensive sectors would not allow us to apply quantitative analysis. The main objective of the study was to identify inbound and outbound open innovative practices as well as to identify major drivers and barriers to engaging in open innovation collaboration, including the role of psychological and individual factors such as trust at the inter-organizational level.

The study aims to answer the question whether R&D activity is conducted by companies in an open innovative environment and in which sectors. The study considers the drivers and barriers of open innovation, explores the pros and cons of such a model of collaboration, and approximates the approach towards future projects.

### **Open innovation survey results – the case of Polish SMEs in advanced technology sector**

#### **The significance of open innovation for Polish advanced technology SME**

For the purpose of the survey, open innovative cooperation was defined as “cooperation based on the mutual exchange of knowledge, technical solutions and licenses.” The first key question is related to whether “companies engage in open innovation activities.” In general, the survey revealed that 36% of Polish SMEs in high- and mid-tech industries engage in both inbound (through acquiring and/or licensing technologies or

knowledge from outside the firm) and outbound open innovation (through licensing out and/or selling technology/knowledge). The proportion of companies conducting open innovation in individual industries was the lowest in the chemical industry (15%), while being the highest in publishing, printing, and media services (26%), as shown in (Figure 1).



**Figure 1. The share of companies leading open innovation collaboration as % of the sample in each industry**

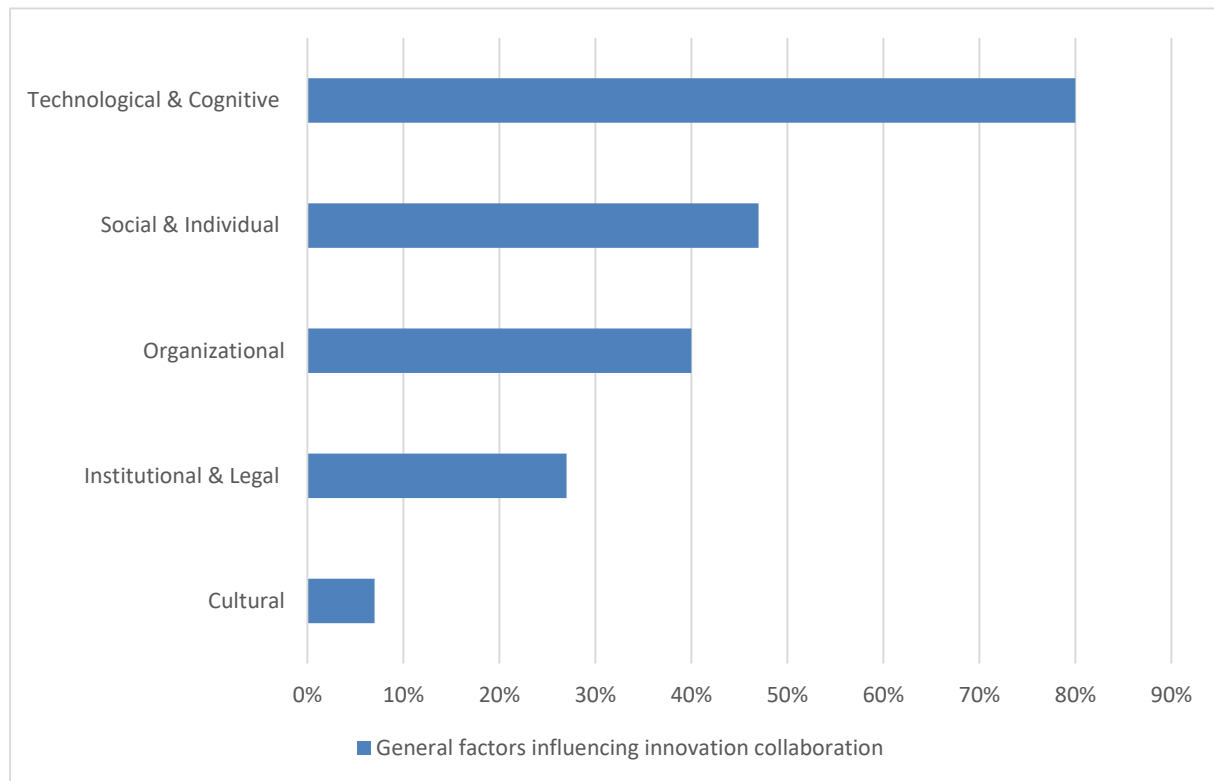
Source: Runiewicz-Wardyn, 2022.

The results for other industries were as follows: (21) “manufacturing of basic pharmaceutical substances and other pharmaceutical products” – 20%; (26) “manufacturing of computers, electronic and optical goods” and (62) “computer programming activities, computer consultancy and other activity” – 25%; (20) “chemical industry and production of chemical products” – 15%; (18) “publishing, printing and media services – 26%; (72) “scientific R&D activity” and (74) “other professionals, scientific and technical activities” – 32%. The high significance of open R&D collaboration in the last two sections is also driven by science-based partnerships with both universities and other research institutions. The size of company does not significantly affect the open innovation cooperation of Polish high- and medium-high-tech firms. Both bigger firms (with 50 to 249 employees) and smaller ones (with 10 to 49 employees) exhibited a similar level of involvement in open inbound and outbound innovation activities. Nevertheless, the proportion of companies conducting innovation processes only internally was larger for the smaller companies than the bigger ones, at 67% vs. 59%. This shows that bigger Polish high- and medium-high-tech firms are more open and eager to exchange knowledge and technology for innovative purposes than the smaller ones.

### Role of general factors affecting the open innovation model

The study also identifies general factors influencing the selection of innovative partners by the surveyed firms. These include cognitive/technological, social/personal, organisational, institutional/legal, and cultural factors. The cognitive factor is linked to the cognitive proximity - the way in which various actors perceive, interpret, and evaluate new knowledge (Breschi et al., 2003). Technological proximity is associated with the degree of overlap in the knowledge bases of two potential partners. Socio-personal factors such as formal and informal social networks enable the flow of non-subject, often implicit, knowledge (Runiewicz-Wardyn, 2020). Organisational factors refer to the inter-organisational and intra-organisational dimensions of innovation partnerships (Antonelli, 2000). The inter-organisational dimension of such a partnership is based on collaboration between autonomous organisations, while the intra-organisational dimension involves collaboration between different units within the

same organisation. Institutional factors refer to interaction among actors from various institutions as part of the industry-university-government Triple Helix model, while cultural factors relate to the shared norms and beliefs of the partners (Adler, Kwon, 2002). Culture influences how people perceive and interpret their environment. Consequently, individuals sharing a common language and culture are more likely to perceive social interactions and exchanges in similar ways (Runiewicz-Wardyn, 2020). In general, the study reveals the following order of significance of the general factors influencing the selection of innovative partners: technological and cognitive (80%), social and personal (47%), organisational (40%), institutional and legal (27%), and cultural (7%) (Figure 2).



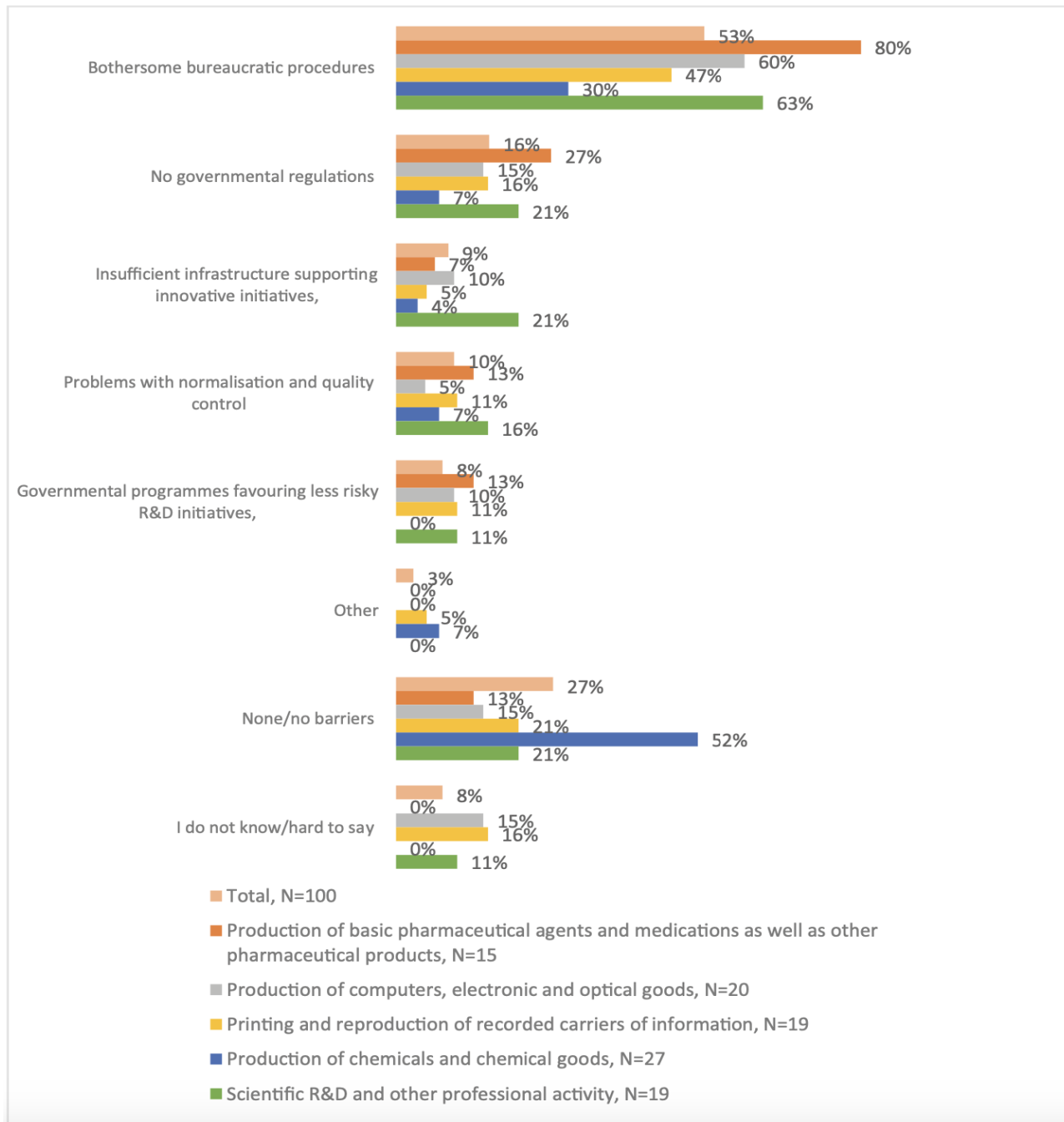
**Figure 2. General factors influencing the selection of innovative partners**

Source: Runiewicz-Wardyn, 2022.

Considering the size of entities, the role of social and personal factors decreases as the company grows, while the importance of technological and organisational factors increases with company growth. The study reveals that technological proximity matters most for medium-sized companies (with 50 to 249 employees), while socio-personal factors are more important for smaller companies (10 to 49 employees).

When asked about the institutional and legal barriers to the implementation of open innovations, 80% of the pharmaceutical industry, 63% of scientific R&D and other professional activity, and 60% of the computer, electronics, and optical industry respondents pointed to the annoying bureaucratic processes.





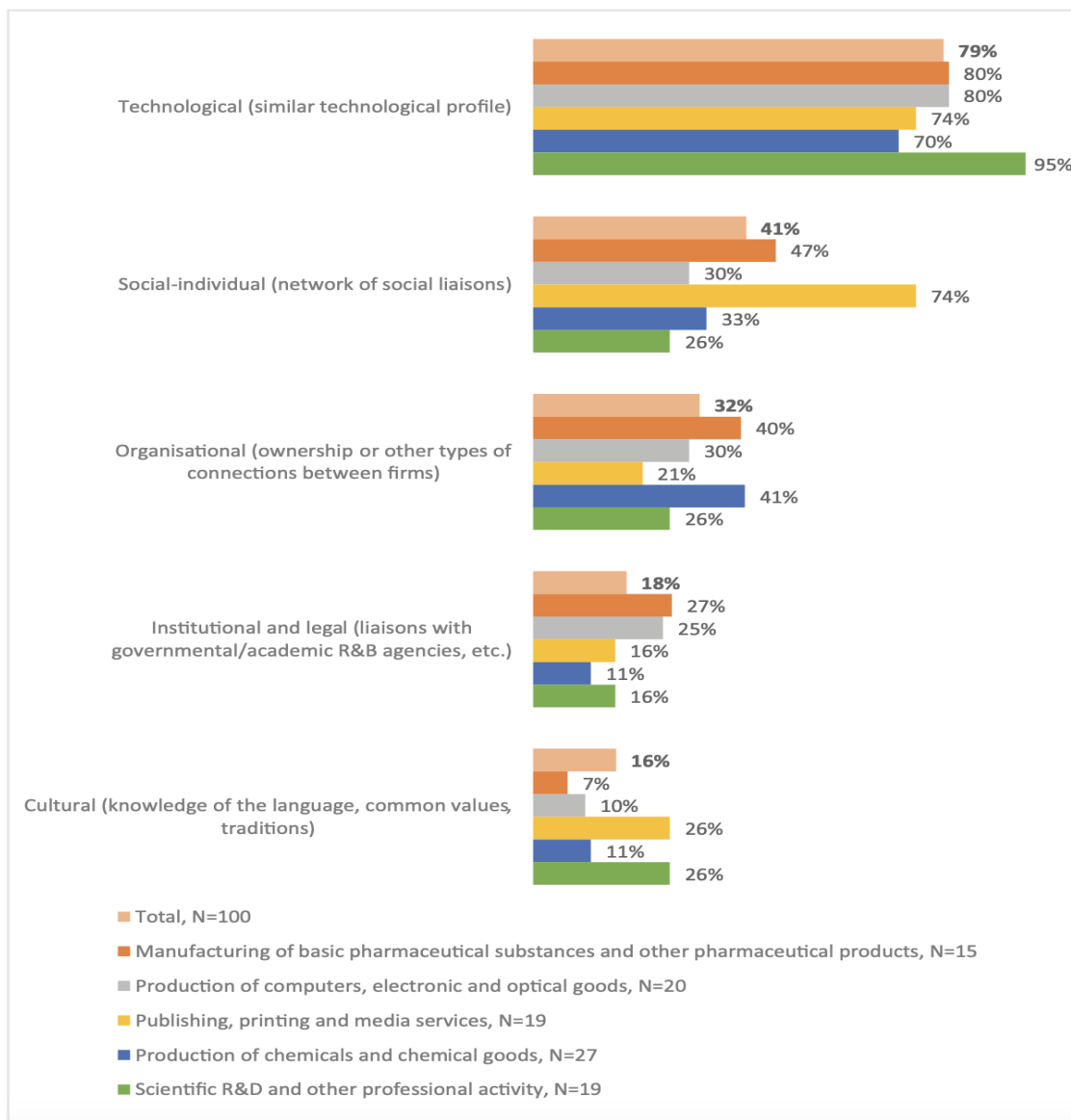
**Figure 3. Institutional and legal barriers to the implementation of the open innovation model**

Source: Runiewicz-Wardyn, 2022.

According to the surveyed company representatives, the lack of courage in taking risks is the personality trait that most inhibits the process of innovative cooperation. This was especially true for “scientific R&D” and “other professional activity” (58%); “production of computers, electronic and optical enterprises” (50%); and “production of pharmaceutical substances, medications” and “other pharmaceutical products” (47%). Also, 27% of the pharmaceutical industry actors complained about the lack of proper government regulations, whereas 21% of scientific R&D and other professional activity actors found insufficient infrastructure supporting innovative initiatives. See (Figure 3) for more details.

### Role of social and organisational factors in the selection of open innovation partners

From the perspective of each surveyed industry, technological and cognitive factors seem to be the most important in the selection of innovation partners, as illustrated in (Figure 4). The exception is the Polish media, publishing, and printing industry, where social and personal factors are just as important (74%) for innovation collaboration as technological and cognitive ones (74%). In the media, publishing, and printing industry, followed by scientific R&D activity, other professional, scientific, and technical activities (26%), we also observe a more important role of cultural factors than in most other industries. The role of culture seems to be less important in the case of basic pharmaceutical substances and other pharmaceutical products (7%). For this industry, technological cognitive factors play the biggest role when choosing a partner (80%). This indicates that Polish pharmaceutical companies operate in an increasingly mature and open environment and have a greater ability to leverage cultural differences in knowledge exchange and to join international networks.

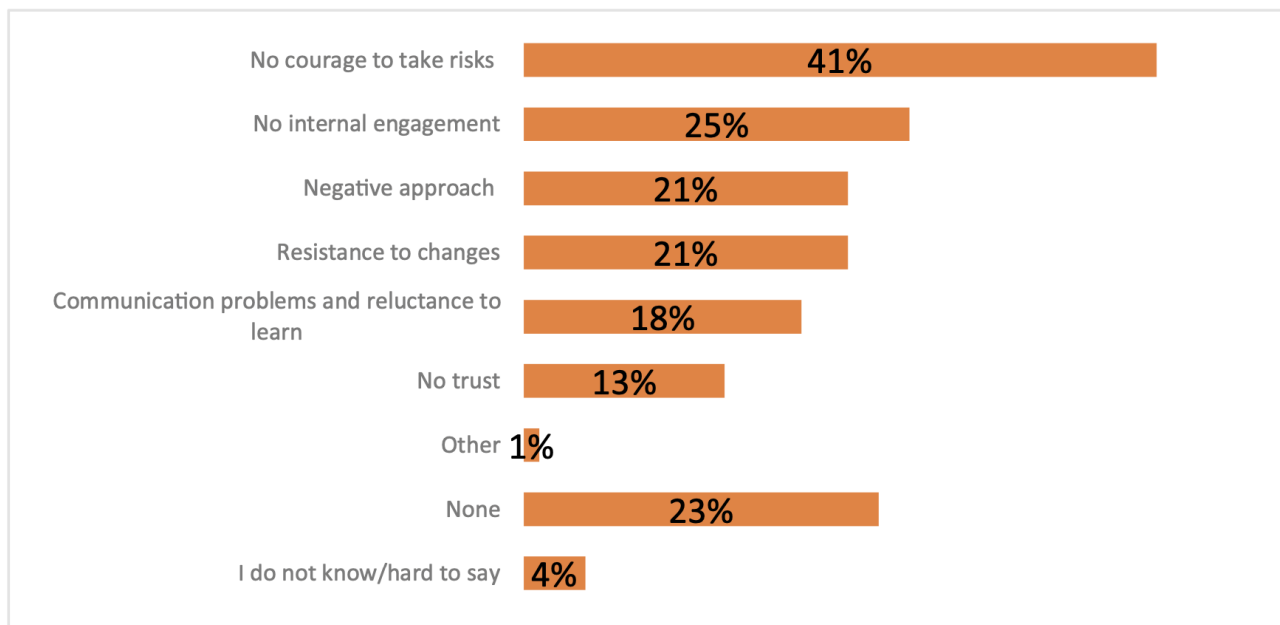


**Figure 4. Factors influencing the selection of innovative partners in high- and medium-high-tech industries**

Source: Runiewicz-Wardyn, 2022.

In addition to the above, physical proximity and clustering were highlighted by most of the surveyed companies as a factor that has a positive effect on innovative interaction and knowledge spillovers. This was especially true of the following industries: chemical and pharmaceutical; manufacturing of computers; computer programming activities; electronic and optical goods. Another factor recognised as important was the development of innovation cooperation with other firms as well as R&D cooperation with universities at the local (city) and regional (voivodship) levels. The size of company did not change the perception of what level of physical proximity is the most beneficial.

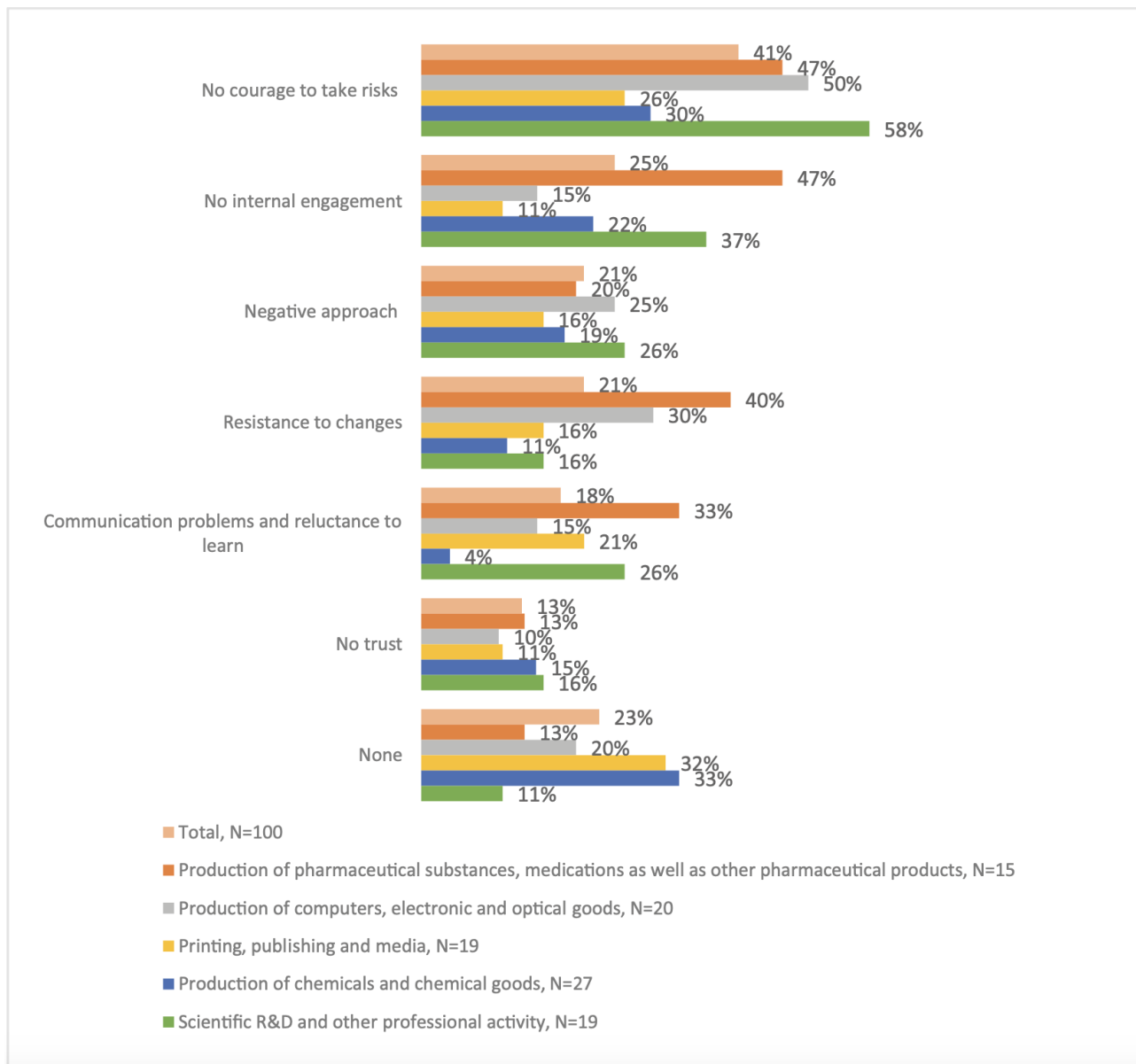
The surveyed company representatives believe that the lack of courage in taking risks is a personality trait that significantly limits the process of innovative cooperation. This was especially true of the following categories: “scientific R&D and other professional activity” (58%), “production of computers, electronic and optical goods” (50%), and “production of pharmaceutical substances, medications, and other pharmaceutical products” (47%), as presented in (Figure 5).



**Figure 5. Personality traits hindering innovative cooperation**

Source: Runiewicz-Wardyn, 2022.

The survey shows that the dominant factor negatively affecting the process of innovation cooperation is a lack of courage in taking risks. This was especially relevant for “scientific R&D and other professional activity” (58%); “production of computers, electronic and optical goods” (50%); and “production of pharmaceutical substances, medications, and other pharmaceutical products” (47%). Further details are presented in (Figure 6).



**Figure 6. Personality traits hindering innovative cooperation (split by sector)**

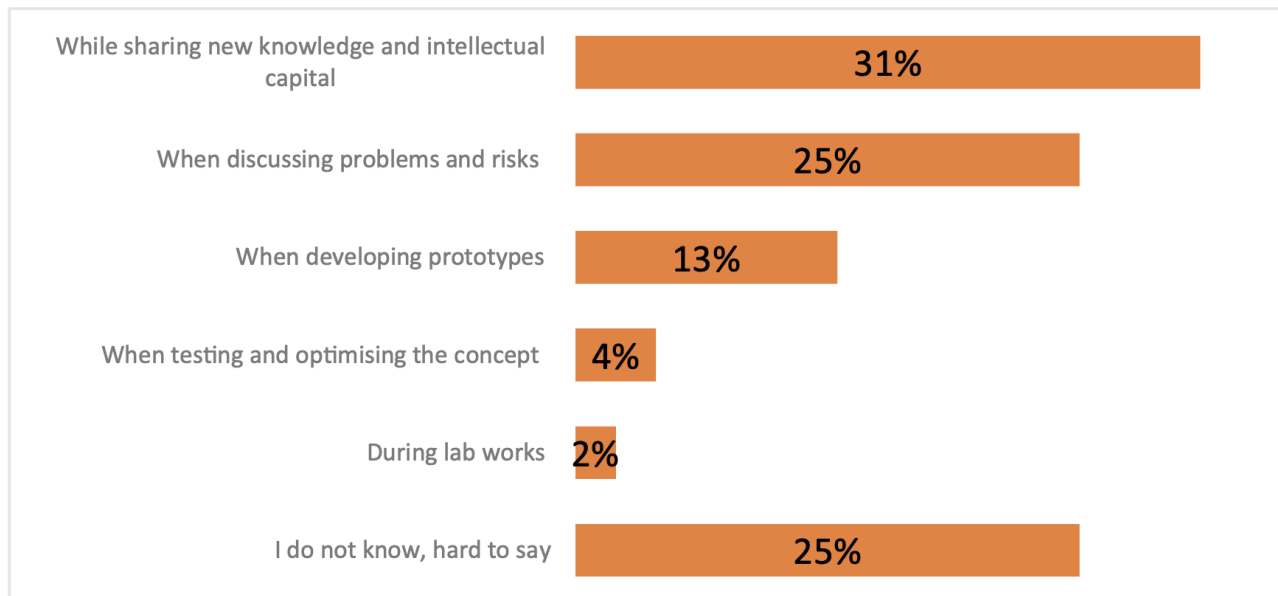
Source: Runiewicz-Wardyn, 2022.

A resistance to changes and negative attitude are more frequently identified by larger companies. Meanwhile, the lack of internal involvement and resistance to changes are particularly frequent in the pharmaceutical industry, at 47% and 40% respectively.

### **Role of trust in open innovation collaboration**

According to all the surveyed company representatives, it is hardest to trust partners when sharing new knowledge and intellectual capital. Given the size of the enterprises, there is no appreciable difference between small and medium-sized enterprises in terms of the difficulties posed by a lack of trust. When asked about activities as part of the innovation process in which companies have the most difficulty trusting partners, the respondents referred to the following situations: when sharing new knowledge and intellectual capital (31% of those interviewed), when discussing problems and risks (25%), when developing prototypes (13%), when testing and improving

concepts (4%), and when performing laboratory work (2%). At the same time, 25% of the respondents said they did not know which activities were associated with a significant problem of trust (Figure 7).



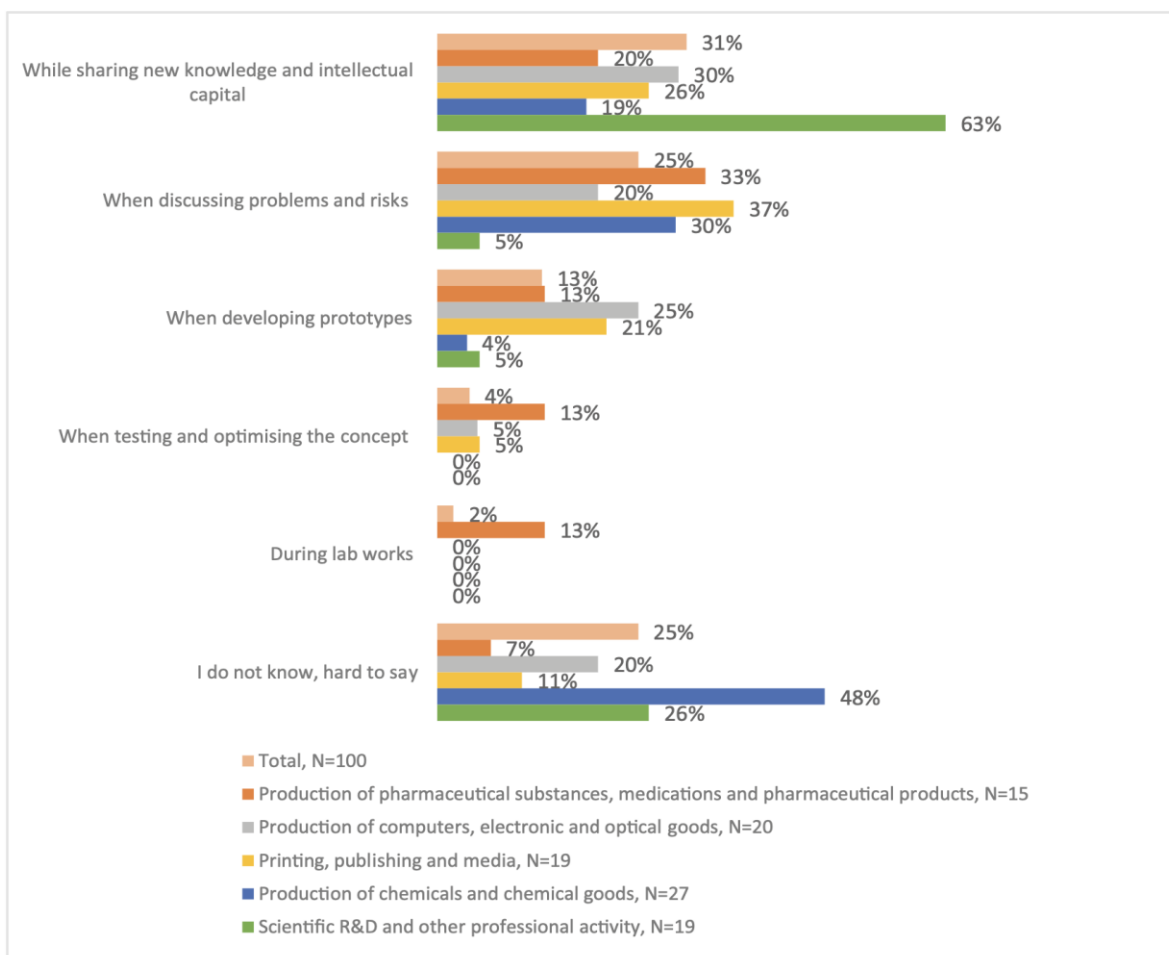
**Figure 7. Activities in which partners are most difficult to trust**

Source: Runiewicz-Wardyn, 2022.

The results vary from one industry to another. Nearly 63% of respondents representing “scientific R&D activity” and “other professional, scientific, and technical activities” declared they had difficulty trusting their partners when sharing new knowledge and intellectual capital (Figure 8). This is significantly more than in the case of companies active in the “manufacturing of computers, electronic and optical goods” (30%); “publishing, printing and media services” (26%); “manufacturing of basic pharmaceutical substances and other pharmaceutical products” (20%); and “chemical industry and production of chemical products” (19%). This result is not surprising since all professional, scientific, and technical activities are becoming increasingly financed by the private sector, in which specialised knowledge is a key factor of success. Therefore, the fear of leakage of knowledge or losing power when sharing research knowledge is very high. The results for the “manufacturing of computers, electronic and optical goods” sector in Poland also reveal a similar type of fear. Yet, it is important to note that when joining the EU Poland adopted the bloc’s *acquis communautaire*, including international standards and regulations ensuring robust protection of IP rights.

New knowledge and intellectual capital sharing is an especially competitive asset in creative industries such as “publishing, printing and media services, computer consultancy, and other activity,” which, alongside R&D, invest a lot in computer hardware and software, and licenses for technology, in order to improve their profitability and the quality of goods and services. This group of respondents in our survey was the most concerned about trust in sharing new knowledge (26%), discussing the risk and problems with partners (37%), and working on prototypes (21%). Another activity in which partners found it difficult to trust one another is “problem discussion and risk sharing.” This was especially true of the “manufacturing of basic pharmaceutical substances and other pharmaceutical products” (33% of those interviewed) and “chemical industry and production of chemical products” (30%). In the pharmaceutical industry, collaborative innovation partnerships involve many entities, such as big corporations, small biotechnology firms, academia, hospital, and clinics. They work together while contributing their unique abilities and maintaining their individual interests. Hence the risk that problem solving may be slowed down by fundamental differences among partners, such as the size and scope of their business activity and processes, the company’s mission, and organisational culture, which increase potential misunderstandings and miscommunication between partners.





**Figure 8. Activities in which partners are the most difficult to trust (breakdown by industry)**

Source: Runiewicz-Wardyn, 2022.

To sum up, the frequent model of conducting innovative activities in the high-tech and knowledge-intensive SMEs was based on internal activities (about two-thirds of the surveyed companies). About a fifth of the surveyed companies used a mixed model, which combined both internal and external activities. The models exclusively based on external activities were rare (for complete study see Runiewicz-Wardyn, 2022).

### Final conclusion and policy implications

Poland's remarkable economic performance in the past few decades strongly relied on competitive labour costs in low- to medium-tech industries. The country has now reached a stage of economic development where efficiency gains and sustainability are more difficult to achieve. The transformation toward high-tech and knowledge-intensive sectors is one of the most important challenges for Polish SMEs in the long term. The open innovation model is one way to enable this process. By applying the open innovation model, SMEs can compensate for their lack of internal R&D resources and competencies, and thus accelerate their internal innovation process and technological catching-up. Yet the study has demonstrated that knowledge about open innovation among SME executives is insufficient. It was explicitly mentioned by only some of the interviewed executives. Additionally, their lack of cooperation was made evident by an analysis of the results of the surveys. Moreover, several bottlenecks slow down Polish SMEs in the effective implementation of the open innovation strategies. These include a lack of resources and skills to develop an open innovation culture; institutional, social, and cultural distances resulting from a large number of diversified players involved in collaborative participation, especially from academia and business; and a low level of trust between cooperating stakeholders,

which in turn stems from a low level of trust in society as a whole. Specific action is needed to increase the efficiency of innovation policies in moderating technological dynamics and stimulating innovation processes in the Polish high-tech sector. Examples of possible measures include breaking the “barrier” of knowledge about open innovation by developing appropriate guidelines and offering consultancy services; setting up clear IP patterns that will consider the needs of all the partners; and putting in place well-established procedures and mutual benefit assessment tools to foster open innovation collaboration. This would help all the partners perceive open innovation as a win-win game and ensure more effective communication in developing an open innovation environment in Polish SMEs. Additionally, clusters should be analysed in terms of geographical proximity as well as institutional and social cohesion. Also, innovation policy should be geared toward building the innovative capacity of enterprises, which is fuelled by the absorption of externally generated R&D. Moreover, innovation policy must consider the nature, dynamics, specific needs and challenges of each industry and its SME environment. Public and other non-profit institutions should be more active in brokering, encouraging and reinforcing such innovation collaboration at the local, regional and global levels. Finally, innovation policies should focus on eliminating more general barriers to a collaborative environment and on investing in building social capital, social trust and an open innovative culture. Efforts to develop innovation skills should start already at the secondary school level. Building a knowledge-based economy requires the activation of society’s openness to the creation, adoption, and diffusion of innovations, as well as an educational system enabling the strengthening of social trust and creativity.

### Research limitations

We recognise that there were several limitations in our study. First, we explored open innovation, which is a relatively new concept. Moreover, the qualitative method applied in our study is based on a rather small and unequally distributed number of high- and medium-high-tech industry enterprises. The sample used in the study is not representative of the whole sector, but it is indicative of the challenges of industry as a whole. Nonetheless, those limitations should be treated as possible indications of new research paths into how Polish companies understand and interpret the open innovation process.

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