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THE POSSIBILITY OF OVERCOMING BARRIERS IN INTERNATIONAL COOPERATION IN THE AREA OF R&D FROM THE POINT OF VIEW OF A RESEARCH UNIT, BASED ON THE EXAMPLE OF THE INSTITUTE OF AVIATION

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Summary

The article presents the possibilities of overcoming barriers in international cooperation from the point of view of a research unit. The goal of the article is the presentation of good management practices in international cooperation in the area of R&D between the Institute of Aviation and General Electric, which reduce the level of uncertainty of cooperation. In the text the results of quantitative research concerning barriers for technological cooperation between Polish entities and foreign partners were used. Case study analysis revealed the possibility of reducing these barriers. Data for the case study were collected in interviews with the managers of both the Polish and the American partner. Partner cooperation between organizations brings mutual benefits and motivates the partners to pursue further development of cooperation and reduces the transaction costs resulting from cooperation in a sensitive area. Both organizations have worked out a series of good practices of international cooperation in the area of R&D, which can be used for overcoming barriers in establishing international R&D cooperation by Polish companies.

Key words: international cooperation, barriers for cooperation, R&D cooperation, high-tech, research institute

Introduction

Since the 1970's we have observed the phenomenon of intensification of international cooperation between companies with a particular focus on joint conduct of R&D works. Globalization of the activity of companies, the easiness of obtaining information and common access to knowledge are the direct reason for the short duration of developed competitive advantages and substantially raise the costs of company's functioning (D'Aveni and Gunther 1995). These factors lead to a situation in which starting international cooperation (including also R&D cooperation) is becoming an integral part of the strategy of many organizations (Hong and Park 2015, Ricciardi 2014). Cooperation in the area of R&D makes it possible to minimize the risk of failure of investments in material and non-material resources necessary for the development and implementation of innovative products. Cooperation makes it possible to work out a company's competitive advantages faster and at a lower cost (Porter 1985, p. 57). It brings undeniable benefits, however, companies encounter barriers in international cooperation related to small experience in international cooperation and worries associated with contacts with a foreign partner. The goal of the article is presentation of the possibilities of overcoming barriers in international cooperation from the point of view of a research unit. The case study was presented on the example of cooperation between General Electric and the Institute of Aviation. Data for the case study were collected by means of interviews with the employees of the Institute of Aviation and the representatives of the management of General Electric and the Institute of Aviation.

Essence of cooperation — an overview of literature

The issue of cooperation between organizations is discussed in many theoretical concepts explaining the mechanisms of cooperation between companies. Among the most significant concepts there is the game theory, transaction cost theory and resource theory.

The game theory describes cooperation between organizations as a non-cooperative game (prisoner's dilemma) between two, or a greater

number of players (companies) (Parkhe, 1993; Axelrod, 1984; Yi et al., 2005; Mayberry, et al. 1992). Players cooperate when they can predict the moves, reactions of the remaining players and the duration of the game (long-lasting game provides stronger motivation for cooperation) (Cho, 2014, Axelrod, 1984, p. 126). An example of a predictable and transparent strategy for players is tit for tat. It involves starting a game from cooperation (that's why it is called polite strategy) and imitating in the subsequent rounds the behaviour of the opponent from the previous round (Dixit and Nalebuff, 2009, p. 96), tit for tat discourages players from behaving in an opportunistic way (in the long-term horizon such behaviours don't bring a victory) and it can be easily identified by the players (Thomson, 2003). With a prospect of long-term cooperation players analyze their moves and optimize benefits from the short-term and long-term view (Camera and Casari, 2009). At the moment when further moves of the players become more and more significant and have a greater and greater impact on the achieved benefits (payout), cooperating companies display greater inclination towards cooperation. Another factor is the structure of payouts which has to clearly encourage players to cooperate (Rapoport, 1988), as well as an efficient system of penalties securing the inevitability of sanctions and limiting opportunistic behaviours (Wang and Yang, 2003).

The theory of transaction costs defines market transactions as transactions based on contracts burdened with the costs associated with the necessity to understand and master the existing market situations and convincing the partner, putting at the other end of the scale hierarchical structures based on authority and burdened by bureaucratic costs (Williamson, 1991), costs of uncertainty and the costs of measurement and coordination associated with the uncertainty and complexity of the environment (Hindmoor, 1998; Thompson, 2003).

Cooperation is an intermediate form between market transactions and hierarchical structures, which makes it possible to avoid failures associated with each of them (Ring and Van de Ven, 1989).

Cooperation also enables the possibility of achieving both common and individual goals (Lui and Ngo, 2005; King, 2017). Organizations which decide to start expansion to foreign markets (especially those where investment risk is elevated) are eager to start cooperation with

partners operating in the target country. Such cooperation makes it possible to reduce the general costs of entering foreign markets and development on a given market, it also allows achieving benefits resulting from the effect and coverage (Buckley and Casson, 1976, p: 33; Witek-Hajduk, 2014, p. 79–92).

According to the resource concept, cooperation between companies is a necessary condition for development and efficient competition (Medcof, 2001). Due to high complexity of the environment, companies more and more often are unable to generate, or acquire resources allowing them to work out a durable competitive advantage (Henderson and Cockburn, 1994; Chesapeake, 1996; Boultellier et al., 2000). In R&D cooperation it is important to protect the possessed information and obtain new sources of knowledge. Establishing cooperation makes it possible for companies to gain access to complementary resources, both material and non-material resources, as well as to jointly create new resources allowing them to achieve common, durable competitive advantage (Dyer and Singh, 1998; Dyer, 2000, p.23–39). The resource concept emphasizes the significance of cooperative relationships between organizations, which make it possible to raise the innovativeness of a company (Danneels, 2002) through the creation of open innovation. Open Innovation means raising the competitiveness of a company through learning and the development of competences of an organization (Ireland et al., 2002; Lavie, 2006) as well as acquisition of knowledge and using it in the organization (Cohen and Levinthal, 1990).

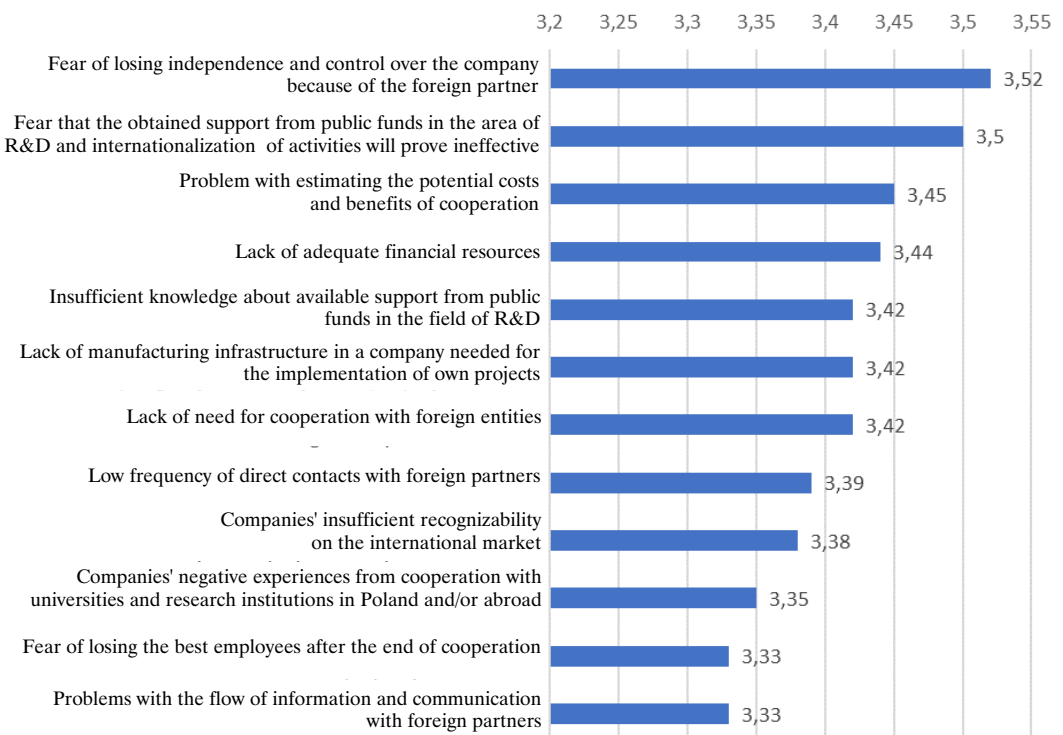
International cooperation and the ongoing processes of globalization have an impact on the shape of cooperation in the area of R&D. International organizations, which focus on the development of innovativeness more and more often establish cooperation with universities and research units for the purpose of optimization of costs and access to complementary material and non-material resources in order to work out a durable competitive advantage (Barta G. et al., 2011).

The essence and barriers of R&D cooperation

The current technological development of information technologies (Schaeffer, 2017) enables almost immediate access to information, which

substantially facilitates establishing cooperation and makes it possible to substantially shorten the process of internationalization. Companies starting their operations right now establish successful international cooperation in a very short time after starting to operate (born globals) (Rennie, 1993), working out competitive advantages by means of their relationships, taking advantage of complementary material and non-material resources within the framework of established alliances (Ditrich and Duysters, 2007). Fast and common access to information means that the time of development and implementation of an innovative product more and more often becomes a key factor which determines success on the market. Companies motivated by the pressure of the market are thus even more eager to establish cooperation in the area of R&D reducing the risk associated with R&D works this way and minimizing investments in material and non-material resources (Dicken, 1992, Mc Gahan, 2004, Franke and Piller, 2004).

Figure 1. Ranking of barriers hampering international cooperation in the area of R&D (Cygler, J., Wyka, S., 2019)



Despite the benefits achieved by entities establishing international cooperation in the area of R&D, organizations point to the existence of barriers which make establishing such cooperation hard, or even impossible. These barriers are usually associated with social and cultural aspects (Bufon et al. 2014 p.7; Wróblewski 2015), lack of awareness of cultural differences (resulting most often from the lack of experience from previous cooperation with foreign partners) (Barkema et al. 1996, Gestland 2012, Fandrejewska and Wasilik 2018). Surveys carried out by the Polish Economic Institute on a sample of 400 Polish companies from the high-tech sector point to the existence of barriers which counteract establishing international cooperation by companies. The ranking of barriers is shown in Figure 1.

R&D cooperation on the basis of the example of General Electric and the Institute of Aviation

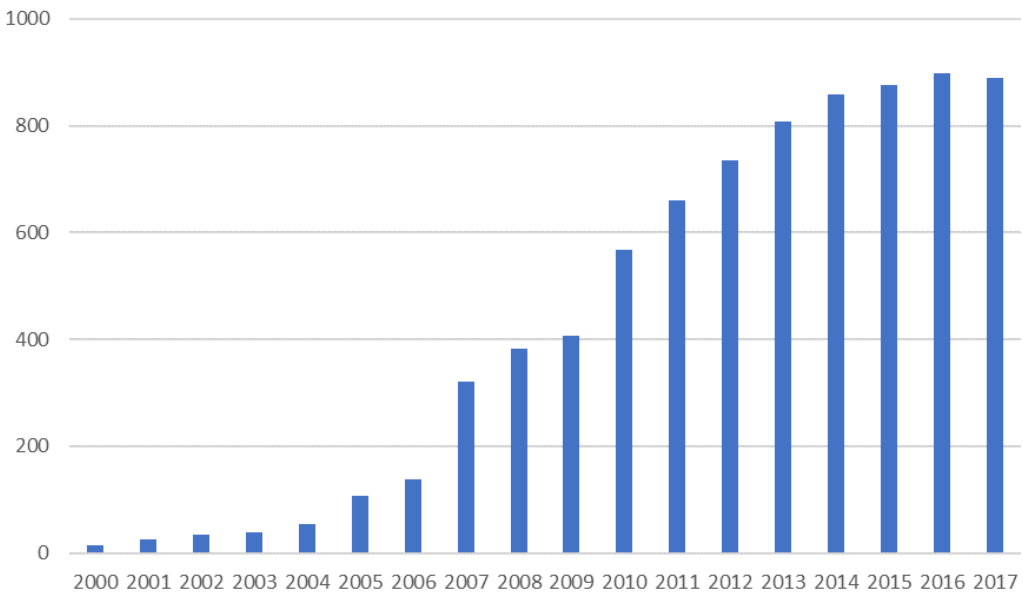
The beginning of cooperation between the Institute of Aviation (ILOT) and General Electric Co. (GE) dates back to the year 2000, that is, the moment when an agreement was signed by the two sides. On the basis of the agreement organizational unit called Engineering Design Center (EDC) was formed. It is a non-capital alliance in its character and the logic behind its formation is transactional (complementary). The agreement on cooperation was signed for five years and it is cyclically renewed taking into consideration the formation of the scope of cooperation resulting from the research needs of the partners.

The cooperation concerns above all research and engineering works with particular attention devoted to working out and development of the most advanced technologies in the world, which are subject to confidentiality of cooperation. What sharing the effects of this cooperation involves is that the American partner co-finances the infrastructure necessary for carrying out the research works conducted by the employees of EDC, which becomes the property of the Institute of Aviation. ILOT is allowed to (within a limited scope) use the skills, knowledge and competences of its employees working at EDC for the implementation of other projects. At the same time GE derives benefits from intellectual property rights generated as a result of joint works.

The cooperation of ILOT and GE has turned out to be exceptionally advantageous for both sides in the financial dimension. The commercial value of implementations carried out by the Institute of Aviation for all clients in the years 2013–2016 exceeded PLN600m.

EDC unit initially, in 2000, had 20 employees and now it has 889. In EDC there are engineers and scientists who are employed at appropriate proportions by ILOT and GE (Figure 2). Also, the scope of cooperation has been expanded in a substantial way taking into consideration the branch and geographical dimension.

Figure 2. Number of employees at EDC in 2000–2017



In the first years of its operation EDC supported the development and handling the maintenance of systems of aircraft engine components, cooperating closely with the business of GE Aviation. Developing cooperation with the American partner, confirming the competences of the team of engineers located in Poland led to the expansion of the project portfolio and to cooperation in the area of designing composite and metal elements of aircraft structures and

engine gondolas from 2005. High competences of engineers working at EDC and the possibility of developing laboratory facilities led GE to the decision to locate in Poland a team of engineers cooperating with the businesses of GE Power and GE Oil and Gas. The teams formed in 2007 started cooperation in the area of design and development of gas turbines, as well as integrated solutions for the transport and mining of oil and gas. Cooperation with GE Oil and Gas led to the launch of HPT laboratory in 2010. The team working for GE Power due to growing scope of responsibility was divided in 2013 into two sections: Distributed Power and Power Generation Engineering. In the following year the newly formed team GE Energy Connections was added to the energy sector. The team's work is focused on projects concerning transmission, distribution and conversion of electric power. In 2016 the business of Aviation Systems was divided into Aviation Systems Mechanical, which continued the development of projects concerning aircraft structures, engine gondolas and propeller systems and Avionics & Digital Solutions, which is focused on research, tests and validation of software and systems of steering aircraft engines, landing gear and flight control surfaces. In the same year cooperation started at an earlier point in time with GE Transportation led to the creation of another business operating within EDC. In 2017 teams carrying out projects for the businesses of GE Additive developing incremental technologies of generation and GE Renewable Energy developing projects of marine wind turbines in cooperation with teams from Germany, Spain, France and Holland appeared in the structure of EDC.

In the geographical dimension it is necessary to emphasize that initially in the alliance of ILOT and GE smaller projects were carried out. Over time EDC employees became active members of technological projects with an international reach (mainly with the United States) and later global projects were carried out. As a result of works conducted in international teams EDC employees had a chance to obtain and develop competences (technical and management competences), which have become competitive on a global scale. The skills of the employees of ILOT were recognized, as EDC was awarded responsibility for the development of complete products (gas turbines, oil extraction installations, aircraft engines), or their parts (aircraft

engines, aircraft structures). At the same time employees from ILOT got engaged in ever more complex projects. Currently, projects carried out at ILOT belong to the most advanced projects in the world in the area of technologies and ways of working on them (Industry 4.0). Less complex works are allocated to other research centres in the world.

Cooperation of the Institute of Aviation should be recognized as a huge success of both sides and be treated as a game with a non-zero, positive result. The fact that both organizations display a very strong will of cooperation brings big benefits in the long-term perspective. This success is based on very good, direct relationship between the sides and on significant engagement of employees on all levels of management. Relations between ILOT and GE are based on mutuality, transparency of rules of cooperation, openness of contacts. The practice of a weekly meeting of the director of ILOT and the president of GE Polska for the purpose of discussing all conducted projects and plans for the future was introduced as a kind of a ritual. What plays an important role are jointly conducted development projects strengthening contacts between employees at lower ranks of the organization. The representatives of GE eagerly participate in the changes carried out in the Institute of Aviation, share their own experiences, in fact, they play the function of an agent of change.

These changes are carried out both in the area of organizational structures, processes of management, organizational culture, as well as creation and implementation of the strategy of development of the institute.

In course of cooperation also an exchange of employees takes place. Educated managers with rich international experience can move from EDC to managerial positions in the Institute of Aviation. At the same time, scientific employees can also move to EDC and develop their competences in international projects. Additionally, ILOT employees (including EDC) can develop their skills and qualifications through trainings, studies, doctoral theses prepared in Poland and abroad (e.g. Ohio State University). In case of employees working for GE, such opportunities for development at the Institute of Aviation are also available. They only need to get a consent from their employer. Thanks to cooperation the Institute has young (average age is 36) and very well

educated engineers and scientists. The Institute currently has about 1,500 employees. Their high motivation, passion and engagement, very good technical, social and financial conditions of work make the Institute of Aviation exceptionally competitive on the international market of scientific research. Thanks to this the Institute can afford to acquire talented engineers and scientific employees from whole Poland. Even though young employees often take advantage of the possibility of working in international teams, they don't display the will to leave the Institute of Aviation. They connect the future of their professional career with ILOT.

The cooperation of ILOT and GE leads to major growth of credibility of the Polish organization on the international market, which brings tangible benefits in form of orders for research from practically the whole world. The Institute of Aviation has become recognizable on the international arena not just in its flagship sectors (aviation, aeronautics), but also in other branches in which it cooperates with GE.

It is also worth emphasizing the restructuring-related value of cooperation with the American partner. ILOT has transformed into a modern, strong research institute, which derives good practices in the area of the management system not just from GE, but also from other local and foreign partners. It has retained its scientific character, but in a modern edition.

Relations between ILOT and GE formed this way have led to a situation in which the cooperation setting is a stable and transparent one. Both sides are vitally interested in mutual development. Due to the form of cooperation (non-capital), the sides are not afraid of losing their independence, even though we are looking at an asymmetrical alliance taking into consideration the size of the partners (in terms of the level of employment and annual revenues).

Taking into consideration the relations of engagement to benefits derived by the two sides — Polish and American — it is necessary to take into consideration both direct and indirect benefits. Thanks to cooperation with GE ILOT gains major revenues not just for works carried out for the ally, but also has facilitated access to clients and projects practically around the whole world. Also, thanks to international cooperation, scientific exchange is easier (cooperation

with OSU, NIAS, NASA). Thus, it is possible to conclude that the relationship is a partnership in its character (Cygler 2002).

It is necessary to admit that initially the cooperation was financed to a greater degree by the American side. Such an approach made it possible to launch cooperation and develop relations between ILOT and GE in the following years. Transactional approach to the creation of cooperation and in particular high complementarity of combined resources, as well as geographical proximity of GE Polska and ILOT mean that transactional costs of cooperation are substantially reduced (high level of trust reduces opportunistic behaviours and the costs of control, coordination and submissiveness). Long duration of cooperation (shadow of the future) encourages the Polish and the American side to support each other and to keep their activities transparent (tit for tat).

Conclusions

Taking into consideration the barriers in international cooperation for Polish entities in the area of R&D, it is necessary to point out that the model of cooperation adopted by ILOT and GE efficiently reduces the above-mentioned limitations. In course of cooperation both ILOT and GE have worked out good practices of international cooperation within the R&D area, which can be useful for other Polish organizations planning, or already carrying out similar projects. The utilization of the experiences of the Institute of Aviation can thus verify the assessment of barriers in international cooperation in the area of R&D with Polish participation, or may help work out mechanisms reducing the transactional costs of cooperation. As a result, this will make it possible to raise the activity of Polish companies and research units in international cooperation in the area of R&D.

It is necessary to remember that a case study as a research method is burdened by certain limitations. Above all, the results of the study cannot serve as a basis for their synthesis, especially that cooperation between ILOT and GE belongs to rare, in terms of scale and coverage, cases of international cooperation in the R&D area in Poland.

Nevertheless, thanks to the possibilities of analyzing the cause and effect phenomena within cooperation described in the case study, we can observe the creation and functioning of management mechanisms limiting barriers (described in Figure 1).

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Recently he is interested in the subject of cooperation between science and business entities with special focus on entry barriers for such cooperation.



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