R&D Cooperation with External Partners and Implementing Open Innovation

Daria Podmetina[1], Maria Smirnova[2]

[1]School of Industrial Engineering and Management, Lappeenranta University of Technology, Lappeenranta, Finland

daria.podmetina@lut.fi

[2] Graduate School of Management, Saint-Petersburg State University, Saint-Petersburg, Russia

smirnova@gsom.pu.ru

Abstract. This paper addresses the role of R&D cooperation with external partners in companies implementing inbound and outbound open innovation. The results of the survey of 206 companies show that the cooperation with external partners is different in companies implementing inbound, outbound, and coupled open innovation compared to closed companies oriented towards internal R&D. Increased importance, success, and intensity of cooperation with external partners are observed for companies with internal R&D and inbound, outbound, and coupled open innovation compared to other firms. The more a company implements open innovation, the higher the intensity, importance, and success of cooperation with external partners are. The importance and success of cooperation with domestic partners is higher than for cooperation with foreign partners for all types of companies.

Keywords: R&D, open innovation, innovation strategy, cooperation, external partners, Russia.

1 Introduction

The role of cooperation in research and development (R&D) in the global and turbulent business environment cannot be underestimated. Companies build links and cooperate in R&D with their stakeholders, such as customers, suppliers, competitors, and public institutions (Enkel and Gassmann, 2008, Smirnova et al., 2009). Many studies show that external links and cooperation increase a company's innovation capability and have a positive effect on innovation output (Bayona et al., 2001; Kaufmann and Tödtling 2001; Klomp and van Leeuwen, 2001; Hagedoorn, 2002; Loof and Heshmati, 2002; Romijn and Albaladejo, 2002; Belderbos et al. 2004; Vivero, 2004; Veugelers and Cassiman, 2005; Lundvall et al., 2002). Better cooperation skills increase companies' innovativeness, and ability to utilize external knowledge, which results in better innovation performance (Cohen and Levinthal, 1990).

The role of the collaborative approach to innovation has significantly increased in the open innovation era (Enkel et al., 2010), resulting in the growing importance of innovation networks (Dittrich and Duysters, 2007; Chesbrough and Prencipe, 2008, Torkkeli et al., 2008). However, the open innovation framework still lacks empirical

ISSN 2183-0606
http://www.open-jim.org

evidence of what the best way is to utilize this concept (Enkel et al, 2010) and how important cooperation with external partners is within this framework.

This paper addresses R&D cooperation within the open innovation framework. The authors apply the classification proposed by Gassman and Enkel (2004), to define three core processes within the open innovation framework: 1) the outside-in process (inbound open innovation) – searching for and incorporating the external knowledge of suppliers, customers, competitors, universities, and research organizations; 2) the inside–out process (outbound open innovation) – transferring the surplus ideas, technologies, and intellectual property to the market; 3) coupled open innovation – a combination of the outside-in and inside-out processes.

This paper studies the role of R&D cooperation with external stakeholders when implementing open innovation in practice. The focus is on the type, importance, and success of R&D cooperation. The main research question is *"Is there a difference in the external R&D cooperation in companies implementing and not implementing open innovation?"* and is followed by these sub-questions:

1. *How are the intensity and success of external R&D cooperation different for companies without open innovation and for companies implementing inbound, outbound, or coupled open innovation?*
2. *What is role of the different types of cooperating partners for inbound, outbound, and coupled open innovation?*
3. *Is there a difference in cooperation with various types of domestic and foreign partners?*

The authors suggest that the differences in companies' intensity and success of cooperation in R&D mainly come from the differences in the degree of innovation strategy openness (adopting none, inbound, outbound, or coupled open innovation) and the proximity of the partner (local or international).

The paper is structured as follows: part 1 introduces the research topic and sets the research questions. Part 2 reviews the literature on open innovation and R&D cooperation and formulates the hypotheses. Part 3 describes the research design, data collection process, and measurement. Part 4 presents key results of the study, part 5 discusses the results, and part 6 concludes.

2 Cooperation in R&D and Implementing Open Innovation

2.1 From a Traditional to an Open Approach to Innovation

Previously, companies had to control all stages of the innovation process themselves and thus most of the R&D was conducted internally (in-house R&D) (Wheelwright and Clark, 1992). Not only R&D, but new product development (NPD), technology innovations, and the commercialization of new products and technologies were conducted within the company. This approach is nowadays referred as the *traditional or closed approach* to innovations.

Since the beginning of the 1990s, the world economy has entered new era, when uncertainty and the globalization process have intensified, and market and

environmental turbulence have increased (Kotler and Caslione, 2009), thus companies have faced higher risks and have become more exposed to domestic and international competition. Due to the degree of turbulence, increased competition, and newly emerged technology opportunities, companies have intensified the use of knowledge, both internal and external (Cohen and Levinthal, 1990; Klevorick et al., 1995).

It has become obvious that the traditional approach to innovation and R&D does not fit this changed environment. Thus, companies have started a transition towards a new, more *open approach to innovations*.

When Chesbrough (2003) launched the term "open innovation", it was a very appropriate time to describe the latest transformation processes in the field of innovations. Nowadays, the open approach has become essential for many companies' innovation practices in terms of an organized search for new ideas (Laursen and Salter, 2006), achieving better use of their internal R&D, and more effective commercialization, combined with decreasing costs and reducing the time to the market (Christensen, 1997).

Chesbrough (2003) introduced several factors that influenced the beginning of the open innovation era: 1) access to the best available knowledge sources, improved both inside and outside the company because of the increase in the educated labor force available; 2) an increased number of possible sources of financing for R&D projects; 3) companies started to cooperate more, search for ideas and technology outside, and incorporate them into innovation policy.

As mentioned in the introduction, open innovation can be classifies into an outside-in process (inbound), an inside–out process (outbound), and coupled open innovation – a combination of the outside-in and inside-out processes (Gassman and Enkel, 2004). In their later work, Enkel and coauthors (2010) also raise a question of finding the optimal ratio between introducing open innovation practices and investing in traditional innovations (Enkel et al., 2010).

In this study, we analyze firms with a traditional approach to innovation, utilizing the assumptions of Cohen and Levinthal (1990), Wheelwright and Clark (1992), and Klevorick et al. (1995), and we group firms with an open approach to innovation following the Gassman and Enkel (2004) classification of the open innovation process.

2.2 R&D Cooperation and Internal R&D

There have been multiple studies on a collaborative approach to innovations (Freytag, 2002; Andrew et Al., 2006; Blomqvist and Levy, 2006, Miles et al., 2004; Johnsen and Ford, 2000; Ford and Johnsen, 2001, Hakansson and Eriksson, 1993). Collaborative innovations are an addition to companies' in-house R&D and outsourcing (Baglieri and Zamboni, 2005) and create additional value within the partner relationship (Walter et Al., 2001, Smith and Blanck, 2002).

The motives for R&D cooperation depend on the type of partner (Tether, 2002, Belderbos et al., 2004). Some firms cooperate in order to extend their internal R&D expertise (Cassiman and Veugelers, 2002), others because of a lack or not of sufficient internal R&D (Keupp and Gassmann, 2009).

Cooperation in R&D may occur on different levels: strategic (partner selection and management), executive (teams and processes), or infrastructural level (Deck and Strom, 2002).

Independent from the level of cooperation, firms need to develop specific organizational competencies and *cooperation capabilities* to develop and manage partnership (Dyer and Singh, 1998), and integrate skills and tacit knowledge with external partners. Companies with a greater cooperation capability can have access to a larger range of technologies and can better manage their R&D resources (Torkkeli et al., 2009).

The intensified cooperation in innovations in the last decades indicates the lack of companies' internal resources and capabilities to satisfy the need for innovations and R&D (Hagedoorn, 2002; De Propris, 2002). As we do not have enough theoretical and empirical evidence on R&D cooperation of companies without internal R&D expertise (a form of outsourcing), and rely on evidence of Baglieri and Zamboni (2005) and Cassiman and Veugelers (2002) mentioned earlier, we assume that companies with internal R&D will cooperate with external partners on R&D more intensively then companies without their own R&D. More than that, we expect to get empirical proof that companies with internal R&D value their partners more and that R&D cooperation for these firms is more successful than for firms without R&D. Thus, our first hypothesis can be formulated as follow:

> *Hypothesis 1: Companies with internal R&D expertise will cooperate with external partners on R&D more intensively and more successfully than companies without internal R&D. Moreover, the external cooperation will be more important for firms with internal R&D than for those without.*

2.3 R&D Cooperation with External Partners

Companies can cooperate on R&D with different partners: suppliers (Hakansson and Eriksson, 1993), competitors (Clark and Fujimoto, 1991), customers (von Hippel, 1988), and research organizations (Gemünden et al., 1996). It is believed that the key sources for cooperative innovations are often lead users, suppliers, or universities (von Hippel, 1988). Companies can also use various channels (suppliers, users, universities) when they search for innovation opportunities (Laursen and Salter, 2006).

The issue of partner selection has been addressed in previous studies, such as the framework for predicting the efficiency of R&D cooperation with different partners proposed by Miotti and Sachwald (2003); or the effect of technology level in partner selection found by Faria et al. (2010).

For cooperative companies, external partners can be classified as core and fringe (additional) (Hart and Sharma, 2004), vertically forward or vertically backward, and horizontal or diagonal (von der Heidt, 2008). The role of core and fringe partners will be quite different for cooperating companies (Hart and Sharma, 2004), obviously core partners will contribute more to R&D, and cooperation with them will be more successful. Following this logic, our second hypothesis is formulated:

Hypothesis 2: The range of core partners and intensity of cooperation will be different for companies with internal R&D only compared to companies with a more diversified innovation strategy such as open innovation.

Companies can cooperate on R&D domestically or with foreign partners. Some studies underline the difference in R&D cooperation with foreign partners (Faria and Schmidt, 2007), when the attitude to knowledge sharing is different in different organizational cultures (Boisot, 1986).

In the case of Russia, we found that companies cooperate more easily with domestic partners due to having the same culture and language (Podmetina et al., 2009, Smirnova et al., 2009). Based on our previous research findings, we set our third hypothesis as follow:

Hypothesis 3: Cooperation with external domestic partners will be more intensive, more successful, and more important for companies than cooperation with foreign partners

2.4 R&D Cooperation and Open Innovation

Companies started to cooperate more, search for ideas and technology outside, and incorporate them into innovation policy, which was one of the factors influencing the beginning of the open innovation era (Chesbrough, 2003).

Customer value increases when companies exploit new ideas and develop new products and technologies both themselves (internally) (Wheelwright and Clark, 1992) and in cooperation with partners (suppliers, clients, or competitors) (inter-firm). The cooperation gives an opportunity to access knowledge and technologies and thus increase the innovativeness of the company, and decrease costs and risks (Faria and Schmidt, 2007).

Thus, cooperation is positioned as the cornerstone of the open innovation concept (Chesbrough, 2006), which implies a high degree of cooperation with partners such as other companies in the industry, suppliers, and clients (Chesbrough, 2003). Both the number of cooperative partners and the quality of cooperation matter for the success of introducing the open innovation principles (Kock and Torkkeli, 2008).

Based on our previous studies (Podmetina et al., 2011, Smirnova et al., 2012), Russian companies with internal R&D and R&D cooperation seem to be more eager to expand their innovation strategy for inbound and outbound open innovation. The other results of our previous research (Podmetina et al., 2009, 2011, Smirnova et al., 2009, 2012) also indicated that the role of external partners for the firms following a cooperative R&D and NPD approach is greater – they depend more on "core" stakeholders. At the same time, for the firms basing innovations on their own internal R&D, external partners can still be of vital importance.

Based on the principles of open innovation and our previous research of Russian innovative companies, we formulate the set of hypotheses related to differences in R&D cooperation in companies implementing inbound, outbound, and coupled open innovation (Hypotheses 4, 5, and 6):

Hypothesis 4: Companies with inbound open innovation will cooperate with external partners on R&D more intensively and more successfully than companies with internal R&D. Moreover, the external cooperation will be more important for firms with inbound open innovation than for those without.

Hypothesis 5: Companies with outbound open innovation will cooperate with external partners on R&D more intensively and more successfully than companies with inbound open innovation and companies with internal R&D. Moreover, the external cooperation will be more important for firms with outbound open innovation than for those without.

Hypothesis 6: Companies with coupled open innovation will cooperate with external partners on R&D more intensively and more successfully than other companies. Moreover, the external cooperation will be more important for firms with coupled open innovation than for those without.

3 Research Design

3.1 Sampling Strategy and Data Collection Process

The study is based on a stratified sample of 206 companies, collected in the nine most innovative regions of Russia (Saint Petersburg (29.1%), Nizhny Novgorod (13.6%), Rostov-on Don (9.7%), Saratov (5.3%), Samara (11.2%), Perm (3.9%), Yekaterinburg (14.6%), Novosibirsk (3.4%), and Krasnoyarsk (5.8%)). Top Russian innovative regions were selected by analyzing the data provided by the Russian Statistical Committee using the methodology of the European Innovative Scoreboard (2006). The strata were formed first by selecting only manufacturing companies with an annual turnover of more than 1 000 000 rubles (about 25 000 euros), then by applying a quota by industry – the share of companies from each industry is equivalent to the shares of these industries in the Russian GDP. Based on this sampling strategy, 1000 companies were pre-selected in the SPARK Russian Business Database. The response rate was about 20%, which provided us with 206 valid filled questionnaires.

The data collection method was personal structured interviews, due to the specific aims and the scale of the study. Interviews lasted from 2 to 4 hours. In Saint Petersburg and its region, the authors conducted the interviews, but in more distant regions, interviewing was outsourced to a professional statistics organization. In these cases, the authors conducted the selective control of the interview process and validation of the paper versions of the questionnaires by comparing them with the electronic ones.

The respondents were directors at different levels, leaders of R&D or innovation departments, and sometimes, sales and marketing directors. Due to the complexity of the questionnaire, it was sometimes necessary to interview several decision-makers in

the company, in order to increase the quality and reliability of the data. The empirical study was conducted during November 2009 – February 2010.

3.2 Questionnaire and Operationalization of Variables

This survey was done for a large-scale international project studying innovations in Russia. The structured questionnaire used for this survey was based on the OECD recommendations for conducting innovation surveys (Oslo manual, 2007) and the Community Innovation Survey (CIS) questionnaire. The questionnaire consisted of more than 100 questions, covering major aspects of the company's R&D, innovations, strategy, finances, cooperation, competition, international business, and so on. The scale of the survey is large, and this paper presents only small part of the research results.

The type of the questions used in this study was mainly dichotomous or a Likert scale from 1 to 5. We use variables related to cooperation on R&D with external partners: intensity of involvement, importance of cooperation, and success of cooperation (scales adopted from CIS Questionnaire, 2008). Importance and success of cooperation were tested only by respondents' answers. Success of cooperation means if companies perceive more efficient or less efficient cooperation with a certain partner.

The open innovation variables for representation of descriptive statistics and mean differences across opened and closed firms was operationalized as a dichotomous question of whether a company implemented or not inbound, outbound, and coupled open innovation (classification of Gassman and Enkel, 2004). The operationalization of the variables, questions, and sources of the scales are presented in Table 1.

3.3 Methodology of the Analysis

This study is an exploratory one aimed at analyzing the difference in cooperation with different external partners between closed and open companies. The size of the sample (N=206) increased the exploratory nature of the study. Due to the exploratory nature of the study, we use descriptive statistics and means analysis (Anova, T-Test). The sigma value is used in defining the significant difference ($p<0.05$).

3.4 Description of the Companies in the Sample

The data sample represented the high and medium technology companies: electronics and optics equipment (11.2%), electronic equipment (7.3%), rubber and plastic industry (3.9%), machine building (13.6%), chemical industry (10.2%), aviation (3.9%), IT and telecommunications (10.2%), metallurgy (17.5%), and others (16 %).

The share of companies conducting internal R&D was high: 78.6%. 100% of IT companies had internal R&D, 93.3% of electrical machinery firms, 91.3% in the electrical and optic industry, 87.5% in the rubber and plastic industry, 86.1% in metallurgy, 75% in aviation and in machinery and equipment, and 72.7% in the oil refinery industry. 86.4% of firms in the sample are new private companies found since 1991. The Soviet Union was dissolved in 1991 and the governmental companies' privatization process started.

Table 1. Operationalization of variables

Variables	Question	Description and Measurement
Internal R&D	Is your company implementing internal R&D?	A dichotomous question was used to measure whether the company conducts internal R&D. The scale was adopted from a CIS questionnaire (2008).
Inbound open innovation (InOI)	Does your company acquire external technologies, innovations, intellectual property, or patents? - no, sometimes, often	Constructed dichotomous variable. Dichotomous answers: "No" - not acquiring external technologies, "Yes" - acquiring sometimes, and acquiring often. Scale developed and validated in our previous survey in 2006 (Podmetina et al., 2009).
Outbound open innovation (OutOI)	Does your company sell the surplus of internally produced technologies, innovations, intellectual property, or patents? - no, sometimes, often	Constructed dichotomous variable. Dichotomous answers: "No" - not acquiring external technologies, "Yes" - acquiring sometimes, and acquiring often. Scale developed and validated in our previous survey in 2006 (Podmetina et al., 2009).
Coupled open innovation (COI)	Companies who implement both inbound and outbound open innovation.	Constructed dichotomous variable. Dichotomous answers: "No" – not implementing inbound and outbound open innovation, "Yes" - implementing inbound and outbound open innovation.
Involvement of external partners in the R&D process. List of partners*:	What external partners are involved in R&D processes? Dichotomous question for each type of partner.	A dichotomous question was used t o find out whether external partners were involved in the R&D process. The scale was adopted from CIS Questionnaire (2008).
Importance of R&D cooperation with external partners List of partners as before	How important is their participation for the success of R&D and innovations? 1 – less important, 5 – more important	The importance of cooperation with the external partners was estimated using a 5-point Likert scale from not important to absolutely important. The scale was adopted from CIS Questionnaire (2008).
Success of R&D cooperation with external partners List of partners: as before	How efficient is their involvement? 1 – inefficient, 5 – very efficient	Success of cooperation with the external partners was estimated using a 5-point Likert scale from inefficient to very efficient. The scale was adopted from CIS Questionnaire (2008).

** Suppliers in Russia, Suppliers abroad, Clients in Russia, Clients abroad, R&D partners, Intermediaries in Russia, Intermediaries abroad, Stakeholders, Competitors in Russia, Competitors abroad, Consultants, External commercial R&D organizations, State R&D centers, Universities, Partners in JVs, Other partners not included in the list.*

Companies are considered new in Russia if they were established after 1991. 12.6% are privatized companies and 1% are state companies. The average age of companies in the sample is 27 years, while the year of foundation varies from 1720 till 2009.

The companies in the sample are rather large: 10.2% have more than 3000 employees, 13.2% have from 1000 to 3000, 21% have from 500 to 1000, 11.7% have from 100 to 500, and 27.3% have from 100 to 250 employees. The share of companies with fewer than 100 employees is only 16.7%.

Out of the 206 companies in the sample, 1.9% assessed their economic situation as "near bankruptcy", 10.7% as "bad", 53.4 % as "satisfactory", 28.6% as "good", and only 3.9 % as "excellent".

The R&D intensity (ratio of R&D expenditure to company sales) was between 1.5 and 3.0% for 38% of companies. This corresponds to an average level of R&D intensity for most of the high and medium tech industries in EU countries. The R&D intensity ratio was lower than 1.5% in 20.7% of the companies. A rate of 3% to 10% was registered in 24.5% of companies, and the remaining 13.6% of companies had an R&D intensity higher than 10%.

4 Key Findings

4.1 Involvement of External Partners in the R&D Process

Our respondents in Russia indicated that innovative firms quite intensively involve external partners (consumers, suppliers, intermediaries, research organizations, and others) into the R&D process (29% on average, Table 3). Companies cooperate more intensively with external partners in product and service modification, technology modification, and in mutual NPD and technology development, than in technology acquisition, and organizational and marketing innovations (Figure 1).

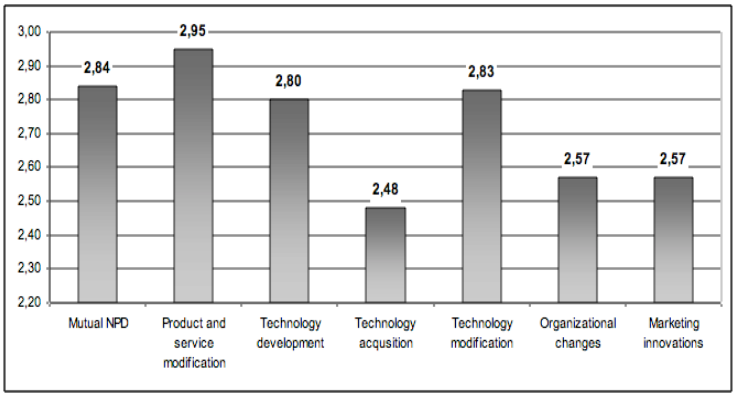

Fig. 1 Involvement of external partners in the R&D process (Likert scale 1 to 5)

Analysis of the involvement of external partners at the different stages of the R&D process (Figure 2) shows that companies cooperate more intensively with external partners in testing prototypes of the product or market testing, and launching the product, than in idea generation, product design, or the engineering stage.

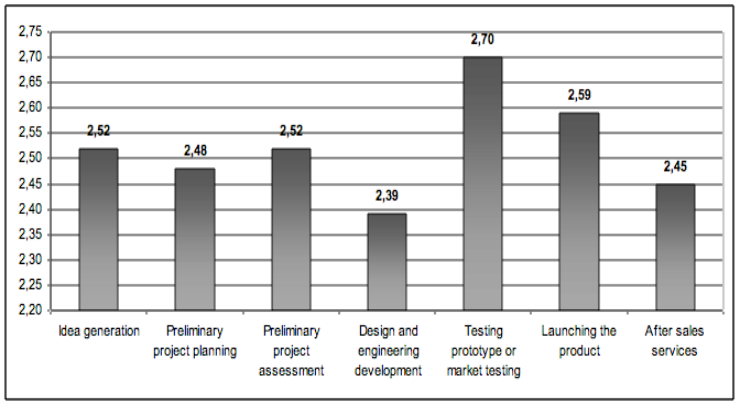

Fig. 2 Involvement of external partners in the different stages of the R&D process

The effect of cooperation can also be negative on the innovations of the companies in the sample. The role of external partners in the implementation of the innovation is shown in Figure 3, where the companies were asked to estimate the pressure from the different external partners on their innovations (Likert scale from 1 to 5).

The highest pressure that companies feel is from the Russian competitors and consumers, as well as from the state quality control and foreign competitors located in Russia. The pressure from the supplier's side (both local and foreign) is significantly lower.

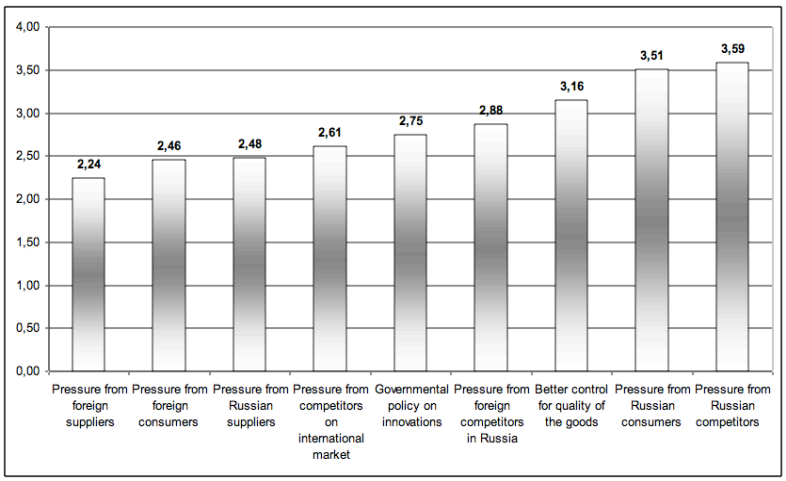

Fig.3 The influencing factors of innovations implementation

4.2 Open Innovation Framework of Russian Companies

In order to test the hypotheses, data were analyzed, separating and comparing the groups of companies as Gassman and Enkel (2004) suggested and testing the involvement of different external partners in the R&D process, the importance of their

cooperation, and the success of cooperation. In Table 2, the distribution of companies in these groups is presented.

Table 2. Open Innovation Framework for Russian Companies

Innovation Strategy	*N*	*Share, %*
	Internal R&D	
IntR&D*	162	78.6
No IntR&D	44	21.4
	Inbound Open Innovation	
InOI	64	31.1
No InOI	142	69.9
	Outbound Open Innovation	
OutOI	27	13.1
No OutOI	179	86.9
	Coupled Open Innovation	
COI and IntR&D	14	6.8
No COI	192	93.2

** Here and in the next tables: IntR&D – Internal R&D, InOI – Inbound open innovation, OutOI – Outbound open innovation, COI – Coupled open innovation*

The share of companies implementing internal R&D is high in the sample – 78.6% (Table 2). The share of companies that launched new or significantly modified products (services, concepts of products/services) was 89.3%.

The share is significantly higher than that found in other studies about NPD in Russia - 38.8% of companies with NPD (Dynkin and Ivanova, 1998) and 59% in the work of Kadochnikov (2004). 80.6% of companies in the sample implemented new or significantly improved technologies or production processes in the analyzed period. The products were developed mostly by the company itself (65.5%). 36.1% of companies developed new products (services) in cooperation with external partners.

31.1% of companies in the sample acquire external technology (inbound open innovation), and 13.1% of companies commercialize the surplus of their innovations to the market (outbound open innovation). A combination of the inbound and outbound open innovation (OI) was observed only in 6.8% of companies.

Companies implementing OI are medium to large size: more than 100 employees in 84.4% of companies with inbound OI, 92.3% of companies with outbound OI, and 94.1% of companies with coupled OI. Due to the fact that these companies are large and typical for Russian companies, and that large companies are older industrial giants, the average age of companies with inbound OI is 38 years, for outbound OI it is 34 years, and for coupled OI it is 39 years.

Companies implementing inbound OI are mostly operating in the electrical and optical, machinery and equipment, chemical, oil refinery and metallurgical industries. Companies with outbound OI are mostly in the metallurgical, machinery and equipment, aircraft, electrical and optical, and telecommunication industries. Firms with coupled OI operate in the metallurgical, telecommunication, machinery and equipment, and aircraft industries.

4.3 R&D Cooperation with External Partners

The analysis of the shares of companies involving external partners in cooperation among companies with internal R&D, and inbound, outbound, and coupled open innovation (Table 3) reveals a trend that companies implementing open innovation have, on average, a higher share of partners involved in the innovation activities.

Only 29% of companies with internal R&D cooperate with external partners in the R&D process, compared to inbound (36.2%), outbound (44%), and coupled (57.6%) open innovation. The intensity of cooperation with external partners increases for each type of partner for companies' open innovation.

Table 3. Intensity of involvement of external partners, %

Type of partner	Open Innovation Framework			
	IntR&D*	InOI*	OutOI*	COI*
Suppliers in Russia	**50.0**	**59.4**	**70.4**	**85.7**
Suppliers abroad	22.2	32.8	40.7	57.1
Clients in Russia	**55.6**	**45.3**	**59.3**	57.1
Clients abroad	23.5	28.1	33.3	42.9
R&D partners	**52.5**	**62.5**	**63.0**	**85.7**
Intermediaries in Russia	27.8	34.4	37.0	57.1
Intermediaries abroad	14.8	20.3	37.0	50.0
Stakeholders	24.7	34.4	44.4	50.0
Competitors in Russia	13.6	17.2	22.2	28.6
Competitors abroad	7.4	15.6	18.5	28.6
Consultants	**42.0**	**48.4**	**59.3**	**71.4**
External commercial R&D organizations	28.4	39.1	44.4	**64.3**
State R&D centers	**33.3**	**40.6**	**48.1**	**71.4**
Universities	28.4	32.8	37.0	42.9
Partners in JVs	27.8	**40.6**	44.4	**64.3**
Other partners	20.4	28.1	44.4	**64.3**
Mean	*29.5*	*36.2*	*44.0*	*57.6*

* *Here and in the next tables: IntR&D – Internal R&D, InOI – Inbound open innovation, OutOI – Outbound open innovation, COI – Coupled open innovation*

4.4 External R&D Cooperation in Companies with Internal R&D

The analysis of the means of importance and success of cooperation with external partners shows higher numbers for companies with internal R&D compared to those who do not conduct R&D internally (Table 4).

The statement is valid for all types of external partners. However, a statistically significant difference is observed for the importance of cooperation with R&D partners, and for success of cooperation with domestic suppliers, clients, partners in joint ventures (JV), and R&D partners.

Hence, we can observe that the means of both importance and success of cooperation with domestic partners (suppliers, clients, intermediaries, and competitors) are higher than with foreign partners. It is valid both for companies with internal R&D and for those without.

Table 4. Cooperation with external partners for companies with internal R&D

Type of partner	%**	Importance of collaboration				Success of collaboration			
		Whole sample	IntR&D	No int R&D	T-test	Whole sample	IntR&D	No int R&D	T-test
		Mean	Mean	Mean	Sig	Mean	Mean	Mean	Sig
Suppliers in Russia	50.0	3.9	4.0	3.6	0.194	4.0	4.1	3.5	**0.049***
Suppliers abroad	22.2	3.8	3.9	3.0	0.078	3.8	3.9	3.4	0.356
Clients in Russia	55.6	4.2	4.3	3.8	0.054	4.1	4.2	3.6	**0.017***
Clients abroad	23.5	3.9	4.0	3.1	0.101	3.7	3.8	3.1	0.256
R&D partners	52.5	4.3	4.4	3.4	**0.000***	4.2	4.4	3.2	**0.000***
Intermediaries in Russia	27.8	4.0	3.9	4.1	0.676	3.7	3.7	3.8	0.776
Intermediaries abroad	14.8	3.7	3.8	3.1	0.233	3.4	3.5	3.1	0.576
Stakeholders	24.7	3.9	4.0	3.7	0.448	3.9	4.0	3.5	0.364
Competitors in Russia	13.6	3.6	3.5	3.7	0.683	3.3	3.3	3.4	0.747
Competitors abroad	7.4	3.2	3.2	3.2	0.975	2.8	2.8	3.0	0.820
Consultants	42.0	3.9	4.0	3.7	0.264	3.7	3.8	3.6	0.503
External commercial R&D organizations	28.4	3.9	4.0	3.7	0.507	3.8	3.9	3.3	0.141
State R&D centers	33.3	4.0	4.1	3.8	0.541	3.8	3.9	3.7	0.451
Universities	28.4	3.9	3.9	3.7	0.429	3.6	3.7	3.5	0.611
Partners in JVs	27.8	3.9	4.0	3.4	0.188	3.9	4.1	2.9	**0.007***
Other partners	20.4	3.8	3.8	3.2	0.244	3.8	3.9	3.2	0.277
Mean	*29.5*	*3.9*	*3.9*	*3.5*		*3.7*	*3.8*	*3.4*	

**Sig at p<0.05;*
*** % means the share of companies involving this type of partner among companies with internal R&D; IntR&D – results for companies with internal R&D; No Int R&D – results for companies without internal R&D; T-test - T-test for differences in means between firms with and without internal R&D.*

4.5 External R&D Cooperation in Companies with Inbound Open Innovation

The analysis of the means of importance and success of cooperation with external partners shows higher numbers for companies with inbound open innovation compared to those without (Table 5). The statement is valid for all types of external partners, except for clients in Russia, when importance is on the same level.

However, a statistically significant difference is observed for the importance of cooperation with consultants and external commercial R&D organizations, and for success of cooperation with external commercial R&D organizations and partners in joint ventures (JV).

Hence, we can observe that the means of both importance and success of cooperation with domestic partners (suppliers, clients, intermediaries and competitors) are higher than with foreign partners. It is valid both for companies with inbound OI and for those without.

4.6 External R&D Cooperation in Companies with Outbound Open Innovation

Next, we analyzed the means of importance and success of cooperation with external partners in companies with outbound open innovation compared to those without (Table 6). The results reveal no differences between the groups of firms in perceived importance and success of cooperation with external partners.

Table 5. Cooperation with external partners for companies with inbound open innovation

Type of partner	%**	Importance of collaboration				Success of collaboration			
		Whole sample	InOI	No InOI	T-test	Whole sample	InOI	No InOI	T-test
		Mean	Mean	Mean	Sig	Mean	Mean	Mean	Sig
Suppliers in Russia	59.4	3.9	4.2	3.7	0.058	4.0	4.2	3.9	0.236
Suppliers abroad	32.8	3.8	3.9	3.6	0.505	3.8	3.7	3.9	0.668
Clients in Russia	45.3	4.2	4.2	4.2	0.731	4.1	4.0	4.1	0.703
Clients abroad	28.1	3.9	4.0	3.8	0.648	3.7	3.5	3.9	0.321
R&D partners	62.5	4.3	4.5	4.1	0.072	4.2	4.4	4.1	0.132
Intermediaries in Russia	34.4	4.0	4.1	3.9	0.482	3.7	3.9	3.5	0.167
Intermediaries abroad	20.3	3.7	3.9	3.6	0.448	3.4	3.5	3.3	0.584
Stakeholders	34.4	3.9	4.3	3.6	0.071	3.9	4.3	3.5	0.073
Competitors in Russia	17.2	3.6	3.6	3.5	0.825	3.3	3.4	3.3	0.780
Competitors abroad	15.6	3.2	3.4	2.7	0.249	2.8	3.1	2.3	0.199
Consultants	48.4	3.9	4.2	3.8	**0.046**	3.7	4.0	3.6	0.145
External commercial R&D organizations	39.1	3.9	4.3	3.6	**0.036**	3.8	4.3	3.5	**0.011**
State R&D centers	40.6	4.0	4.2	3.9	0.376	3.8	4.1	3.7	0.219
Universities	32.8	3.9	4.0	3.8	0.411	3.6	3.9	3.5	0.258
Partners in JVs	40.6	3.9	4.1	3.7	0.168	3.9	4.3	3.4	**0.012**
Other partners	28.1	3.8	4.2	3.3	0.053	3.8	4.1	3.5	0.201
Mean	36.2	3.9	4.1	3.7		3.7	3.9	3.6	

**Sig at p<0.05; ** % means the share of companies involving this type of partner among companies with InOI; InOI – results for companies with InOI; No InOI– results for companies without InOI; T-test - T-test for differences in means between firms with and without InOI.*

Table 6. Cooperation with external partners for companies with outbound open innovation

Type of partner	%**	Importance of collaboration				Success of collaboration			
		Whole sample	OutOI	No OutOI	T-test	Whole sample	OutOI	No OutOI	T-test
		Mean	Mean	Mean	Sig	Mean	Mean	Mean	Sig
Suppliers in Russia	70.4	3.9	4.1	4.0	.480	4.0	4.0	4.0	.926
Suppliers abroad	40.7	3.8	3.7	3.8	.924	3.8	3.7	3.8	.664
Clients in Russia	59.3	4.2	4.4	4.2	.494	4.1	4.3	4.0	.378
Clients abroad	33.3	3.9	3.9	3.9	.947	3.7	3.7	3.7	.908
R&D partners	63.0	4.3	4.1	4.3	.412	4.2	3.9	4.2	.234
Intermediaries in Russia	37.0	4.0	3.9	3.9	.942	3.7	4.0	3.6	.313
Intermediaries abroad	37.0	3.7	3.8	3.7	.824	3.4	3.6	3.3	.564
Stakeholders	44.4	3.9	3.9	3.9	.838	3.9	3.8	3.9	.727
Competitors in Russia	22.2	3.6	3.4	3.6	.640	3.3	3.3	3.3	.845
Competitors abroad	18.5	3.2	3.2	3.2	.974	2.8	2.8	2.8	.966
Consultants	59.3	3.9	3.6	4.0	.107	3.7	3.6	3.8	.607
External commercial R&D organizations	44.4	3.9	4.0	3.9	.807	3.8	4.0	3.7	.590
State R&D centers	48.1	4.0	3.7	4.1	.263	3.8	3.6	3.9	.297
Universities	37.0	3.9	3.5	3.9	.251	3.6	3.7	3.6	.986
Partners in JVs	44.4	3.9	3.6	4.0	.217	3.9	3.8	3.9	.930
Other partners	44.4	3.8	3.6	3.8	.711	3.8	3.6	3.8	.615
Mean	*44.0*	*3.9*	*3.8*	*3.9*		*3.7*	*3.7*	*3.7*	

Sig at p<0.05; * % means the share of companies involving this type of partner among companies with OutOI; OutOI– results for companies with OutOI; No OutOI– results for companies without OutOI; T-test - T-test for differences in means between firms with and without OutOI

We can conclude that our Hypothesis 5 was not supported. The highest means, as expected, are obtained for cooperation with clients in Russia, but various forms of cooperation with R&D partners also have relatively high scores.

Hence, we can observe that the means of both importance and success of cooperation with domestic partners (suppliers, clients, intermediaries, and competitors) are higher than with foreign partners. It is valid both for companies with outbound OI and for those without. Then we can also mention the additional support for Hypothesis 3 on cooperation with domestic and foreign partners, in the case of companies with outbound OI.

4.7 External R&D Cooperation in Companies with Coupled Open Innovation

Finally, we analyze companies who implement the full scope of open innovation: inbound and outbound. The analysis of the means of importance and success of cooperation with external partners shows higher numbers for companies with coupled open innovation compared to those without (Table 7). For this overall assumption on the role of combining the elements of the open innovation strategy when shaping the company's cooperation with external stakeholders, no strong evidence was found to support it. In fact, the results confirm a statistically significant difference between firms with COI and without COI – in the case of cooperation with external commercial R&D organizations, the overall trend identifies higher scores both for importance and perceived success of cooperation by firms implementing COI.

Table 7. Cooperation with external partners for companies with coupled open innovation

Type of partner	%**	Importance of collaboration				Success of collaboration			
		Whole sample	COI	No COI	T-test	Whole sample	COI	No COI	T-test
		Mean	Mean	Mean	Sig	Mean	Mean	Mean	Sig
Suppliers in Russia	85.7	3.9	4.7	3.9	0.075	4.0	4.3	3.9	.285
Suppliers abroad	57.1	3.8	4.0	3.7	0.552	3.8	3.8	3.8	.846
Clients in Russia	57.1	4.2	4.6	4.2	0.301	4.1	4.4	4.0	.347
Clients abroad	42.9	3.9	4.3	3.8	0.421	3.7	3.7	3.7	.991
R&D partners	85.7	4.3	4.5	4.3	0.516	4.2	4.5	4.1	.300
Intermediaries in Russia	57.1	4.0	4.2	3.9	0.487	3.7	4.3	3.6	.083
Intermediaries abroad	50.0	3.7	4.2	3.6	0.221	3.4	4.0	3.2	.150
Stakeholders	50.0	3.9	4.4	3.8	0.308	3.9	4.7	3.8	.115
Competitors in Russia	28.6	3.6	3.5	3.6	0.862	3.3	3.3	3.3	.905
Competitors abroad	28.6	3.2	3.5	3.1	0.515	2.8	3.1	2.7	.542
Consultants	71.4	3.9	4.1	3.9	0.585	3.7	4.2	3.7	.192
External commercial R&D organizations	64.3	3.9	4.7	3.8	**0.033**	3.8	4.7	3.7	**.019**
State R&D centers	71.4	4.0	4.3	3.9	0.424	3.8	4.0	3.8	.758
Universities	42.9	3.9	4.3	3.8	0.331	3.6	4.4	3.6	.102
Partners in JVs	64.3	3.9	4.0	3.9	0.830	3.9	4.4	3.8	.137
Other partners	64.3	3.8	4.3	3.6	0.133	3.8	4.4	3.6	.222
Mean	*57.6*	*3.9*	*4.2*	*3.8*		*3.7*	*4.1*	*3.6*	

**Sig at p<0.05; ** % means the share of companies involving this type of partner among companies with COI; COI– results for companies with COI; No COI– results for companies without COI; T-test - T-test for differences in means between firms with and without COI*

5 Discussion of the Results

Russia has inherited some specific managerial practices from its Soviet past, which significantly influence companies' cooperative skills and cooperation strategy. Our research addresses the need of Russian firms to move from the orientation towards suppliers to orientation towards clients (Farley & Deshpande, 2005), and to build cooperative capabilities (Johanson, 2007). On the other hand, the developing Russian market provides us with an opportunity to research the emerging innovation strategies in Russian firms in general, and the emerging open innovation phenomena in particular. Russian firms might have specific drivers to firm's openness (Smirnova et al., 2011).

According to the applied open innovation framework (Gassman and Enkel, 2004), we found that 31.1% of companies in the sample acquire external technology (implement inbound open innovation), and 13.1% of companies commercialize the surplus of their innovations to the market (implement outbound open innovation). The combination of the inbound and outbound open innovation (OI) was observed in only 6.8% of companies. In our previous study (Podmetina, et al., 2013), we have already tackled the level of openness of the company both to sourcing and acquisition of external knowledge, and to R&D collaboration with external partners, as well as to internal knowledge exchange in the firm, and can conclude that sometimes the openness of the firm is not that obvious for companies themselves.

The limited number of companies with open innovation and specifically with outbound and coupled open innovation can be explained by the high traditionalism in management in Russia, less flexibility, the industrial composition of the sample, and institutional factors. To add to that fact, the open innovation concept is only starting to spread in Russia, with new workshops and training organized, international projects implemented, and journal articles published.

Our sample represents the innovative companies in Russia. The share of companies that launched new or significantly modified products (services, concepts of products/services) was 89.3%. The share is significantly higher than found in the other studies about NPD in Russia - 38.8% of companies with NPD (Dynkin and Ivanova, 1998) and 59% in the work of Kadochnikov (2004). Companies with internal R&D cooperate with external partners on R&D more intensively and more successfully than companies without internal R&D; and that external cooperation is more important for firms with internal R&D than for those without.

Thus, considering the limited statistical significance of the number of partners, we can conclude that our *Hypothesis 1* was partially supported. When building external relationships, Russian companies face obstacles such as instability of relationships in the market, low partner information availability, and high risk of opportunistic behavior (Salmi, 2004; Johanson, 2007).

The core R&D cooperation partners are almost the same for companies implementing open innovation and companies relying only on internal R&D: domestic suppliers and clients, R&D partners, consultants, and governmental R&D organizations. Thus, our *Hypothesis 2* got partial support: the range of core partners does not differ for companies with internal R&D and companies implementing open innovation, but the

intensity of cooperation with external partners is much higher for companies with open innovation.

The intensity of cooperation with external domestic partners (suppliers, clients, intermediaries, and competitors) is higher than with foreign partners for all types of companies, with the exception of equal intensity of cooperation with intermediaries in companies with outbound open innovation and cooperation with competitors in companies implementing coupled open innovation. Thus, *Hypothesis 3* was supported for most of the partners in most of the companies with open innovation and without.

We have also observed that the means of both importance and success of cooperation with domestic partners (suppliers, clients, intermediaries, and competitors) are higher than with foreign partners. This is valid for companies with internal R&D, inbound, outbound, and coupled OI, and without. Thus, we can also mention the additional support for Hypothesis 3 on cooperation with domestic and foreign partners in the case of companies with internal R&D, inbound, outbound, and coupled OI.

Companies with inbound OI cooperate with external partners on R&D more intensively and more successfully than companies without inbound OI; and external cooperation is more important for firms with inbound OI than for those without. Thus, considering the limited statistical significance of number of partners, we can conclude that our *Hypothesis 4* was partially supported. There are more cases of differences among groups of firms that could be identified at the level of $p < 0.1$.

Next, we analyzed the means of importance and success of cooperation with external partners in companies with outbound open innovation compared to those without. The results reveal no differences in perceived importance and success of cooperation with external partners between the groups of firms. We can conclude that our *Hypothesis 5* was not supported. The highest means, as expected, were obtained for cooperation with clients in Russia, but various forms of cooperation with R&D partners also have relatively higher scores.

Companies with coupled OI cooperate with external partners on R&D more intensively and more successfully than companies without coupled OI; and external cooperation is more important for firms with coupled OI than for those without. Thus, considering the limited statistical significance of number of partners, we can conclude that our *Hypothesis 6* was partially supported. There are more cases of differences among groups of firms that could be identified at the level of $p < 0.1$.

We can conclude that cooperation has an important role in Russian innovating companies and this role is defined by type of innovation (Smirnova, et al., 2009) and innovation strategy, which in our case is open innovation (Chesbrough, 2006). Our main assumption has been that following at least some of the open innovation strategy elements would have an impact on a company's R&D cooperation with external partners. Summing up the findings, we may conclude that all in all, the results show that firms with open innovation involve external partners more actively.

6 Conclusions

Companies from transitional economies, such as Russia, experience pressure from both global turbulence of the market and from the ongoing transformation process in

the market. Companies need more resources to compete with foreign rivals and need more knowledge to fill the innovation gap caused by the heritage of the centrally planned economy. Developing cooperation skills and increasing innovativeness provides an opportunity for companies to compete successfully on both domestic and international markets.

This study has shown that cooperation with external partners plays an important role when implementing open innovation in practice. The results of the study show that companies with more open innovation strategies tend to indicate higher importance and success of cooperation.

Open innovation theory puts cooperation in a milestone place in the process of implementing open innovation principles in practice. The logic behind this statement is defined by the nature of the externalization process –acting beyond a company's borders at all stages of the innovation process always involves a certain level of cooperation with external partners.

In addition, the effect of partner location was found during data analysis. Companies place more value on cooperation with domestic suppliers than with foreign suppliers. This is explained by the easier transfer of knowledge locally due to proximity, better communication, and cultural similarity.

The study has a number of limitations arising from the data collection in one country and the relatively small sample of companies, which enables us to generalize only for innovative companies in Russia. In addition, we excluded Moscow and the capital region from the data collection process, due to structural differences and the number of outlier indicators from Moscow, as created in our previous study.

The practical results of the study aim to equip managers with knowledge of the importance of analyzing stakeholders and cooperation partners in the process of implementing open innovation. For international society, it is beneficial to know more about the business practices of Russian companies, about which not much is known and which are actively entering international markets nowadays.

The future research in this field we see as deepening the analysis of causalities between the cooperation with different types of partners and success in implementing and benefiting from open innovation in terms of decreasing R&D costs and time-to-market for new products. The interesting aspect is the analysis of a portfolio of cooperation with external partners for companies with different types of open innovation strategies. In general, we see more theoretical and empirical papers on the benefits of open innovation, contributing to viewing open innovation as a theory, not just as a phenomenon.

7 References

Andrew, J. P., Sirkin, H. L. & Butman, J. (2006). *Payback: Reaping the rewards of innovation.* Harvard Business School Press.

Baglieri, E. & Zamboni, S. (2005). Partnering along the demand chain: cooperation in new product development process. Proceedings of 21st IMP Conference.

Bayona, C., García-Marco, T. & Huerta, E. (2001). Firms' motivations for cooperative R&D: an empirical analysis of Spanish firms. *Research Policy*, *30(8*), 1289-1307.

Belderbos, R, Carree, M. & Lokshin, B. (2004). Cooperative R&D and Firm Performance. *Research Policy, 33*(10), 1477–1492.

Blomqvist, K. & Levy, J. (2006). Cooperation capability – a focal concept in knowledge creation and collaborative innovation in networks. *International Journal of Management Concepts and Philosophy, 2*(1), 31-48.

Boisot. M (1986). Markets and hierarchies in a cultural perspective. *Organization Studies*. 7(2). 135-158

Cassiman, B. & R. Veugelers, (2002). R&D Cooperation and Spillovers: Some Empirical Evidence from Belgium, *American Economic Review*, *92*(4), 1169-1184.

Chesbrough, H.W. & Prencipe, A. (2008). Networks of innovation and modularity: a dynamic perspective. *International Journal of Technology Management*, *42*(4), 414–425.

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business Press, Boston, Massachusetts. 227p.

Chesbrough, H. (2006). *Open Business Models: Hoe to Thrive in the New Innovation Landscape*. Harvard Business School Press , Boston, Massachusetts.256 p.

Christensen, C. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business School Press, Boston, MA, USA

Clark, K. & Fujimoto, T. (1991). *Product development performance.* Boston, MA: Harvard Business School Press.

Cohen, W.M. & Levinthal D.A. (1990). Absorptive Capacity - A New Perspective on Learning and Innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Deck, M. & Strom, M. (2002). Model of co-development emerged. *Research-Technology Management*, *45*(3), 47-53.

De Propris, L. (2002). Types of innovation and inter-firm co-operation. *Entrepreneurship and Regional Development*, *14*, 337 – 353.

Dittrich, K. & Duysters, G. (2007). Networking as a means to strategy change: the case of open innovation in mobile telephony. *Journal of Product Innovation Management*, *24*(6), 510–521.

Dyer, J. & H. Singh (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.

Dynkin, A., & Ivanova, N. (1998). Technological Innovation in Russia. *Research Technology management, 41* (Jan/Feb), 44-47.

Enkel, E. & Gassmann, O. (2008). Driving open innovation in the front end. The IBM case. Working Paper University of St. Gallen and Zeppelin University, St. Gallen and Friedrichshafen.

Enkel, E., Gassmann, O. & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management, 39*(4).

Faria, P. & Schmidt, T. (2007). International Cooperation on Innovation: Empirical Evidence for German and Portuguese Firms, ZEW Discussion Papers 07-060, ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research.

Faria, P., Lima, F. & Santos, R. (2010) Cooperation in innovation activities: The importance of partners. *Research Policy*, 39 (2010), 1082 – 1092.

Ford, D. & Johnsen, T. (2001). Managing networks of supplier and customer relationships for technological innovation: initial case study, Proceedings of 17th IMP Conference.

Freytag, V. (2002). Innovation in co-operation and co-operation innovation. Proceedings of 18th IMP Conference, Dijon, France.

Gassmann, O. & Enkel, E. (2004). Towards a Theory of Open Innovation: Three Core Process Archetypes. Proceedings of the R&D Management Conference (RADMA), Lisbon, Portugal, July 6-9, 2004.

Gemunden, H. G., Ritter, T. & Heydebreck, P. (1996) Network configuration and innovation success: an empirical analysis in German high-tech industries. *International Journal of Research in Marketing*, *13*(5), 449– 62.

Hagedoorn, J. (2002). Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. *Research Policy*, *31*(4), 477-492.

Hakansson, H. & Eriksson, A-K. (1993). Getting innovations out of supplier networks. *Journal of Business-to Business Marketing*, *1* (3), 3-34.

Hart, S.L. and Sharma, S. (2004) 'Engaging fringe stakeholders for competitive imagination', *Academy of Management Executive*, 18 (1), 7–18.

Johnsen, T. & Ford, D. (2000). Managing collaborative innovation in complex networks: findings from exploratory interviews. Proceedings of 16th IMP-conference in Bath, UK, 2000.

Kadochnikov, S., Essine, P. & Slobodyan, S. (2004). What explains the product differentiation of Russian companies: competitive pressure or technological spillovers? *CERGE-EI Policy Brief*, *3* (June), 1-3.

Kaufmann, A. & Todtling, F. (2001). Science-industry interaction in the process of innovation: the importance of boundary-crossing between systems. *Research Policy*, *30*(5), 791-804.

Keupp, M. M. & Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management* 39(4) 311-316.

Klevorick, A. K., Levin, R. C., Nelson, R. R. & Winter, S. G. (1995). On the sources and significance of interindustry differences in technological opportunities. *Research Policy*, *24*, 185-205.

Klomp, L. & van Leeuwen G. (2001). Linking Innovation and Firm Performance: A New Approach, *International Journal of the Economics of Business*, *8*(3), 343–364.

Kock, C. & Torkkeli, M. (2008). Open Innovation: A "Swingers' Club" or "Going steady"?, IE Business School Working paper WP08-11, 05.02.2008.

Kotler, F. & Caslione, J. (2009). *Chaotics: The Business of Managing and Marketing in The Age of Turbulence*. Amacom Publishing.

Laursen, K. & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, *27*(2), 131-50.

Loof, H. & Heshmati, A. (2002). Knowledge Capital and Performance Heterogeneity: A Firm-level Innovation Study. *International Journal of Production Economics*, *76*(1), 61–85.

Lundvall, B. A., Johnson, B., Andersen, E. S. & Dalum B. (2002). National systems of production, innovation and competence building. *Research Policy*, *31*, 213–231.

Miles, R. E., Miles, G. & Snow, C. C. (2004). *Collaborative Entrepreneurship. How Groups of Networked Firms Use Continuous Innovation to Create Economic Wealth?* Stanford University Press.

Miotti, L. & Sachwald, F. (2003). Co-operative R&D: why and with whom? An integrated framework of analysis. *Research Policy*, *32,* 1481 – 1499.

Oslo Manual (2007). Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition.

Podmetina, D., Volchek, D., Dabrowska, J., & Fiegenbaum, I. (2013). Human resource practices and open innovation. *International Journal of Innovation Management*, 17 (5), 1-22.

Podmetina D., Vaatanen, J., Torkkeli, M. & Smirnova, M. (2011). Do Russian Firms Utilize Open Innovation Paradigm? Study of Technology Commercialization and Acquisition. *International Journal of Business Innovation and Research,* 4 (4/5), 298-317.

Podmetina D., Vaatanen, J., Torkkeli, M. & Smirnova, M. (2009). Innovativeness and Internationalisation . Empirical Study of Russian R&D Oriented Companies. *International Journal of Innovation Management,* 13 (2), 1-23.

Romijn, H. & Albaladejo, M. (2002). Determinants of Innovation Capability in Small Electronics and Software Firms in Southeast England. *Research Policy*, *31*(7), 1053-1067.

Smirnova, M., Podmetina, D., Vaatanen, J.& Kouchtch, S. (2009). Key stakeholders' interaction as a factor of product innovation: the case of Russia. *International Journal of Technology Marketing*, 4 (2/3) 230-247.

Smirnova M., Naude P., Henneberg S.C., Mouzas S. & S.P. Kouchtch (2011). The impact of market orientation on the development of relational capabilities and performance outcomes: The case of Russian industrial firms. *Industrial Marketing Management,* 40 (1), 44-53.

Smirnova, M., Podmetina, D., Vaatanen, J. & Torkkeli, M. (2012). Collaborative approaches to new product development: the case of Russia. *Int. J. Entrepreneurship and Innovation Management,* 15 (1/2), 91 – 107.

Smith, P. G. & Blanck, E. (2002). From experience: leading dispersed teams. *The Journal of Product Innovation Management 19*(4), 294–304.

Tether, B. (2002). Who co-operates for innovation, and why. An empirical analysis. *Research Policy*, *31*, 947-967.

Torkkeli M., Podmetina D. & Väätänen J. (2009). Knowledge Absorption in Emerging Economy –Role of Foreign Investments and Trade Flows in Russia. *International Journal of Business Excellence*, 2(3/4) 269–284.

Veugelers, R. & Cassiman, B. (2005). R&D cooperation between firms and universities: some empirical evidence from Belgian manufacturing. *International Journal of Industrial Organization*, 23(5-6), 355 - 379.

Vivero, R. (2004). The Impact of Process Innovations on Firm's Productivity Growth: The Case of Spain. *Applied Economics*, *34*, 1007–1016.

Von der Heidt, T. (2008) 'Developing and testing a model of cooperative interorganisational relationships (IORs) in product innovation in an Australian manufacturing context: a multi-stakeholder perspective', A thesis submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy, School of Commerce and Management, Southern Cross University, Australia.

von Hippel, E. (1988). *The Sources of Innovation.* Oxford University Pre New York.

Walter, A., Ritter, T. & Gemunden, H. G. (2001). Value-creation in buyer-seller relationships: theoretical considerations and empirical results from a supplier's perspective. *Industrial Marketing Management*, 30(4), 365-377.

Wheelright, S. & Clark K. (1992). *Revolutionizing Product Development, Quantum Leaps In Speed, Efficiency, And Quality*. New York: The Free Press.

Acknowledgement

Authors express their gratitude to anonymous reviewer whose detailed and constructive comments helped to improve the paper significantly. We are also very thankful to professors Marko Torkkeli and Juha Väätänen, who participated in the development of early versions of this paper and their comments, criticism and professional feedback contributed a lot to the development of this research.