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Vitaliy Roud, Valeriya Vlasova

FIRM-LEVEL EVIDENCE ON THE COOPERATIVE INNOVATION STRATEGIES IN RUSSIAN MANUFACTURING

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This paper focuses on revealing the heterogeneous impact of firms' specificities and the environment on the sophistication of the cooperative innovation strategies. We use the firm-level data on innovation strategies of over 800 innovation-active manufacturing enterprises in Russia to model the networking strategy as a simultaneous choice of the range of cooperative linkages (within and beyond the value chain and knowledge production sectors) with a special respect to geography of partners. The determinants comprise the internal factors (as absorptive capacity) and the external conditions (e.g. technological opportunities, appropriability and competition regimes). Revealed effects prove the initial heterogeneity hypothesis thus challenging the wide-spread simplified perception of 'openness' of the innovation strategy as a one-dimensional characteristic.

Keywords: Innovation cooperation; open innovation; firm-level; Russia; manufacturing; innovation strategy; econometric analysis

Thematic area: Applied economics

JEL: L2, O3

¹ Laboratory for Economics of Innovation, National Research University Higher School of Economics; <u>vroud@hse.ru</u>

² Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, <u>vvvlasova@hse.ru</u>

1. Introduction

For the recent decades the cooperative behavior has been considered as one of the central topics in the innovation studies. The importance of engaging external knowledge sources was formally emphasized in the central conceptual models (e.g. the chain-link model of innovation (Kline and Rosenberg, 1986)) and reflected in the statistical measurement frameworks (Oslo Manual, 2005). These theoretical considerations were fully supported by the emerging base of empirical evidence that has greatly improved our understanding of different patterns of cooperative innovation strategies. However, few researchers focused on the empirical analysis of the determinants for the cooperative innovation strategies, addressing the full range of heterogeneities of motivations for the different configurations of collaborative networks.

This study employs the firm-level data on the innovation activities of the Russian manufacturing enterprises to address the major research question: what are the key determinants (including the internal firm specificity and the characteristics of the external environment) that define a cooperative strategy in innovation activities: partner choice and geographical patterns of networking.

To address this question we use the results of the specialized survey entitled "Monitoring the innovation activity of actors of the innovative process", which the Institute for Statistical Studies and the Economics of Knowledge of the National Research University Higher School of Economics has undertaken in 2014-2015 and provides data for 805 innovation-active manufacturing enterprises.

We analyze nine possible types of innovation cooperation chosen by firms: cooperation with customers, suppliers of raw materials, competitors, providers of services, related valuechain members, consulting firms, universities, research organizations and public authorities. We control for six dimensions determining cooperative strategies: firm-specific characteristics, level of competition, technological opportunities, absorptive capacity, appropriability conditions and public support as explanatory variables. The estimation of a multivariate probit model and multinomial logit model provides a measure of factors determining firm's decision on cooperation and its geographical pattern.

The rest of the paper is structured as follows. Section 2 provides a brief overview of the theoretical and empirical literature on innovation cooperation, focusing on innovation cooperation strategies and factors that may either contribute or prevent cooperative behavior. Section 3 shifts the focus to the dataset description, variables construction and estimation methodology. An econometric analysis of the cooperative behavior is delivered in Section 4. Section 5 presents main results and concludes with possible directions for future research.

2. 2. Background

2.1. Cooperation as a core of innovation strategy

Business environment is characterized by widespread circulation of knowledge, rise in venture capital, short product and innovation life cycles and other. Driven by these changes companies are forced to place on the same level of importance both internal and external knowledge resources. Moreover, firms' awareness that they are unable to hold in-house all knowledge and competencies they require, forces them to open up their research and innovation process (Powell and Grodal, 2005; Pavitt, 2005).

Firms obtain various benefits from innovation cooperation by attracting external knowledge, competences, human resources, tangible assets and intellectual property objects. Further each cooperation type has its particular benefits contributing to a multi-partner cooperation.

A cooperative buyer-supplier relationship allows firms to reduce production and operating costs and project development lead times (Clark, 1989), because suppliers have high position in the knowledge chain and operate in the same in the same industry segment, having close contextual knowledge distance to the company (Un, Asakawa, 2015). Suppliers support innovation process, helping to overcome shortcomings in markets, technical resources and capabilities (Zhang and Li, 2010) and providing an opportunity to involve in planning and operation (Fritsch, Franke, 2004). Cooperation with suppliers is essential for marketing and organizational innovation (Sánchez-González, 2013).

An innovation cooperation with clients also help firms to gain the competitive advantages. Customers act as a source of information about user needs (Tether, 2002), market trends and opportunities (Von Hippel et al. 1999) and competitors' offers (Padmore, Schuetze, Gibson, 1998), allowing the company to reduce the risk of uncertainty associated with market introduction. These linkages are especially beneficial when the nature of innovation project is novel and complex or the final market is poorly understood.

Science-industry linkages hold a unique position among all cooperation types. Being a source of fundamental knowledge important to innovation, technology and economic growth (Cohen, Nelson, Walsh, 2002; Mansfield, 1998) and upstream in the knowledge chain of the industry (Un, Asakawa, 2015), collaboration with universities and research organizations enables to realize radical innovations (Kaufmann, Tödtling, 2001), to receive public support for innovation activity and to accelerate the return on investments through shorter innovation cycles and costs reduction (Veugelers and Cassiman, 2005). Moreover, such cooperative agreements increase the mobility of employees and researches across both sectors (Hackett, 2008), allowing

enterprises to trainee employees and to offer highly qualified and expert researches (Schmidt et al., 2007). Nonetheless, this type of cooperation is characterized by the divergence of respective objectives related to the lack of complementarity between scientific studies and business function (Fiaz, Naiding, 2012; Garcia et al., 2015), high uncertainty, communication and trust issues connected to transmission of information.

Many companies are in close coordination with public authorities that provide a legal framework for cooperative agreements, on the one hand, and financial support, on the other. It is an effective tool to support direct investment in various sectors of the economy, to harmonize sectoral legislation and to strengthen the company's market power. Consulting firms, for its part, could provide a variety of inputs to the innovation process (e.g. specialist skills and market information) and stimulate new innovative ideas (Tether, 2002), concerning changes in organization or marketing strategies (Garcia et al., 2015).

Collaboration with competitors differs from all previous types significantly, because they belong to the same industry sector (Miotti and Sachwald, 2003) and have common goals and problems and pursue common innovation projects (Tether, 2002). These linkages are valuable in long complex innovation projects, allowing partners to improve their knowledge, skills and absorptive capacity through the cooperation. The basic problem is the possibility of opportunistic behavior resulting in coordination, communication and trust problems (Edwards-Schachter et al., 2013; Wu, 2014). The lack of a strong intellectual property management and regulation can cause a non-cooperation.

Broadly, firms pursue different objectives when enter into cooperation with external entities, i.e. value chain actors, market players, knowledge producers and other. Nevertheless, they are often forced to delay or even abandon their collaborative projects due to various external and internal hindering factors.

2.2. Determinants of cooperative strategies

The variety of cooperative strategies implies the heterogeneity of motives behind the particular choices of collaborative partners. Numerous surveys of innovation activities (e.g. CIS) have been conducted over the last decades, providing information on innovation behavior of firms. It has led to an increase of empirical studies, including research on:

- Motives leading to innovation and R&D cooperation (e.g. Bayona, García-Marco and Huerta 2001; Segarra-Blasco and Arauzo-Carod 2008; De Faria, Lima and Santos, 2010; Arvanitis 2012),
- Patterns of cooperative innovation and R&D strategies (e.g. Hagedoorn 2002; Tether 2002; Dachs, Ebersberger and Pyka 2008; Franco and Gussoni 2010),

- Factors affecting the choice of partners and the likelihood to enter into a cooperation agreement (e.g. Cassiman and Veugelers 2002, 2005; Miotti and Sachwald 2003; Belderbos et al. 2004; De Faria and Schmidt, 2012; Abramovsky et al., 2008; Badillo and Moreno 2016; Srholec 2014), and
- The impact of cooperation on firm innovativeness and performance (e.g. Kaiser 2002; Becker and Dietz 2004; Fritsch and Franke 2004; Jaklic, Damijan and Rojec 2008).

All papers investigating various R&D and innovation cooperation strategies and analyzing factors that affect the decision to cooperate and key finding of these studies are presented in Table A1 (see Appendix 1). Pursuant to the literature review determinants of firms' innovation cooperation strategies can be arranged into six groups (see Table 1).

Category	Definition
Firm-specific characteristics	Background characteristics of the firms, e.g. size, age, form of ownership, sector of activity
Level of competition	The potential existence of comparative advantages at the industry and firm level
Technological opportunities	Firm innovativeness: the suitability of the currently existing and exploitable external resources
Absorptive capacity	The link between the external stock of technological opportunities and the in-house capabilities
Appropriability conditions	An ability to obtain the benefits from innovation by protecting innovations from imitation
Public support	Public financial support from local and national administrations

 Table 1 Determinants of cooperative strategies

Most studies show that firms' strategic decisions rely heavily on firm-specific characteristics, such as industry affiliation, size, age and other. Large companies have sufficient financial, human and technological resources and its own knowledge base needed for innovation activity (Bayona, García-Marco and Huerta, 2001). Firms with foreign participation are more likely to cooperate with customers and universities (Tether, 2002), while a general belonging to a group increases innovation cooperation with customers and suppliers (Belderbos et al., 2004).

Another group of factors relates to the playing field. On the one hand, an increase of competition in the market encourages firms' willingness to engage in innovation partnership, because it enables to broaden the value chain and to strengthen the competitive position (Arvanitis, 2012). On the other hand, a high degree of intensity in competition attended by a risk of leaking knowledge prevent the cooperation (Dachs, Ebersberger and Pyka, 2008).

In general, innovation capabilities of firms depend on the balance between the ability to conduct and expand internal R&D (technological opportunities) and to seize the opportunities offered by external environment (absorptive capacity). Technological opportunities could be assessed as the share of expenditures for R&D and innovation activities (Castellacci, 2007),

importance of different types of innovation and the length of their establishment. Absorptive capacity characterizes the "ability of a firm to identify, assimilate and exploit knowledge from the external environment" (Cohen, Levinthal, 1990), expressed in staff qualification, corporate culture, access to outside sources of information (incoming spillovers) in relation to the development and implementation of innovation.

Outgoing spillovers in turn are resources that can be used by external partners for their personal interest (Becker and Dietz, 2004). Confidence in a steady return on implemented innovations is provided through effective intellectual property protection mechanisms, otherwise the probability of free-riding problem related to innovation investments increases (Belderbos et al., 2004). Alternatively, low appropriability conditions enable intra-firms knowledge diffusion (Castellacci, 2007), with a possible beneficial effect on the productivity growth. Empirically, firm's ability to appropriate returns from innovations has a positive significant effect on the probability of innovation cooperation of any kind (Lhuillery and Pfister, 2009; Veugelers and Cassiman, 2005 among other).

Considering that innovation is a costly and uncertain process, various direct and indirect measures of financial support from public authorities affect cooperation decisions significantly. Availability of public support has a particular effect on science-industry interaction in the process of innovation (Arranz and Fdez. De Arroyable, 2008; Miotti and Sachwald, 2003).

Previous studies have shown that firm-specific characteristics and high level of absorptive capacity play a key role in the propensity for R&D and innovation cooperation regardless of cooperation type. Sustainable competitive advantages encourage firms to engage in innovation cooperation with knowledge producers and competitors. At the same time there is no effect on the cooperation within the supply chain. Firm's technological opportunity that refers to ease the achievement of innovations and technical improvements is especially important for vertical and institutional cooperation. Appropriability conditions contribute to better likelihood of vertical and institutional cooperation. The impact of public support on the probability of innovation cooperation is very strong, especially for cooperation with customers, suppliers and knowledge production sector.

Nevertheless, most of the existing literature focuses on R&D cooperation and not on patterns of cooperative arrangements for innovation. Researchers often consider different cooperation strategies as independent, regardless of possible interdependence among them due to complementarities and substitutability (Belderbos et al., 2004). Moreover, they combine several partners in a single cooperation strategy: vertical (suppliers and consumers), horizontal (competitors) and institutional (universities and research organizations) cooperation. Only a small number of studies are focused on factors determining geographical patterns in the choices

of cooperation partners, while what defines the duration of collaboration is entirely unexplored. In this paper we take into account all these shortcomings and drawbacks.

3. Data and Method

3.1. General information on data source

The empirical work is based on the results from a specialized survey entitled "Monitoring the innovation activity of actors of the innovative process", which the Institute for Statistical Studies and the Economics of Knowledge of the National Research University Higher School of Economics has undertaken on a regular basis since 2009³. The aim of the project is to develop empirical studies and to accumulate empirical knowledge about the innovation nature and types of interaction between various actors in the national innovation system.

The monitoring of the manufacturing and services industries adapts techniques from integrated European Manufacturing Survey – research into technology levels and innovative activity in industry (organized by a consortium of 18 research centers and universities and coordinated by Fraunhofer ISI, Germany⁴) and international standards on statistical measures of innovation. It expands the original framework with a number of specialized modules that ensure the methodological compatibility with CIS, but also provide a basis for assessing the respondents' experience of participating in the official innovation surveys.

The survey in 2014-2015 focuses on the innovation activities of the manufacturing and service sector companies. The sample includes more than 1300 firms, data are weighted by population characteristics derived from the Federal State Statistics Service (Rosstat) that include information on the number of enterprises in each industry sector and size group. The present analysis is based on a sample of 805 innovation-active firms representatively reflecting innovation cooperation patterns in Russian manufacturing sector. The brief sample characteristics are presented in Table A2 in Appendix 2.

3.2. Variables definition

We consider nine types of innovation cooperation partners: customers, suppliers of raw materials, competitors, providers of services, related value-chain members, consulting firms, universities, research organizations and public authorities. For each partner we account for three degrees of the geographical proximity: regional (less than 100 km), national (more than 100 km) and abroad.

Potential determinants of cooperative behavior patterns (explanatory variables) are divided into six categories pursuant to the review of theoretical empirical studies. Table A3 in Appendix 3 summarizes definitions of the variables.

³ <u>https://www.hse.ru/en/monitoring/innproc/</u>

⁴ http://www.isi.fraunhofer.de/isi-en/i/projekte/fems.php

Firm-specific characteristics: SIZE variable captured by the log of average number of employees and included in the model as a continuous variable, AGE is a dummy variable with value 1 if there are less than 5 years since registration, ownership variables on whether the firm is STATE- or FOREIGN-owned, variables assessing the operating results as a rate of changes in the staffing level (GROWTH) and as a return on sales index (ROS). Sectoral differences are monitored by a set of INDUSTRY dummies based on NACE Rev 1.1.

Competitive environment: Complex indicators to capture the level of competition: market structure - MONOPOLY (less than two direct competitors) and OLIGOPOLY (from 2 to 5 rivals), potential markets for future development (REGIONAL, NATIONAL and/or FOREIGN), different types of advantages acquired by competitors over the firm in PRICE, QUALITY and/or NOVELTY of products, adaptation of products according to customers' requirements (CUSTOMIZATION), short time of DELIVERY, additional customer SERVICES and OTHER strengths of competitors.

Technological opportunity: The level of investment intensity is derived from the question on what is the share of total innovation expenditures in the total turnover: LOW (less than 2.5%), MEDIUM (from 2.5% to 10%) and HIGH (more than 10%). There are three dummy variables for strategically important for business development types of innovation: REGULAR R&D, development and/or implementation of significantly improved or fundamentally new types of PRODUCT and PROCESS. Moreover, PERIOD variables represent the long-term process (more than 3-5 years) of development and/or implementation of product and process innovation, respectively.

Absorptive capacity: STAFF_HIGH represents the share of employees with a high education qualification and/or doctor degree. CULTURE variables capture the company management attitude towards the involvement of external partners at various stages of development and implementation of innovations (EXTERNAL), independent exchange of idea among the various units of the company (INTERNAL) and the presence of developed standard procedures for interaction with the implementing partners of research and development (PROCEDURES). Catching the variable OWN EFFORT, we consider if the majority of implemented innovations were developed predominately by firms own. Moreover, there are five dummy variables that account for the IMPORTANCE of various internal sources of information for development and implementation of new products, manufacturing processes and services. OUTBOUND knowledge flow dummy accepts value 1 for firms that acquire and/or transfer technologies associated with development and implementation of innovations.

Appropriability conditions: Methods of intellectual property protection used to protect the rents from the firms' innovation activity: FORMAL including patenting of inventions, industry designs and utility models, registration of trademarks and information units, copyright, and INFORMAL such as confidentiality agreements with the company's personnel or commercial confidentiality ("know-how"), elaborating product design and other.

Public support: Three dummy variables taking the value 1 if the company has used on of state support measures in 2011-2014: HORIZONTAL such as tax remissions and preferences; depreciation bonuses; subsidizing of interest rates on loans; NETWORKING for instance, technology platforms and regional innovation clusters creation and TARGETED including contracts within federal target programs, state grants and targeted support for training innovation managers.

Distribution of surveyed firms by the fact of innovation cooperation and its geographical pattern are presented in Table A4 Appendix 4. The means and standard deviations for each group of determinants are presented in Table A5 in Appendix 5. The vast majority (98.1%) of innovation-active firms in Russian manufacturing are engaged in innovation cooperation, while about 80% prefer to cooperate with several types of partners simultaneously (see Figure 1). Cooperation within the supply chain is the most common among innovative firms, while only a quarter interact with universities and research organizations that could be important strategic partners.



Figure 1 Population of the alternative cooperation modes in relative terms

Notes: Decision-making process among innovation-active manufacturing firms

We undertake a latent class analysis to identify five typical patterns of cooperation with regard to partner type and geographical location (see Table 3). Firms may engage in cooperation with clients and suppliers located anywhere (Cluster 1), within a regional value-chain (Cluster 2) or within a global value chain building on the resources of local universities and research organizations (Cluster 3). Also we can distinguish a cooperation on the national level with

various partners (Cluster 4) and a broad networking with different external actors and frequent interaction with national public-sector R&D (Cluster 5).

		Clusters							
		1. Clients and 2. Regional value- suppliers chain		3. Global value chain and local knowledge providers	4. National networking	5. Broader networking and national knowledge base			
Cluster Size		38.2%	33.1%	12.7%	10.9%	5.1%			
Indicators: Inno	ovation co	operation with							
Customore/	regional	0.343	0.715	0.801	0.157	0.839			
Clients	national	0.546	0.001	0.749	0.640	0.879			
Cilents	foreign	0.126	0.000	0.213	0.148	0.375			
Suppliers of	regional	0.173	0.724	0.654	0.178	0.888			
raw materials	national	0.521	0.005	0.865	0.537	0.997			
naw matchais	foreign	0.162	0.013	0.382	0.319	0.531			
Polated value	regional	0.045	0.351	0.502	0.178	0.505			
chain members	national	0.153	0.026	0.406	0.334	0.640			
chain members	foreign	0.028	0.000	0.078	0.062	0.069			
Drovidoro of	regional	0.069	0.289	0.688	0.087	0.848			
services	national	0.066	0.002	0.300	0.251	0.797			
301 11003	foreign	0.020	0.000	0.068	0.091	0.239			
	regional	0.023	0.103	0.405	0.042	0.207			
Competitors	national	0.039	0.006	0.382	0.204	0.372			
	foreign	0.000	0.000	0.005	0.001	0.007			
Posoarah	regional	0.054	0.110	0.213	0.299	0.853			
organizations	national	0.097	0.017	0.004	0.775	0.829			
organizations	foreign	0.013	0.000	0.006	0.128	0.026			
	regional	0.080	0.078	0.265	0.260	0.772			
Universities	national	0.019	0.006	0.000	0.585	0.568			
	foreign	0.002	0.000	0.000	0.038	0.049			
Conculting	regional	0.000	0.052	0.126	0.042	0.305			
firms	national	0.018	0.002	0.029	0.121	0.256			
	foreign	0.013	0.000	0.010	0.046	0.000			
Public	regional	0.081	0.146	0.264	0.333	0.631			
authorities	national	0.031	0.007	0.060	0.392	0.409			
uuu ioniico	foreign	0.000	0.000	0.000	0.034	0.000			

Table 3 Profiles of innovation cooperation strategies derived using latent class analysis

3.3. Estimation methodology

To investigate the factors that lead firms to cooperate we estimate a multivariate probit model (Cappellari, Jenkins, 2003) with nine binary equations, each one representing a pattern of innovation cooperation on the assumption that it is possible to cooperate with several partners simultaneously and that various cooperative strategies are interdependent. The model provides unbiased, asymptotically normal and efficient estimations. To address the question of possible interdependence of partner selection strategies we test values of non-diagonal cross-equation correlations (*rhos*) and test the hypothesis that all contemporaneous correlations among error terms across equations are equal to zero based on the likelihood ratio test.

To assess the factors influencing the geographical breadth of the cooperation networks we estimate a multinomial logit model (Greene, 2012, 803-805). It includes same explanatory variables and uses maximum likelihood estimation (MLE) to calculate probability of cluster membership.

4. Estimation results

The results are presented in two steps. First, we estimate a multivariate probit model to identify factor that influence the probability of engaging in cooperation. Second, we analyze what defines the geographical pattern of cooperation for innovation using multinomial logit model.

In line with previous studies, the multivariate probit estimation results show that small and young firms rarely cooperate with knowledge production sector (see Table 4). Cooperative activity of high- and medium high-tech companies is substantially higher, especially when a firm collaborate across the supply chain, with related value-chain members and science partners. Orientation on national and foreign markets has significant positive effect on cooperation with competitors, universities and public authorities, while the lack of competitive advantage in quality of products and price stimulate firms to cooperate with suppliers of raw materials and consulting firms.

The crucial role is played by absorptive capacity and incoming spillovers. Efficient management and corporate culture (encouragement of in-house ideas exchange and external partners' involvement in innovation process, existence of standard procedures for cooperation) are keys to an extensive cooperation network. This is in line with the finding by Dachs et al. (2008) and Badillo and Moreno (2016). However, only while cooperation with knowledge producers and consultants, firms highly appreciate their efforts and trust them to develop the majority of innovations.

Moreover, the results support the assumption of simultaneity of innovation partner choice. Positive correlation coefficient ranging from 0.146 to 0.673 show that firms rather consider them as complementarities than alternatives. These finding are consistent with other scientific studies, e.g. Belderbos et al. (2004) and Baddilo & Moreno (2012) for the case of the Netherlands and Spain respectively. Nevertheless, another reason for this are omitted factors affecting cooperative strategies jointly (Srholec, 2014).

	Customers	Suppliers of raw materials	Related value-chain members	Providers of services	Rival firms	Research org.	University	Consulting firms	Public authorities
Form-specific c	haracteristics	5							
Log size	-0.0277	0.0255	-0.0127	0.0256	-0.0243	0.0967**	0.0971**	0.0412	0.0463
Log_size	(0.0431)	(0.0406)	(0.0384)	(0.0386)	(0.0440)	(0.0453)	(0.0455)	(0.0591)	(0.0426)
Age less 5	-0.497**	-0.0312	0.0392	-0.0398	0.281	-0.545*	-1.187***	-0.131	-0.0100
Age_less 5	(0.217)	(0.222)	(0.211)	(0.219)	(0.232)	(0.317)	(0.420)	(0.367)	(0.255)
High tech	0.310	0.321*	0.569***	0.227	0.230	0.745***	0.967***	0.196	-0.115
Ingn_teen	(0.191)	(0.181)	(0.168)	(0.172)	(0.189)	(0.197)	(0.192)	(0.240)	(0.183)
Medium_high_	0.310**	0.244*	0.251*	0.0810	0.137	0.493***	0.497***	-0.153	-0.0565
tech	(0.154)	(0.145)	(0.137)	(0.139)	(0.156)	(0.165)	(0.164)	(0.207)	(0.152)

 Table 4 Determinants of cooperation strategies for innovation (multivariate probit model)

		Suppliers	Related						
	Customers	of raw	value chain	Providers	Rival	Research	University	Consulting	Public
	Customers	matariala	value-cham	of services	firms	org.	University	firms	authorities
	0.129	materials	members	0.190	0.0622	0.267	0.0156	0.471**	0.204*
Medium_low_	0.128	0.178	0.3/8***	0.189	0.0623	0.267	-0.0156	-0.4/1***	-0.304*
tech	(0.150)	(0.141)	(0.134)	(0.136)	(0.154)	(0.168)	(0.1/6)	(0.238)	(0.160)
Foreign	-0.324	-0.472**	-0.134	-0.223	0.0757	-0.367	-0.107	0.238	-0.102
8	(0.202)	(0.195)	(0.197)	(0.201)	(0.223)	(0.239)	(0.231)	(0.266)	(0.212)
State	-0.184	-0.294*	0.327**	0.0966	-0.0282	0.374**	0.205	0.0490	0.337**
State	(0.172)	(0.163)	(0.155)	(0.157)	(0.182)	(0.174)	(0.175)	(0.209)	(0.162)
Growth_1	0.0100	0.0768	-0.0128	0.255	0.429	0.606*	-0.0519	-0.705	0.102
(>30% decrease)	(0.356)	(0.306)	(0.288)	(0.302)	(0.327)	(0.348)	(0.361)	(0.698)	(0.321)
Growth_2	0.00763	0.340*	-0.0909	0.472**	0.235	0.563**	0.0264	-0.147	-0.175
(10- 30% decrease)	(0.219)	(0.199)	(0.188)	(0.197)	(0.217)	(0.225)	(0.216)	(0.304)	(0.210)
Growth 3	-0.0862	0.257*	-0.191	0 376**	0.167	0.0502	-0 294*	0.122	-0.224
(1/10%)	(0.168)	(0.152)	(0.140)	(0.162)	(0.177)	(0.185)	(0.172)	(0.233)	(0.161)
(+/- 10%)	(0.108)	(0.132)	(0.149)	(0.102)	(0.177)	(0.165)	(0.172)	(0.233)	(0.101)
Growth_4	0.0277	0.285	0.128	0.348*	0.184	0.289	-0.237	-0.0222	-0.116
(10-30%	(0.212)	(0.195)	(0.185)	(0.198)	(0.215)	(0.219)	(0.212)	(0.286)	(0.203)
increase)	0.447	0.452*	0.012	0.200	0.201	0 (20**	0.70.4**	0.292	0.267
Growth_5	-0.447	-0.453*	-0.213	0.306	0.321	0.630**	-0.794**	0.282	-0.367
(>30% increase)	(0.295)	(0.273)	(0.283)	(0.283)	(0.300)	(0.308)	(0.353)	(0.378)	(0.308)
ROS2 (0-2%)	-0.0729	0.0287	0.713***	0.221	0.304	-0.427	-0.555**	0.144	-0.0806
()	(0.262)	(0.229)	(0.238)	(0.227)	(0.263)	(0.263)	(0.258)	(0.345)	(0.234)
ROS3 (2-5%)	-0.0835	-0.0923	0.415*	0.149	0.188	-0.0256	-0.385*	-0.0351	-0.100
11000 (2 0 /0)	(0.245)	(0.212)	(0.225)	(0.212)	(0.244)	(0.237)	(0.232)	(0.319)	(0.216)
ROS4 (5-10%)	-0.233	-0.0404	0.597***	0.127	0.169	-0.131	-0.402*	-0.0835	-0.305
1100 (0 10/0)	(0.249)	(0.216)	(0.228)	(0.214)	(0.248)	(0.240)	(0.236)	(0.319)	(0.222)
ROS5 (> 10%)	-0.454*	-0.0365	0.348	0.0316	0.0416	-0.0485	0.0145	-0.0819	-0.145
	(0.256)	(0.227)	(0.237)	(0.226)	(0.262)	(0.251)	(0.246)	(0.330)	(0.232)
Level of competition	0.102	0.100	0.0001	0.100	0.010#	0.000	0.005	0.0474	0.0507
C monopoly	-0.193	-0.190	0.0881	-0.103	-0.310*	0.0936	-0.235	-0.0474	-0.0605
	(0.152)	(0.143)	(0.140)	(0.142)	(0.167)	(0.161)	(0.165)	(0.218)	(0.157)
C oligopoly	-0.00685	-0.0111	0.00277	-0.0341	-0.0866	-0.00326	0.0693	0.0162	-0.0////
	(0.128)	(0.121)	(0.113)	(0.114)	(0.127)	(0.132)	(0.132)	(0.174)	(0.126)
M regional	0.175	-0.223	0.0864	-0.0800	0.555**	0.0282	0.179	-0.156	0.422*
- 0	(0.210)	(0.200)	(0.193)	(0.191)	(0.258)	(0.275)	(0.338)	(0.313)	(0.241)
M national	0.101	-0.121	-0.0218	-0.137	0.681***	0.337	0.666**	0.0139	0.515**
	(0.202)	(0.192)	(0.184)	(0.184)	(0.251)	(0.257)	(0.318)	(0.290)	(0.231)
M foreign	0.203	-0.191	-0.179	-0.293	0.588**	0.398	0.566*	0.270	0.504*
	(0.240)	(0.224)	(0.214)	(0.214)	(0.278)	(0.280)	(0.338)	(0.321)	(0.259)
A price	-0.202	0.213*	-0.0540	-0.0309	0.119	0.0735	-0.00901	-0.000699	-0.114
	(0.126)	(0.122)	(0.114)	(0.115)	(0.125)	(0.132)	(0.135)	(0.1/1)	(0.127)
A_quality	(0.206)	0.305*	0.240	0.185	0.280	-0.293	-0.110	0.859***	-0.0190
A 16	(0.200)	(0.202)	(0.178)	(0.180)	(0.191)	(0.218)	(0.214)	0.108	(0.190)
A_noverty	0.0840	0.0971	0.217*	0.104	0.0210	0.129	-0.174	-0.108	-0.0180
	(0.146)	(0.139)	(0.129)	(0.128)	(0.144)	(0.152)	(0.159)	(0.193)	(0.143)
A_customization	-0.478**	-0.00928	0.0374	-0.211	-0.0133	-0.151	-0.0938	0.247	-0.221
	(0.203)	(0.210)	(0.191)	(0.191)	(0.207)	(0.222)	(0.227)	(0.250)	(0.212)
A_delivery_times	0.437	0.0512	0.698***	-0.193	0.623***	-0.0566	0.138	-0.315	-0.791***
	(0.308)	(0.242)	(0.233)	(0.241)	(0.236)	(0.273)	(0.256)	(0.338)	(0.304)
A_services	-0.0538	-0.0620	0.0379	0.0646	-0.0358	-0.143	0.0302	0.0333	0.126
	(0.190)	(0.181)	(0.168)	(0.165)	(0.193)	(0.195)	(0.189)	(0.250)	(0.182)
A_other	0.162	0.133	0.235	0.152	0.0890	0.0885	-0.00360	0.281	0.0982
	(0.246)	(0.220)	(0.212)	(0.210)	(0.237)	(0.253)	(0.246)	(0.304)	(0.231)
Technological oppor	tunity								
High_int	0.124	0.0841	-0.116	-0.137	-0.157	0.0253	0.0574	-0.319	-0.219
	(0.189)	(0.178)	(0.172)	(0.172)	(0.196)	(0.199)	(0.204)	(0.258)	(0.191)
Medium int	0.208	0.256*	0.101	-0.0764	0.00721	0.0288	0.273*	0.110	-0.0446
	(0.147)	(0.140)	(0.134)	(0.136)	(0.157)	(0,160)	(0.163)	(0,195)	(0,149)
Low int	0.0/89	0.0255	0.0946	-0.0578	0.171	0.0327	0.0966	_0 119	-0.0827
LOw_IIIt	(0.147)	(0.129)	(0.120)	-0.0370	(0.155)	(0.1(2))	(0.166)	-0.119	-0.0627
1	(0.14/)	(0.158)	(0.130)	(0.130)	(0.155)	(0.162)	(0.100)	(0.211)	(0.150)

Regular R&D	-0.265**	-0.155	0.108	-0.105	0.150	-0.0169	-0.142	0.229	0.172
	(0.124)	(0.115)	(0.109)	(0.110)	(0.123)	(0.128)	(0.131)	(0.166)	(0.121)
Product_inn	0.0988	0.129	-0.181	0.126	0.310*	-0.153	-0.0668	-0.285	-0.0638
	(0.151)	(0.143)	(0.140)	(0.145)	(0.172)	(0.165)	(0.169)	(0.212)	(0.156)
Process_inn	0.128	0.134	0.305**	0.322**	0.0462	-0.0192	-0.128	0.266	0.0790
	(0.148)	(0.140)	(0.140)	(0.144)	(0.163)	(0.165)	(0.161)	(0.220)	(0.155)
Product_long	0.138	0.106	-0.116	0.0944	0.254	0.121	-0.111	-0.0957	0.226
D 1	(0.159)	(0.148)	(0.142)	(0.141)	(0.159)	(0.156)	(0.162)	(0.212)	(0.149)
Process_long	-0.0445	-0.0952	-0.158	0.214	-0.1//	0.196	0.284*	0.294	0.272*
Abcomptive conseits	(0.105)	(0.132)	(0.149)	(0.146)	(0.109)	(0.104)	(0.103)	(0.209)	(0.138)
Staff high	-0.00251	-0.00202	0.000377	-0.00188	0.00149	0.00327	0.00103	0.00221	0.00284
Stari_ingi	(0.00238)	(0.00202)	(0.00215)	(0.00221)	(0.0014)	(0.00253)	(0.00254)	(0.00316)	(0.00238)
Culture coop	0.323**	-0.00962	0.182*	0.262**	0.0776	0.296**	0.209	0.349**	0.174
external	(0.128)	(0.119)	(0.110)	(0.111)	(0.125)	(0.126)	(0.129)	(0.167)	(0.123)
Culture coop	-0.00924	0.117	0.0566	-0.0285	0.259**	0.169	-0.170	-0.0847	-0.0750
procedures	(0.127)	(0.120)	(0.111)	(0.113)	(0.125)	(0.126)	(0.132)	(0.171)	(0.124)
Culture acon	0.265***	0 220**	0.0276	0.260**	0.200**	0.0777	0.0337	0.00526	0.122
Culture_coop_	(0.119)	(0,110)	(0.104)	(0.106)	(0.119)	(0.120)	(0.120)	-0.00320	(0.1122)
internal	(0.119)	(0.110)	(0.104)	(0.100)	(0.119)	(0.120)	(0.120)	(0.152)	(0.114)
Own_effort	-0.0237	0.0335	-0.194* (0.102)	-0.141	-0.181	-0.085***	-0.412***	-0.257*	0.0177
Imp internal	(0.114)	0.160	0.0560	0.157	0.113)	0.0801	0.119)	(0.143)	0.240
nnp_nnernal_	(0.202)	(0.193)	(0.182)	(0.137	(0.222)	(0.225)	(0.238)	(0.257)	(0.199)
K&D	0.0580	0.128	(0.162)	(0.165)	0.597***	0.215	0.101	(0.237)	(0.177)
Imp_manuf_	0.0580	-0.128	0.316*	0.325*	0.58/***	(0.215	(0.222)	0.0889	0.0511
departments	(0.200)	(0.191)	(0.182)	(0.164)	(0.210)	(0.227)	(0.232)	(0.238)	(0.199)
Imp_marketimg	-0.167	0.0946	0.0952	-0.254**	-0.151	-0.173	-0.0353	-0.287	-0.174
	(0.134)	(0.128)	(0.120)	(0.124)	(0.139)	(0.141)	(0.141)	(0.189)	(0.138)
client									
Imp_manag_	0.111	-0.0338	-0.334**	-0.0561	-0.143	0.0374	0.0802	0.273	0.0192
stakeholders	(0.156)	(0.143)	(0.147)	(0.144)	(0.169)	(0.169)	(0.171)	(0.210)	(0.156)
Imp_informal	0.301**	0.00359	-0.0285	0.270**	0.0107	-0.270*	-0.0469	-0.265	-0.0740
	(0.130)	(0.120)	(0.116)	(0.116)	(0.131)	(0.145)	(0.143)	(0.195)	(0.131)
Outbound	-0.147	0.0282	0.0105	0.116	-0.139	0.111	-0.238*	0.380**	-0.0979
Knowledge flow	(0.113)	(0.108)	(0.104)	(0.105)	(0.119)	(0.121)	(0.125)	(0.156)	(0.117)
Appropriability con	nditions		P		P			1	
App_formal	-0.176	0.118	0.0407	0.0780	0.0379	0.393***	0.137	0.373**	0.0457
	(0.121)	(0.112)	(0.110)	(0.111)	(0.127)	(0.133)	(0.132)	(0.187)	(0.121)
	(0.121)	0.112)	0.000		0.0782	0.255*	0.486***	0.187	0.242**
App_informal	0.332***	0.112	0.202*	0.365***	(0.122)	(0.120)	(0.122)	(0.170)	(0.121)
App_informal	(0.121) 0.332*** (0.121) 0.678*	0.112 (0.114)	0.202* (0.109)	0.365*** (0.111)	(0.122)	(0.130)	(0.133)	(0.170)	(0.121)
App_informal Constant	(0.121) 0.332*** (0.121) 0.678* (0.402)	0.112 0.112 (0.114) 0.0675	0.202* (0.109) -1.334***	0.365*** (0.111) -1.557***	(0.122) -2.113***	(0.130) -2.139***	(0.133) -1.644***	(0.170) -2.440***	(0.121) -1.557***
App_informal Constant	(0.121) 0.332*** (0.121) 0.678* (0.403)	$\begin{array}{c} (0.112) \\ \hline 0.112 \\ (0.114) \\ \hline 0.0675 \\ (0.374) \end{array}$	0.202* (0.109) -1.334*** (0.377)	0.365*** (0.111) -1.557*** (0.378)	(0.122) -2.113*** (0.453)	(0.130) -2.139*** (0.450)	(0.133) -1.644*** (0.477)	(0.170) -2.440*** (0.569)	(0.121) -1.557*** (0.405)
App_informal Constant	(0.121) 0.332*** (0.121) 0.678* (0.403)	$\begin{array}{c} (0.112) \\ 0.112 \\ (0.114) \\ 0.0675 \\ (0.374) \end{array}$	0.202* (0.109) -1.334*** (0.377)	0.365*** (0.111) -1.557*** (0.378)	(0.122) -2.113*** (0.453)	(0.130) -2.139*** (0.450)	(0.133) -1.644*** (0.477)	(0.170) -2.440*** (0.569)	(0.121) - 1.557 *** (0.405)
App_informal Constant	(0.121) 0.332*** (0.121) 0.678* (0.403) Rho1	0.112 (0.114) 0.0675 (0.374) Rho2	0.202* (0.109) -1.334*** (0.377) Rho3	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440**** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261***	0.112 (0.114) 0.0675 (0.374) Rho2	0.202* (0.109) -1.334*** (0.377) Rho3	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694)	0.112 (0.114) 0.0675 (0.374) Rho2	0.202* (0.109) -1.334*** (0.377) Rho3	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694) 0.146**	0.112 (0.114) 0.0675 (0.374) Rho2 0.368***	0.202* (0.109) -1.334*** (0.377) Rho3	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694) 0.146** (0.0683)	0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693)	0.202* (0.109) -1.334*** (0.377) Rho3	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3 Rho /4	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694) 0.146** (0.0683) 0.255***	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510***	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3 Rho /4	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694) 0.146** (0.0683) 0.255*** (0.0722)	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675)	0.365*** (0.111) -1.557*** (0.378) Rho4	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3 Rho /4 Rho /5	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261**** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581***	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378***	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595****	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /3 Rho /4 Rho /5	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106)	0.112 0.112 0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737)	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786)	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416	0.112 0.112 0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187***	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202***	(0.122) -2.113*** (0.453) Rho5	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716)	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706)	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802)	(0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295***	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191**	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181**	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274***	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277***	0.130) -2.139*** (0.450) Rho6	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906)	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181**	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749)	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832)	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906)	(0.133) -1.644*** (0.477) Rho7	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0906) 0.0110	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287***	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454***	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309***	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.302***	(0.133) -1.644*** (0.477) Rho7 	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110	0.112 0.112 0.114 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 0.125	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287***	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454***	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309***	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393***	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120)	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0906) -0.0110 (0.102)	0.112 0.112 0.114 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144*	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0716) 0.181** (0.0726) 0.287*** (0.0952)	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0786) 0.274*** (0.0749) 0.454*** (0.0966)	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.255***	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393*** (0.106) 0.1105***	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.72***	(0.170) -2.440*** (0.569) Rho8	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0906) -0.0110 (0.102) 0.169**	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.25.57)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454*** (0.0966) 0.231***	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.275	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.257)	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.20)	(0.170) -2.440*** (0.569) Rho8 0.546***	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /4 Rho /6 Rho /7 Rho /8 Rho /9	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.106) 0.0416 (0.0906) -0.0110 (0.102) 0.169** (0.0784)	0.112 0.112 0.114 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765)	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669)	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0786) 0.274*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672)	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795)	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798)	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894)	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111)	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9 * significant at 10	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110 (0.102) 0.169** (0.0784) %; ** signific.	0.112 0.112 0.114 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765) ant at 5%; ***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669) * significant at	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0786) 0.274*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672) 11%	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795)	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798)	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894)	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111)	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9 * significant at 100 Standard errors in	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110 (0.102) 0.169** (0.0784) %; ** signific parentheses	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765) ant at 5%; ***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669) * significant at	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672) 11%	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795)	0.130) -2.139*** (0.450) Rho6 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798)	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894)	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111)	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9 * significant at 100 Standard errors in Number of observa-	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110 (0.102) 0.169** (0.0784) %; ** signific parentheses ations = 805	0.112 0.112 (0.114) 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765) ant at 5%; ***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669) * significant at	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672) 11%	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795)	0.130) -2.139*** (0.450) Rho6 0.450) 0.450) 0.450) 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798)	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894)	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111)	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9 * significant at 100 Standard errors in Number of observa Likelihood ratio te	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110 (0.102) 0.169** (0.0784) %; ** signific parentheses ations = 805 est of rho21 =	0.112 0.112 0.112 0.112 0.0675 (0.374) Rho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.0968 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765) ant at 5%; ***	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669) * significant at	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0706) 0.274*** (0.0749) 0.454*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672) 11%	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795) 0.81= rho91=	0.130) -2.139*** (0.130) -2.139*** (0.450) Rho6 0.450) 0.450) 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798) rho32= rho42	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894) = rho52= rho0	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111) 62= rho72= rh	(0.121) -1.557*** (0.405)
App_informal Constant Rho /2 Rho /2 Rho /3 Rho /4 Rho /5 Rho /6 Rho /7 Rho /8 Rho /9 * significant at 100 Standard errors in Number of observa Likelihood ratio te rho92= rho43= rho	0.121) 0.332*** (0.121) 0.678* (0.403) Rho1 0.261*** (0.0694) 0.146** (0.0683) 0.255*** (0.0722) 0.581*** (0.0722) 0.581*** (0.106) 0.0416 (0.0809) 0.295*** (0.0906) -0.0110 (0.102) 0.169** (0.0784) %; ** signific parentheses ations = 805 st of rho21 = p53= rho63= r	0.112 0.112 0.112 0.112 0.112 0.112 0.0675 0.374) R ho2 0.368*** (0.0693) 0.511*** (0.0765) 0.525*** (0.0950) 0.525*** (0.0950) 0.598 (0.0763) 0.191** (0.0837) 0.121 (0.105) 0.144* (0.0765) ant at 5%; *** r ho31= rho41 ho73= rho83=	0.202* (0.109) -1.334*** (0.377) Rho3 0.510*** (0.0675) 0.378*** (0.0737) 0.187*** (0.0716) 0.181** (0.0726) 0.287*** (0.0952) 0.108 (0.0669) * significant at = rho51= rho6 = rho51= rho6	0.365*** (0.111) -1.557*** (0.378) Rho4 0.595*** (0.0786) 0.202*** (0.0786) 0.274*** (0.0749) 0.454*** (0.0749) 0.454*** (0.0966) 0.231*** (0.0672) 11%	(0.122) -2.113*** (0.453) Rho5 0.258*** (0.0802) 0.277*** (0.0832) 0.309*** (0.109) 0.376*** (0.0795) 0.81= rho91= 074= rho84= 1	0.130) -2.139*** (0.130) -2.139*** (0.450) Rho6 0.450) 0.450) 0.762*** (0.0906) 0.393*** (0.106) 0.418*** (0.0798) rho32= rho42 rho94= rho65:	(0.133) -1.644*** (0.477) Rho7 0.541*** (0.120) 0.673*** (0.0894) = rho52= rho6 = rho75= rho8	(0.170) -2.440*** (0.569) Rho8 0.546*** (0.111) 62= rho72= rh 35= rho95= rho	(0.121) -1.557*** (0.405)

rho86= rho96= rho87= rho97= rho98 = 0: chi2(36) = 566.706 Prob > chi2 = 0.0000

The analysis of factors determining the geographical pattern of cooperation (see Table 5) revealed that state-owned high-tech firms prefer to develop national and global cooperative networks, while young companies with low operating profit margins companies that implement most of innovations on their own and recognize the importance of internal R&D have small cooperation networks and collaborate mostly with clients and suppliers.

Absence of competitive advantage in price and timely delivery discourage firms to develop national networking, but subject to the availability of public support and effective mechanisms of IP protection. Enterprises performing innovation activity on a regular basis motivates cooperate within a global value chain while taking full advantage of the potential offered by local universities and research organizations.

 Table 5 Determinants of innovation cooperation geographical scope (marginal effects)

		Global value chain		Broader networking				
	Regional value-chain	and local knowledge	National networking	and national				
		providers		knowledge base				
Base outcome	vs clients and suppliers							
Firm-specific characteristics								
Log size	0.00219	0.00365	0.0111	-0.00652				
105_5120	(0.0453)	(0.0375)	(0.00997)	(0.304)				
Age less 5	-0.143	0.0990	-0.0738	0.0114				
1190_1000 0	(0.189)	(0.272)	(0.0991)	(0.527)				
High tech	0.283	-0.0864	0.0856	0.000786				
Ingn_teen	(0.411)	(0.119)	(0.133)	(0.0396)				
Medium high tech	0.159	-0.0493	0.0331	0.00773				
	(0.318)	(0.0429)	(0.0862)	(0.360)				
Medium low tech	0.0765	-0.0653	-0.0139	0.0175				
weatum_low_teen	(0.281)	(0.0320)	(0.0440)	(0.810)				
Foreign	-0.0314	-0.00137	-0.0235	0.00364				
Toregn	(0.0526)	(0.0548)	(0.0355)	(0.170)				
State	0.0210	0.0931	0.0467	0.00293				
State	(0.0716)	(0.170)	(0.0889)	(0.138)				
Growth 1 (>30% decrease)	-0.0379	0.0686	-0.00403	-0.00494				
Glowin_1 (>30%decrease)	(0.111)	(0.114)	(0.0625)	(0.233)				
Growth $2(10-30\%$ decrease)	0.0117	-0.0170	0.0566	-0.00314				
Glowin_2 (10-30% decrease)	(0.0556)	(0.0638)	(0.0813)	(0.148)				
Growth $3(\pm/, 10\%)$	-0.0237	-0.0340	0.00135	0.0114				
Glowm_3 (+/- 10%)	(0.0641)	(0.0462)	(0.0506)	(0.530)				
Growth $4(10-30\%$ increase)	-0.0115	0.0113	-0.0118	0.00579				
Glowin_4 (10-30% increase)	(0.0555)	(0.0760)	(0.0307)	(0.270)				
Growth 5 (>30% increase)	0.0931	0.0460	-0.0639	0.0300				
Growin_5 (>50% mercase)	(0.490)	(0.331)	(0.0725)	(1.360)				
POS2 (0-2%)	-1.171	-0.132	-0.0692	0.997				
KOS2 (0-270)	(0.0787)	(0.0653)	(0.0379)	(0.478)				
POS3(2-5%)	-0.167	-0.133	-0.0680	0.999				
K055 (2-5%)	(0.0706)	(0.0709)	(0.0474)	(0.526)				
POS4(5-10%)	-0.166	-0.150	-0.0673	0.999				
KOS4 (5-10%)	(0.0627)	(0.0538)	(0.0414)	(0.453)				
POS5 (> 10%)	-0.151	-0.132	-0.0731	0.998				
KOS5 (> 10%)	(0.0710)	(0.0622)	(0.0368)	(0.451)				
Level of competitiveness	-							
C monopoly	-0.0257	-0.0193	-0.0141	-0.0115				
	(0.117)	(0.101)	(0.0606)	(0.539)				
Coligonoly	-0.00147	-0.0243	0.00624	-0.0118				
	(0.0924)	(0.109)	(0.0401)	(0.552)				
M regional	0.0789	0.0733	0.0133	0.0637				
	(0.734)	(0.654)	(0.270)	(2.829)				

M_ninclail (0.84) (0.412) (0.234) (0.22) M foreign 0.259 0.0074 0.0230 0.0610 Aprice (0.135) (0.466) (0.222) (0.708) Aprice (0.245) (0.103) (0.0080) (0.0220) (0.2137) Aguality (0.099) (0.0507) (0.0620) (0.225) A_provelly (0.075) (0.0821) (0.0356) (0.356) A_castormization (0.057) (0.0822) (0.0301) (0.144) A_delivery_times (0.0997) (0.0575) (0.0031) (0.144) A_delivery_times (0.0997) (0.0575) (0.0811) (0.0152) A_delivery_times (0.0997) (0.0576) (0.0811) (0.0153) A_services (0.0997) (0.0576) (0.0811) (0.0153) A_services (0.0997) (0.0576) (0.0811) (0.0153) A_services (0.0975) (0.0812) (0.0165) (0.0165) Matimumint (0.0577)		0.189	0.0457	0.0399	0.0576
M. foreign 0.229 0.00974 0.0230 0.02101 A_price 0.0157 -0.0384 -0.02390 0.0289 A_price 0.0157 -0.0814 -0.00480 0.0290 0.00439 A_gnality -0.0841 -0.00480 0.0290 0.0157 A_movelay -0.0070 0.0155 -0.0306 0.0077 A_stromization -0.0542 0.0164 -0.0339 0.0242 0.06971 (0.0070) (0.0201) (0.0171) 0.0242 0.09811 -0.0635 -0.0430 -0.0753 A_services -0.0971 (0.0200) (0.0171) A_other -0.0535 -0.06420 -0.0420 -0.0111 A_other -0.0535 -0.06420 -0.0411 -0.0111 Medium_int -0.0123 -0.0420 -0.0111 -0.0111 Medium_int -0.0532 (0.0353 (0.0182) -0.0111 Medium_int -0.0542 -0.0123 -0.0111 -0.0111 Medium_in	M_national	(0.864)	(0.442)	(0.284)	(2.622)
M_integin (1.35) (0.466) (0.22) (2.708) Aprice (0.0157) (0.013) (0.0089) (0.277) Aqnaliy (0.009) (0.009) (0.020) (0.020) Aqualiy (0.007) (0.0020) (0.020) (0.020) Agrowelly (0.0077) (0.0087) (0.0030) (0.0350) Agrowelly (0.0077) (0.020) (0.030) (0.021) Agrowelly (0.0067) (0.020) (0.031) (1.104) Agrowelly (0.081) (0.0355) (0.0030) (2.347) Agrowelly (0.081) (0.0355) (0.0430) (0.052) Agrowelly (0.087) (0.057) (0.057) (0.057) (0.012) (0.012) Agrowelly (0.0257) (0.0597) (0.051) (0.012) (0.021) Agrowelly (0.0257) (0.0940) (0.0431) (0.259) Medium int (0.0257) (0.0432) (0.026) (0.027) Igh int (0.0257)	M foreign	0.259	0.00974	0.0230	0.0610
Aprice 0.0157 -0.0394 -0.0390 0.0289 A quality -0.0841 -0.00480 0.0299 0.00439 A quality -0.00720 0.00570 0.00350 (0.0255) A, novely -0.00720 0.0156 -0.0306 0.00376 A_customization -0.0542 0.0164 -0.0339 0.0326 A_customization -0.0668 -0.0430 0.0733 A_services -0.0897 0.0829 -0.0331 -0.0113 A_services -0.09977 0.0829 -0.0313 -0.0111 A_services -0.00977 0.0829 -0.0133 -0.0111 Technological opportunity -0.0133 -0.0250 0.0133 (0.0250) Medium_int -0.0133 -0.0250 0.0133 0.0250 0.0132 Iow_int -0.0577 -0.0371 -0.0500 0.0429 Iow_int -0.0571 -0.0633 0.06643 Iow_int -0.0573 0.01661 0.0575 Iow_int	M_loreign	(1.395)	(0.406)	(0.292)	(2.708)
A. Junce (0.245) (0.103) (0.098) (0.137) A. guality -0.0841 -0.00480 0.0299 0.00439 A. noveliy -0.00701 (0.0657) (0.0620) (0.0305) (0.0356) A_noveliy -0.0075 (0.0822) (0.0305) (0.0356) (0.0356) A_customization -0.0524 (0.0164) -0.0330 (0.247) A_delivery_times -0.06971 (0.0699) (0.0592) (0.0315) (0.0111) A_services -0.00526 -0.00520 (0.0429) (0.0007) (0.0897) (0.0817) (0.0817) A_other -0.0536 -0.00692 0.0429 0.0000 (0.0327) A_other -0.0575 (0.0400) (0.0431) (0.0123) (0.0123) Medium_int -0.0257 -0.04021 -0.0250 0.0220 Medium_int -0.0257 -0.06091 -0.0264 0.0324 Medium_int -0.0257 -0.06020 0.00235 -0.0020 Low_jint -0.0	A price	0.0157	-0.0394	-0.00390	0.0289
A_guality -0.0811 -0.00480 0.0299 (0.0439) A_novelty -0.00720 0.0155 -0.0336 (0.025) A_sustamization -0.0542 0.0164 -0.0339 (0.0242) A_custamization -0.0542 0.0164 -0.0339 (0.0242) A_delivery_times 0.0891 -0.0968 -0.0430 (0.0753) A_services -0.0927 0.0829 -0.0331 -0.0111 A_other -0.00927 0.0829 -0.0131 -0.0121 A_other -0.00927 0.0829 -0.0141 -0.00801 A_other -0.00575 (0.00750) (0.0173) -0.0250 Technological oportunity -0.0123 -0.0429 -0.0013 (0.255) Medium_int -0.01257 -0.0131 -0.0250 (0.0132) (0.0142) Low_jint -0.0127 -0.0290 -0.0250 (0.0132) (0.0269) Continuous R&D -0.0547 0.0260 -0.0232 (0.123) Coninuous R&D -	A_price	(0.245)	(0.103)	(0.0958)	(1.327)
C. Junovelly (0.109) (0.0507) (0.0620) (0.020) A_novelly -0.00720 0.0156 -0.0366 0.00767 A_customization -0.0575 (0.0822) (0.0305) (0.0356) A_delivery_times 0.0891 -0.0968 -0.0430 0.0753 A_delivery_times -0.0997 (0.0825) (0.0607) (0.200) A_services -0.00927 (0.0872) (0.0111) (0.012) C0.0997 (0.0877) (0.0877) (0.0877) (0.0111) (0.012) Technological opportunity -0.0120 -0.0141 -0.0056 (0.0977) (0.0251) Medium_int 0.0123 -0.0120 -0.0141 -0.0056 (0.0122) Low_jnt 0.0123 -0.0120 -0.0141 -0.0120 (0.0251) Low_jnt 0.0527 (0.0332) 0.06600 (0.0475) Low_jnt 0.0527 -0.0037 -0.0264 (0.0250) Continuous R&D -0.0547 0.0620 0.08353 0.00631	A quality	-0.0841	-0.00480	0.0209	0.00439
A_novelty -0.00720 0.0156 -0.0306 0.00767 A_eusomization -0.0542 0.0164 -0.0389 0.0325 A_services 0.0891 -0.0068 -0.0130 0.0242 A_services 0.0891 -0.0088 -0.0130 0.0753 A_services -0.00927 0.0829 -0.0315 -0.0111 A_other -0.00971 0.0829 -0.04740 -0.0123 A_other -0.00972 0.0829 -0.0437 -0.00060 A_other -0.00971 (0.0575) (0.0897) 0.00811 -0.0183 Technological opportunity -0.0123 -0.04030 -0.0143 -0.0256 Medium_int 0.0858 -0.0390 0.0152 0.0102 Medium_int 0.0575 -0.0261 0.0290 -0.0290 Continuous R&D -0.0251 (0.0660) 0.0123 -0.0260 Continuous R&D -0.0254 (0.0785) -0.0264 0.0296 Product_inn -0.0244 (0.0155)	A_quanty	(0.109)	(0.0507)	(0.0620)	(0.205)
Number of the second	A novelty	-0.00720	0.0156	-0.0306	0.00767
A_custmization -0.0542 0.0164 -0.0389 0.0242 A_defivery_times 0.0891 -0.0968 -0.0430 0.0753 (0.981) 0.0355 0.06301 (3.247) A_services -0.00927 0.0829 -0.0115 -0.0111 A_other -0.00536 -0.00692 0.0429 0.0000 A_other -0.0536 -0.00692 0.0429 0.0000 Technological opportunity -0.0123 -0.0420 -0.0141 -0.0056 Medium_int 0.0123 -0.0420 -0.0141 -0.0256 Medium_int 0.0257 -0.0037 -0.0260 0.0250 Icoint 0.0257 -0.0037 -0.0260 0.0230 Continuous R&D -0.0547 0.00631 0.00631 0.00631 Continuous R&D -0.0547 0.00600 0.00321 0.0158 Continuous R&D -0.0531 0.00631 0.0059 0.0158 Continuous R&D -0.0141 0.0135 0.00406 0.0241 <td></td> <td>(0.0575)</td> <td>(0.0822)</td> <td>(0.0305)</td> <td>(0.356)</td>		(0.0575)	(0.0822)	(0.0305)	(0.356)
(0.0607) (0.201) (0.1024) (1.104) A_delivery_times 0.0591 -0.00968 -0.0430 0.0753 A_services -0.00927 0.0829 -0.0115 -0.0111 A_services -0.00927 0.0829 -0.0155 -0.0112 A_other -0.0356 -0.00892 0.0429 0.0000 (0.0870) (0.0871) (0.0870) (0.0811) (0.0123) Technological opportunity -0.0420 -0.0441 -0.00546 (0.0125) (0.0475) (0.0440) (0.0453) (0.0226) Medium_ini 0.0225 (0.0332) (0.0660) (0.475) Low_int (0.324) (0.163) (0.0422) (1.329) Continuous R&D -0.0547 0.0620 0.00335 0.00631 (0.0451) (0.125) (0.04981 -0.0298 0.0158 (0.0452) (0.0453) (0.0533) (0.0591 -0.00321 Process_inn -0.0414 0.0182 -0.00832 -0.00323 -0.00323 <td>A_customization</td> <td>-0.0542</td> <td>0.0164</td> <td>-0.0389</td> <td>0.0242</td>	A_customization	-0.0542	0.0164	-0.0389	0.0242
A_delivery_times 0.0891 -0.0968 -0.0430 0.0733 A_services -0.00927 0.0829 -0.0315 -0.0111 A_services -0.00990 (0.0552) (0.0746) (0.057) A_other -0.0056 -0.00692 0.04129 -0.0000 Technological opportunity -0.0123 -0.0420 -0.0141 -0.00566 Technological opportunity -0.0255 -0.0420 -0.0141 -0.00566 Medium_int -0.0257 -0.09091 -0.0152 -0.0102 (0.027) -0.090917 -0.0206 -0.0256 Low_int -0.0527 -0.090917 -0.0206 -0.0632 Continuous R&D -0.01547 -0.0620 -0.00335 -0.00631 Continuous R&D -0.01547 -0.00981 -0.0158 -0.00546 -0.01414 -0.0159 -0.00535 -0.00631 Product_inn -0.00458 -0.00981 -0.00535 -0.0158 -0.01414 -0.0159 -0.00593 -0.0159		(0.0607)	(0.200)	(0.0241)	(1.104)
(0.981) (0.0355) (0.0630) (3.247) A_services -0.00927 -0.0859 -0.01315 -0.0111 (0.0999) (0.0576) (0.0746) (0.0525) A_other -0.0536 -0.00692 0.0429 0.0000 Technological opportunity (0.0877) (0.00746) (0.0181) (0.0182) Technological opportunity (0.0575) (0.0940) (0.0453) (0.256) Medium, int 0.0888 -0.0300 0.0152 0.0102 Low_int 0.0527 -0.00937 -0.0260 0.0290 Continuous R&D -0.0547 0.0620 0.00835 0.06544 (0.0454) (0.135) (0.0402) (0.296) Product_inn 0.04454 -0.0391 -0.00818 -0.0391 (0.111) (0.185) (0.0460) (0.742) Process inn -0.0414 0.0333 0.0533 -0.0519 Product_long -0.00933 0.0333 0.0540 -0.0311 Process_long -0.	A_delivery_times	0.0891	-0.0968	-0.0430	0.0753
A_services 0.00927 0.0829 0.0315 0.0111 0.09990 (0.0579) (0.0746) (0.555) A_other -0.0536 0.00692 0.0429 0.0001 Technological opportunity (0.0877) (0.0811) (0.0181) (0.0182) Technological opportunity (0.0575) (0.0420) (0.0433) (0.256) Medium_int (0.0527) (0.0930) (0.0152) (0.0175) Low_int (0.0527) (0.0937) -0.0260 (0.027) Continuous R&D -0.0521 (0.0421) (1.329) Continuous R&D -0.0547 (0.0402) (0.0286) Product_inn (0.0458 -0.0981 (0.0402) (0.296) Procus_inn (0.0441 (0.182) (0.0835) (0.121) Product_long (0.0602) (0.182) (0.0635) (0.261) Product_long (0.0602) (0.143) (0.0635) (0.261) Product_long (0.00033 (0.00033) (0.0635) (0.261)		(0.981)	(0.0355)	(0.0630)	(3.247)
(0.0999) (0.052) (0.0746) (0.052) A_other -0.0536 -0.00692 (0.081) (0.081) Technological opportunity -0.01429 (0.081) (0.0182) Technological opportunity -0.0420 -0.0141 -0.00566 Medium_int (0.0575) (0.0940) (0.0453) (0.256) Medium_int (0.0527) (0.00660) (0.0475) (0.020) Low_int (0.0527) (0.0073) (0.0542) (1.329) Continuous R&D -0.0447 (0.0620) (0.0433) (0.0296) Product_inn (0.0454) (0.135) (0.0402) (0.296) Process_inn -0.0414 (0.0359) -0.00362 (0.021) Process_inn -0.0414 (0.0359) (0.061) (0.051) Product_long (0.0602) (0.145) (0.051) (0.021) Product_long (0.0602) (0.145) (0.0540) (0.021) Product_long (0.0602) (0.0455) (0.021) (0.021) <td>A_services</td> <td>-0.00927</td> <td>0.0829</td> <td>-0.0315</td> <td>-0.0111</td>	A_services	-0.00927	0.0829	-0.0315	-0.0111
A.other -0.0536 -0.06902 0.0429 0.00001 Technological opportunity -		(0.0999)	(0.0592)	(0.0746)	(0.525)
(0.0897) (0.0876) (0.0811) (0.0812) Technological opportunity 0.0123 -0.0420 -0.0141 -0.09546 High_int 0.0123 0.0420 -0.0141 -0.09546 Medium_int 0.0888 -0.0300 0.0152 0.0102 Low_int 0.0527 -0.00370 -0.0260 0.0220 Continuous R&D -0.0547 0.0620 0.00835 0.00634 (0.0155) (0.0442) (0.135) (0.0402) (0.296) Product_inn 0.00458 -0.00981 -0.0280 0.0158 (0.0141) (0.182) (0.0405) (0.0405) (0.296) Process_inn -0.0414 0.0359 -0.00362 0.0234 (0.06012) (0.145) (0.06835) (1.105) Process_long -0.00933 0.0333 0.0593 0.0261 Outodis3 0.0633 0.0593 0.00161 0.00490 Culture_coop_external 0.0309 0.00141 (0.00409 0.0122 <t< td=""><td>A_other</td><td>-0.0536</td><td>-0.00692</td><td>0.0429</td><td>0.0000</td></t<>	A_other	-0.0536	-0.00692	0.0429	0.0000
Technological opportunity Image: State		(0.0897)	(0.0576)	(0.0811)	(0.0182)
High_int 0.0123 -0.0420 -0.0141 -0.00546 Medium_int (0.0575) (0.0400) (0.0453) (0.0256) Medium_int 0.0527 (0.0332) (0.0660) (0.475) Low_int (0.0527) (0.00937) (-0.0260) (0.0542) Continuous R&D (0.0547) (0.0660) (0.0542) (0.329) Continuous R&D (0.0547) (0.0200) (0.0298) (0.0053) Orduct_inn (0.0458) (0.00981) (0.0298) (0.0158) Orduct_inn (0.0414) (0.0359) (0.0406) (0.742) Process_inn (0.141) (0.182) (0.0835) (1.105) Product_long (0.0602) (0.145) (0.0533) (0.021) Process_long (0.0602) (0.145) (0.0533) (0.0221) Process_long (0.0601) (0.0455) (0.0533) (0.02114) Outot1_cong_internal (0.0145) (0.0533) (0.02114) (0.00490) culture_coog_procedures (0.117)<	Technological opportunity		1	-	
(0.0575) (0.0940) (0.0433) (0.256) Medium_int (0.0888 -0.0390 0.0152 0.0102 Low_int (0.0257) -0.00937 -0.0260 (0.0290) Low_int (0.324) (0.166) (0.0542) (1.329) Continuous R&D -0.0547 (0.0620) (0.0835) (0.00634) (0.0454) (0.135) (0.0402) (0.226) Product_inn -0.00458 -0.00981 -0.0298 (0.0178) Process_inn -0.00414 (0.0355) (0.0142) (0.0363) (0.0160) Product_long (0.0602) (0.145) (0.0535) (0.261) Process_long -0.00933 (0.0333 (0.0533) (0.021) Process_long -0.00015 (0.0540) (0.0381) Outfly (0.00145) -0.0001 (0.00494) (0.00105 Culture_coop_external (0.0360) (0.00145) (0.0373) (0.0232) -0.0021 Culture_coop_internal (0.0118) -0.0120 (0.0	High_int	0.0123	-0.0420	-0.0141	-0.00546
Medium_int 0.0888 0.0390 0.0152 0.0102 Low_int (0.225) (0.0321) (0.0660) (0.475) Low_int 0.0527 -0.00937 -0.0260 0.0290 Continuous R&D -0.0547 0.0620 0.00835 0.00634 (0.0454) (0.135) (0.0400) (0.742) Product_inn -0.00458 -0.00981 -0.0298 0.0158 (0.125) (0.0978) -0.0208 0.0158 (0.125) (0.0978) -0.0362 0.0234 (0.141) (0.182) (0.0835) (1.105) Process_inn -0.0414 0.0359 -0.0052 0.0169 Process_long -0.00933 0.0333 0.0535 (0.261) Process_long -0.00933 0.0333 0.00535 (0.0261) Colume_cop_external 0.0309 0.0205 0.0322 0.00611 Colume_cop_external 0.0153 -0.0205 0.0323 -0.0023 culture_cop_internal 0.0118 <t< td=""><td></td><td>(0.0575)</td><td>(0.0940)</td><td>(0.0453)</td><td>(0.256)</td></t<>		(0.0575)	(0.0940)	(0.0453)	(0.256)
(0.225) (0.0332) (0.060) (0.475) Low_int (0.0527) -0.0260 0.0290 (0.324) (0.166) (0.0542) (1.329) Continuous R&D -0.0547 0.0620 0.00835 0.00634 (0.0454) (0.155) (0.0402) (0.296) Product_inn 0.00458 -0.00981 -0.0288 0.0158 (0.125) (0.0473) (0.0406) (0.742) Process_inn -0.0414 0.0359 -0.00362 0.0234 Product_long 0.00363 0.0639 0.0169 0.00559 (0.0801) (0.0455) (0.0593) -0.00812 Process_long -0.00933 0.0333 0.0693 -0.00812 Inter_coop_external (0.000145) -0.0001 0.00494 0.00105 Culture_coop_external (0.0363) (0.0753) (0.0730) (0.285) culture_coop_internal (0.0148) -0.0020 0.0189 -0.0122 culture_coop_internal (0.017) (0.0573)	Medium_int	0.0888	-0.0390	0.0152	0.0102
Low_int 0.0527 -0.00937 -0.0260 0.0290 0.0324) (0.166) (0.0542) (1.329) Comtinuous R&D -0.0547 0.0620 0.00835 0.00634 0.0458) -0.00981 -0.0298 0.0158 Product_inn 0.00458 -0.00981 -0.0208 0.0158 0.0125) (0.0978) (0.0406) (0.742) Process_inn -0.0414 0.0359 -0.00362 0.0234 0.0141 (0.182) (0.0835) (1.105) Process_long -0.00933 0.0333 0.0593 -0.00812 0.00602) (0.145) (0.0540) (0.081) Absorptive capacity	- · ·	(0.225)	(0.0332)	(0.0660)	(0.475)
(0.324) (0.166) (0.0842) (1.329) Continuous R&D -0.0547 0.0620 0.00835 0.00634 Product_inn 0.00458 -0.00981 -0.0298 0.0158 Process_inn -0.0144 0.0359 -0.00362 0.0234 Process_inn -0.0141 0.0359 -0.00362 0.0234 Product_long 0.00363 0.0639 0.0169 0.00559 Process_long -0.00933 0.0333 0.0533 -0.0611 Process_long -0.00001 (0.0455) (0.0540) (0.381) Absorptive capacity - - - - Staff_high 0.000415 -0.00001 0.000490 - (0.00148) (0.000869) (0.0114) (0.00490) culture_coop_procedures 0.0153 -0.0223 -0.00052 culture_coop_internal 0.0118 -0.0189 -0.0123 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0121 -0.0583 culture_coo	Low_int	0.0527	-0.00937	-0.0260	0.0290
Continuous RefD -0.0847 0.0620 0.00453 0.00634 (0.0454) (0.135) (0.0402) (0.296) Product_inn -0.0948 -0.09981 -0.0298 0.0158 (0.125) (0.0978) (0.0406) (0.742) Process_inn -0.0414 0.0359 -0.00362 0.0234 (0.141) (0.182) (0.0835) (1.105) Process_iong -0.00933 0.0333 0.0593 -0.00812 (0.0602) (0.145) (0.0535) (0.261) Process_iong -0.00933 0.0333 0.0593 -0.00812 (0.0602) (0.145) (0.0549) (0.01014 (0.00105 (0.0801) (0.0455) (0.053) (0.021 (0.0105 (0.0148) (0.000869) (0.0114) (0.000490 (0.0105 (ulture_coop_external 0.0313 -0.0221 0.00614 (0.00148) (0.0226) (0.0235) (0.245) (ulture_coop_internal 0.0118 -0.018 -0.0223 -0.0		(0.324)	(0.166)	(0.0542)	(1.329)
Internation (0.043) (0.13) (0.0402) (0.0402) Product_inn (0.0458 (-0.0981) (-0.0406) (0.742) Process_inn (-0.0414) (0.0359) (-0.0362) (0.0234) (0.141) (0.182) (0.0355) (1.105) Product_long (0.0602) (0.145) (0.0535) (0.261) Process_long (-0.0933 (0.0333) (0.0535) (0.0261) Absorptive capacity (0.0801) (0.04055) (0.0540) (0.0381) Absorptive capacity (0.000148) (0.000869) (0.00114) (0.000105 culture_coop_external (0.0953) (0.0753) (0.0730) (0.285) culture_coop_internal (0.0113) -0.0220 0.0189 0.0122 (0.117) (0.0518) (0.0770) (0.568) (0.125) (0.0573) culture_coop_internal (0.0118) -0.0189 -0.0223 -0.00524 (0.117) (0.0518) (0.0753) (0.245) (0.0236) own_effort	Continuous R&D	-0.054/	0.0620	0.00835	0.00634
Product_lini 0.00438 -0.0081 0.0028 0.0135 0(125) (0.0978) (0.0406) (0.742) Process_inn -0.0414 0.0359 -0.00362 0.0234 0(141) (0.182) (0.0305) (1.105) Process_iong -0.00436 0.0639 0.0169 0.00559 (0.0602) (0.145) (0.0535) (0.261) Process_iong -0.00933 0.0333 0.0593 -0.00812 (0.0801) (0.0445) (0.0540) (0.0381) Absorptive capacity - - 0.00014 (0.00490) culture_coop_external 0.0309 0.0205 0.0322 0.00611 culture_coop_procedures -0.0153 -0.0205 0.0322 0.00611 culture_coop_internal 0.0118 -0.0123 -0.0023 -0.0023 culture_coop_internal 0.0118 -0.0123 -0.0223 -0.0024 culture_coop_internal 0.0118 -0.0123 -0.0230 -0.0230 culture_coop_inter	Droduct inn	(0.0454)	(0.135)	(0.0402)	(0.296)
Process_inn (0.121) (0.097) (0.040) (0.142) Process_inn (0.141) (0.182) (0.0352 (0.0234) Product_long (0.0602) (0.145) (0.0555) (0.0559) Process_long (0.0602) (0.145) (0.0553) (0.261) Process_long -0.00933 0.0333 0.0593 -0.00812 Absorptive capacity (0.00115) -0.00001 (0.00494) 0.00015 Culture_coop_external 0.0139 (0.0220) 0.0122 0.00611 (0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures (0.0113) -0.0220 0.0189 0.0122 culture_coop_internal 0.0113 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0230 -0.0230 culture_coop_internal 0.0114 0.0553 -0.0231 -0.0230 culture_coop_internal 0.0111<	Product_inn	(0.125)	-0.00981	-0.0298	0.0158
Process_init -0.0414 0.0339 -0.00302 0.0024 init (0.141) (0.032) (0.082) (0.082) (0.025) Product_long (0.041) (0.182) (0.083) (0.169) 0.00559 Process_long (0.0602) (0.145) (0.0533) 0.0593 -0.00812 Absorptive capacity (0.0801) (0.0455) (0.0540) (0.381) Absorptive capacity (0.00148) (0.000869) (0.00114) (0.00490) culture_coop_external 0.0309 0.02205 0.0322 0.00611 (0.00148) (0.00753) (0.0730) (0.285) culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0114 0.0533 (0.0253) (0.245) Own_effort -0.0845 (0.0320 0.00495 -0.0224 (0.0365) (0.0460) (0.0532) (0.245) imp_manuf_dep<	Process inn	0.0414	(0.0978)	(0.0406)	(0.742)
Product_long (0.0141) (0.02) (0.033) (0.033) Product_long 0.00363 0.0639 0.0169 0.00559 Process_long -0.00933 0.0333 0.0593 -0.00812 Memory (0.0801) (0.0455) (0.0540) (0.381) Absorptive capacity (0.000148) (0.000869) (0.00144) (0.000490) culture_coop_external 0.0309 0.0205 0.0322 0.00611 (0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures 0.0113 -0.0220 0.0189 0.0122 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0183 -0.0031 -0.0211 imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329	Flocess_IIII	-0.0414	(0.182)	-0.00302	(1.105)
Induct_long 0.00002 0.01003 0.00003 0.00003 Process_long -0.00933 0.0333 0.0533 -0.00812 Boorptive capacity (0.06002) (0.0455) (0.0540) (0.381) Absorptive capacity (0.000148) -0.00001 0.000494 0.000105 culture_coop_external (0.00148) (0.000869) (0.00114) (0.00490) culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 culture_coop_internal 0.0118 -0.0189 -0.00524 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0233 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0233 -0.00524 culture_coop_internal 0.0112 (0.0753) (0.0253) (0.245) own_effort -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0239 0.04669 0.0288 0.00491	Product long	0.00363	0.0639	0.0169	0.00559
Process_long (0.0002) (0.143) (0.053) (0.001) Process_long (0.0801) (0.0455) (0.0540) (0.0811) Absorptive capacity (0.00148) (0.00069) (0.00144) (0.00010) culture_coop_external (0.00148) (0.000869) (0.00114) (0.00490) culture_coop_procedures (0.0153) (0.0753) (0.0730) (0.285) culture_coop_internal (0.0117) (0.0518) (0.0767) (0.568) culture_coop_internal (0.0117) (0.0518) (0.0767) (0.568) culture_coop_internal (0.0118) -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0845 (0.0320) (0.00495) -0.0230 imp_internal_R&D -0.0845 (0.0320) (0.0532) (0.230) imp_manuf_dep -0.029 0.0469 0.0288 0.0499 (0.028) (0.133) (0.0335) (0.0430) (0.0335) (0.0430) <t< td=""><td>Troduct_tong</td><td>(0.0602)</td><td>(0.145)</td><td>(0.0535)</td><td>(0.261)</td></t<>	Troduct_tong	(0.0602)	(0.145)	(0.0535)	(0.261)
Internal (0.080) Interse (0.054) (0.054) (0.054) Absorptive capacity 0.000415 -0.0001 0.000494 0.000105 (0.00148) (0.000869) (0.00114) (0.00490) culture_coop_external 0.0309 0.0205 0.0322 0.00611 (0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures 0.0118 -0.0120 0.0189 0.0122 (0.017) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0275 (2.231) imp_manag_stakeholders 0.0488 0.00623 -0.00491 (0.190) imp_informal -0.0630<	Process long	-0.00933	0.0333	0.0593	-0.00812
Absorptive capacity (0.0010) (0.0010) (0.0010) Staff_high 0.000415 -0.00001 0.000494 0.000105 culture_coop_external 0.0309 0.0205 0.0322 0.00611 culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 culture_coop_internal 0.0189 0.0123 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 imp_manag_stakeholders 0.0488 0.00623 -0.0233 -0.00405 imp_informal -0.0630 -0.0134 -0.00579 0.00420 (0.0515)	1100035_1011g	(0.0801)	(0.0455)	(0.0540)	(0.381)
Staff_ligh 0.000415 -0.00001 0.000494 0.000105 culture_coop_external 0.0309 0.0205 0.0322 0.00611 culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 culture_coop_internal 0.0183 -0.0220 0.0189 0.0122 culture_coop_internal 0.0118 -0.0189 -0.0233 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0233 -0.00524 culture_coop_internal 0.0118 -0.0189 -0.0233 -0.00524 culture_coop_internal 0.0142 (0.0734) (0.125) (0.0245) Own_effort -0.0911 0.0538 -0.0831 -0.0011 (0.236) (0.133) (0.0469 0.0228 0.0499 (imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 (imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 (imp_manag_stakeholders 0.0482 -0.0134 -0.00579 0.00820 (imp_manag_stake	Absorptive capacity	(******)	(000,000)	(0.000 10)	(0.000)
(0.00148) (0.000869) (0.00114) (0.00490) culture_coop_external 0.0309 0.0205 0.0322 0.00611 (0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 (0.117) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 (0.258) (0.173) (0.275) (2.231) imp_maketimg_client -0.0209 -0.0464 0.00608 -0.00919 (0.0575) (0.0423) (0.0335) (0.430) (0.190) imp_informal -0.0630 -0.0134	Staff_high	0.000415	-0.00001	0.000494	0.000105
culture_coop_external 0.0309 0.0205 0.0322 0.00611 (0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures 0.01153 -0.0220 0.0189 0.0122 (0.17) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 (0.236) (0.133) (0.0842) (1.086) imp_manuf_dep -0.0299 -0.0469 0.0288 0.0499 (0.258) (0.473) (0.275) (2.231) imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 (0.0575) (0.0423) (0.0535) (0.430) (0.236) (0.430) imp_manag_stakeholders 0.0488		(0.00148)	(0.000869)	(0.00114)	(0.00490)
(0.0953) (0.0753) (0.0730) (0.285) culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 (0.117) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 (0.258) (0.473) (0.275) (2.231) imp_marketing_client -0.0209 -0.0464 0.00608 -0.00919 (0.0575) (0.0424) (0.0535) (0.430) (0.133) imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 (0.0515) (0.0430) (0.0293) (0.381) has_outbound_knowledgeflow -0.00842 -	culture_coop_external	0.0309	0.0205	0.0322	0.00611
culture_coop_procedures 0.0153 -0.0220 0.0189 0.0122 (0.117) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.0245) Own_effort -0.0911 0.0538 -0.00831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 imp_informal -0.0630 -0.0124 (0.0504) (0.190) imp_informal -0.00842 -0.0166 -0.00579 0.00820 imp_informal -0.00842 -0.0166 -0.00579 0.00820 imp_informal -0.00842 -0.0166 -0.00579 0.00820 <td>-</td> <td>(0.0953)</td> <td>(0.0753)</td> <td>(0.0730)</td> <td>(0.285)</td>	-	(0.0953)	(0.0753)	(0.0730)	(0.285)
(0.117) (0.0518) (0.0767) (0.568) culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 (0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 imp_mankteing_client -0.0209 -0.0464 0.00608 -0.00919 imp_maag_stakeholders 0.0488 0.0623 -0.0223 -0.00405 imp_informal -0.0630 -0.0123 (0.0335) (0.430) imp_informal -0.0209 -0.0464 0.00608 -0.00919 imp_informal -0.0209 -0.0464 0.00608 -0.00919 imp_informal -0.0630 -0.0123 (0.0335) (0.430) imp_informal -0.0630 -0.0134 -0.00514 (0.0190)	culture_coop_procedures	0.0153	-0.0220	0.0189	0.0122
culture_coop_internal 0.0118 -0.0189 -0.0223 -0.00524 0.0.0365) (0.0660) (0.0532) (0.245) 0wn_effort -0.0911 0.0538 -0.0831 -0.00121 imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 imp_mantf_dep -0.0209 -0.0464 0.00608 -0.00919 imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 imp_informal -0.0630 -0.0123 (0.133) (0.430) imp_informal -0.0630 -0.0134 -0.00579 0.00820 imp_informal -0.0268 -0.00602 -0.0105 imp_informal -0.00545 -0.00514 -0.00514 imp_informal -0.0280 -0.0268 0.0467 -0.00514 <td></td> <td>(0.117)</td> <td>(0.0518)</td> <td>(0.0767)</td> <td>(0.568)</td>		(0.117)	(0.0518)	(0.0767)	(0.568)
(0.0365) (0.0660) (0.0532) (0.245) Own_effort -0.0911 0.0538 -0.0831 -0.00121 (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 imp_manag_stakeholders 0.0488 (0.0233) (0.430) (0.430) imp_informal -0.0209 -0.0464 0.00608 -0.00919 imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 imp_informal -0.0630 -0.0134 -0.00579 0.00820 imp_informal -0.00842 -0.0166 -0.00602 -0.0105 imp_informal -0.0280 -0.0268 0.0467 -0.00514 imp_informal 0.0280 -0.0268 0.0467 <	culture_coop_internal	0.0118	-0.0189	-0.0223	-0.00524
Own_effort -0.0911 0.0538 -0.0831 -0.00121 imp_internal_R&D (0.142) (0.0734) (0.125) (0.0573) imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep (0.236) (0.133) (0.0842) (1.086) imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 (0.258) (0.473) (0.275) (2.231) imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 (0.0988) (0.123) (0.0335) (0.430) imp_manag_stakeholders 0.0488 0.00623 -0.0223 -0.00405 (0.0575) (0.0424) (0.0504) (0.190) imp_informal -0.0630 -0.0134 -0.00579 0.00820 (0.0515) (0.0430) (0.0293) (0.381) has_outbound_knowledgeflow -0.0280 -0.0268 -0.00602 -0.0105 (0.0926) (0.0945) (0.0497) (0.491) 0.9491 App_ormal<		(0.0365)	(0.0660)	(0.0532)	(0.245)
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imp_internal_R&D -0.0845 0.0320 0.00495 -0.0230 imp_manuf_dep (0.236) (0.133) (0.0842) (1.086) imp_manuf_dep -0.0329 0.0469 0.0288 0.0499 (0.258) (0.473) (0.275) (2.231) imp_marketimg_client -0.0209 -0.0464 0.00608 -0.00919 imp_manag_stakeholders 0.0488 (0.0233) (0.430) imp_informal -0.0630 -0.0134 -0.0223 -0.00405 imp_informal -0.0630 -0.0134 -0.00579 0.00820 imp_informal -0.00842 -0.0166 -0.00602 -0.0105 imp_informal -0.00842 -0.0166 -0.00602 -0.0105 imp_informal 0.0280 -0.0268 0.0467 -0.00514		(0.142)	(0.0734)	(0.125)	(0.0573)
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Appropriability conditions 0.0280 -0.0268 0.0467 -0.00514 App_formal (0.0307) (0.0786) (0.0542) (0.240) App_informal 0.0537 0.0135 0.0545 -0.00294 (0.0639) (0.0289) (0.0707) (0.137)		(0.0926)	(0.0945)	(0.0497)	(0.491)
App_formal 0.0280 -0.0268 0.0467 -0.00514 (0.0307) (0.0786) (0.0542) (0.240) App_informal 0.0537 0.0135 0.0545 -0.00294 (0.0639) (0.0289) (0.0707) (0.137)	Appropriability conditions	. /			/
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App_informal 0.0537 0.0135 0.0545 -0.00294 (0.0639) (0.0289) (0.0707) (0.137)		(0.0307)	(0.0786)	(0.0542)	(0.240)
(0.0639) (0.0289) (0.0707) (0.137)	App_informal	0.0537	0.0135	0.0545	-0.00294
		(0.0639)	(0.0289)	(0.0707)	(0.137)

Public Support				
PS_horizontal	0.0228	0.0467	0.0212	0.0107
	(0.122)	(0.152)	(0.0779)	(0.494)
PS_targeted	-0.0407	0.125	0.000470	-0.00835
	(0.115)	(0.108)	(0.0354)	(0.392)
PS_networking	0.0291	0.0139	0.0852	-0.00401
	(0.0567)	(0.0478)	(0.105)	(0.188)
Number of observations $= 805$				
Standard errors in parentheses				
Statistically significant estimated	multinomial logistic reg	gression coefficients are r	narked in bold	
chi2(200) = 475.61 Prob > chi2 =	= 0.0000			
Pseudo $R2 = 0.2137$				

The findings also highlight a strong positive impact of the effectiveness of protection mechanisms for appropriating the benefits of successful innovations on firms' cooperative behavior. Availability of effective appropriability mechanisms, especially informal, increases the probability of innovation cooperation and contributes to the cooperation with knowledge producers, related industry actors and public authorities on the national level.

The availability of public support also facilitates the expansion of the cooperative linkages. Results achieved underscore the findings of previous studies (i.e. Veugelers and Cassiman (2005), Arranz and Fdez. De Arroyabe (2008), Badillo and Moreno (2016)). Networking measures, such as programs for creation and support of technology platforms and regional innovation clusters, are especially important for an intensive long-term cooperation with universities and research organizations and the development of national networking.

5. Conclusion

This article provides evidence for the ongoing discussion on the factors influencing firm's cooperative strategy in innovation activities: decision to cooperate (or not) and geographical pattern, and employs the firm-level data on the innovation activities of the Russian manufacturing enterprises.

To keep pace with changes in the global business environment, that is characterized by a high degree of dynamism, global and fierce competition, rapidly growing value and availability of knowledge and other, companies are forced to align their innovation strategy and corporate culture, and also to build external innovation networks.

Firms engage in cooperative relations with many different partners such as customers and suppliers, related value-chain members, competitors, providers of services, universities, research organizations, consulting firms or public authorities, each of which contribute in accordance with their capacity and competences. The choice of cooperative innovation strategy depends on a variety of factors, that could be divided into several categories based on the review of theoretical and empirical studies: firm-specific characteristics, level of competition, technological

opportunities, absorptive capacity, appropriability conditions and the availability of public support.

Innovation-active enterprises in Russian manufacturing cooperate with various external actors along the whole innovation process quiet frequently, especially preferring to interact with several partners simultaneously. However, the specific degree of participation of each party in innovation development and implementation is non-observed.

The results indicate strong differences in determinants of innovation cooperation strategy across different types of partners. Large incumbent companies in high-tech sectors prefer long-term cooperation with R&D sector. Firms, in cooperation with universities and research organizations, are mostly oriented towards foreign markets, have an adequate intellectual protection system and receive public support. The availability of government support (i.e. networking measures) facilitates expansion of the cooperative linkages, especially with knowledge production sector promotes the development of national networking. Most importantly, firms highly appreciate the contribution made by universities and research organizations in innovation development and implementation process.

Focus on process innovation stimulates collaboration with providers of services and related value-chain members. Such companies develop broader networking and rely on a national knowledge base. At the same time, focus on product innovation and orientation on national and foreign markets has a positive effect on cooperation with competitors. The lack of competitive advantage in quality of products and price stimulate firms to cooperate with suppliers of raw materials and consulting firms. Availability of effective appropriability mechanisms contributes to cooperation with knowledge producers, related industry actors and public authorities on the national level.

The obtained results are broadly consistent with other studies and confirm that, besides general firm-specific characteristics, company's capacity to identify, assimilate and apply valuable external knowledge (absorptive capacity) affects most of their cooperative strategies in innovation activities. Young companies that implement most of innovations on their own and find internal R&D as important sources of information have small cooperation networks and collaborate mostly only within the supply chain.

The revealed heterogeneity of the impact of endogenous and exogenous conditions for the cooperation with different actors challenges the wide-spread simplified perception of 'openness' as a one-dimensional characteristic of the innovation strategy. This should be taken in mind as a framing consideration in the theoretical modelling of the innovation processes as well as the practical policy development aimed at intensified networking.

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Appendix 1

Authors, Year of	Title	Country,	Dependent	Independent Variables	Methodology	Key Findings
publication		Survey Years	Variables			
Faria and	International	Germany and	Cooperation	Export status, part of a	Bivariate	Statistically significant variables:
Schmidt, 2012	cooperation on	Portugal,	types:	group, absorptive capacity	probit model	1. Domestic partner:
	innovation: Firm-	1998-2000	Domestic	(in-house R&D activities,		size (+), industry (+), part of a group (+), absorptive
	level evidence from		partner	the skill level of firms'		capacity (+), public funding (+), outgoing spillovers
	two European		Foreign partner	employees), innovation		(+)
	countries			intensity, incoming and		2. Foreign partner:
				outgoing knowledge		size (+), export status (+), part of a group (+),
				spillovers, size, industry,		absorptive capacity (+), public funding (+), outgoing
				public funding		spillovers (+)
Veugelers and	R&D cooperation	Belgium, 1993	Cooperation	Size, ownership, constraints	Instrumental	Statistically significant variables:
Cassiman, 2005	between firms and		with universities	(risk and cost), own R&D	probit model	1. Cooperation with universities:
	universities.			capacity, public funding,		const (-), size (+), foreign (-), cost (-), risk (+),
	Some empirical			vertical cooperation,		cooperation with universities at industry level (+),
	evidence from			appropriability conditions		public funding (+), vertical cooperation (+)
	Belgian			(strategic and legal),		2. Cooperation with universities (correction for
	manufacturing			incoming spillovers, export		endogeneity for the complementary strategies):
				intensity, cooperation with		const (-), risk (-), cooperation with universities at
				universities at industry level		industry level (+), public funding (+)
Kaiser, 2002	An empirical test of	Germany,	Binary choice	Horizontal and vertical	Nested	Statistically significant variables:
	models explaining	1995	between	spillovers, research	multinomial	1. Mixed cooperation:
	research		cooperation and	productivity, the generality	logit	R&D generality-approach (>3) (+), strong decrease in
	expenditures and		non-cooperation	of the research approach,	(NMNL) and	sales (+), increase in sales (+), eastern German firms
	research			market demand	Multinomial	(+)
	cooperation:				logit model	2. No cooperation:
	evidence for the				(MNL)	size (-), transport sector (-), R&D generality-
	German service					approach (>3) (-), R&D productivity science (-),
	sector					horizontal spillovers (-)

Review of empirical studies on R&D and innovation cooperation

Miotti and Sachwald, 2003	Co-operative R&D: why and with whom? An integrated framework of analysis	France, -	Cooperation types: horizontal, vertical, institutional	Size, part of a group, industry, public funding, market share, permanent R&D, constraints (risk and cost), lack of information (market and technological)	Logit regression model	Statistically significant variables: 1. Vertical cooperation: const (-), size (+), part of a group (-), lack of market information (+) 2. Cooperation with public institutions: const (-), size (+), public funding (+), permanent R&D (-), science (+), cost (-) 3. Horizontal cooperation: const (-), size (+), public funding (+), high-tech industry (+), cost (+)
Dachs, Ebersberger and Pyka, 2008	why do firms cooperate for innovation? A comparison of Austrian and Finnish CIS3 results	Finland and Austria, 1995	1) Innovation activity; Product innovation, Process innovation 2) Cooperative behavior: any partner, suppliers, customers, competitors, universities and research institutions	Size, part of a group, industry, export status, innovation expenditure, diversification of the innovative efforts, hampering factors (internal and economic), internal knowledge flow, basicness of R&D, appropriability conditions (strategic and formal), public funding, incoming spillovers, innovation type, speed of technological development, labor productivity	Multivariate logit model	Statistically significant variables (ex. Finland): 1. Collaboration with suppliers: const (-), public funding (+), diversification of the innovative efforts (+), process and product innovation (+), internal knowledge flow (+), appropriability conditions (strategic and formal) (+), incoming horizontal and vertical spillovers (+) 2. Collaboration with customers: const (-), public funding (+), appropriability conditions in industry (-), process and product innovation (+), diversification of the innovative efforts (+), appropriability conditions (strategic and formal) (+), incoming horizontal and vertical spillovers (+) 3. Collaboration with competitors: const (-), public funding (+), labor productivity (+), process innovation (+), innovation expenditure (+), horizontal incoming spillovers (+) 4. Collaboration with universities and research organizations: const (-), public funding (+), labor productivity (+), continuous of R&D (+), product innovation (+), diversification of the innovative efforts (+), internal knowledge flow (+), appropriability conditions (+), incoming horizontal (-) and vertical (+) spillovers, basicness of R&D (+)

Badillo and	What drives the	Spain, 2006-	Cooperation	Size, part of a group, sector,	Multivariate	Statistically significant variables:
Moreno, 2016	choice of the type	2008	types:	public support, R&D	probit	1. Vertical cooperation:
	of partner in R&D		horizontal,	intensity, appropriability	model	const (-), incoming spillovers (+), legal protection (+),
	cooperation?		vertical,	conditions (legal), incoming		R&D intensity (+), subsidies (+), part of a group (+),
	Evidence for		institutional	spillovers, constraints (risk		size (+)
	Spanish		Group	and cost), lack of qualified		2. Cooperation with public institutions:
	manufactures and		cooperation	personnel, export intensity		const (-), incoming spillovers (+), R&D intensity (+),
	services					risk (-), subsidies (+), part of a group (+), large size
						(+), industrial sector (-)
						3. Horizontal cooperation:
						const (-), incoming spillovers (+), R&D intensity (+),
						subsidies (+), part of a group (+), size (+), industrial
						sector (-)
						4. Group cooperation:
						const (-), incoming spillovers (+), legal protection (+),
						risk (-), public finding - subsidies (+), size (+),
						industrial sector (-), part of a group (+)
Franco and	Firms' R&D	Italy,	Cooperation	Incoming spillovers,	Multinomial	Statistically significant variables:
Gussoni, 2010	cooperation	2002-2004	types: market,	appropriability, size, sector,	logit model	1. Market vs Mixed cooperation:
	strategies: the		science, mixed	export status, costs of		const (+), size (-), subsidies (-), incoming spillovers (-),
	partner choice			innovation, subsidies -		appropriability conditions (-), permanent R&D (-),
				public funding, participation		export status (+), manufacturing industry (+)
				in a multinational group,		2. Science vs Mixed cooperation:
				permanent R&D		const (-), incoming spillovers (-), export status (+),
						manufacturing industry (+)
						3. Market vs Science cooperation:
						const (+), size (-), subsidies (-), appropriability
						conditions (-), permanent R&D (-)

Come Distance D&D Construction OC and 1008 tensor (continuity for the first tensor of the second sec	
Carree, Diederen, K&D Cooperation 90 and 1998 (types: (Vertical, norizontal, probit model 1. Vertical cooperation:	
Lokshin and Strategies horizontal, institutional), industry const (-), horizontal (-), ver	ertical (+), institutional (+),
Veugelers, 2004 vertical, outgoing spillovers, R&D incoming spillovers, R&D	intensity (+), R&D intensity
institutional intensity, size, industry, squered (-), size (+), organi	izational capability
ownership, part of a group, constraint (+), risk constrai	int (+), service (+), part of a
constraints (organizational group (+), R&D subsidy (+	+)
capability, risk, cost), speed 2. Cooperation with public	c institutions:
of technological change, const (-), institutional incom	ming spillovers (+), R&D
internal knowledge flows, intensity (+), size (+), organ	anizational capability
R&D subsidy constraint (+), speed of tech	chnological change (+), R&D
subsidy (+)	
3. Horizontal cooperation:	
const (-), institutional incom	ming spillovers (+), size (+),
industry average firm size ((+), risk constraint (+),
speed of technological char	inge (+), service (+), foreign
multinational (-)	
Arranz and Fdez. The choice of Spain, 1997 Cooperation Size, part of a group, Logit Statistically significant variables and Fdez.	riables:
de Arroyabe, partners in R&D types: industry, permanent R&D, regression 1. Vertical cooperation:	a analy (1) high to sh
2008 cooperation: An norizontal, incoming spillovers model const (+), size (+), part of a	a group (+), nign-tech,
empirical vertical, (science), external K&D, includin-high-tech industry	y(+), public runding(+),
firms look of market information 2 Cooperation with public	logy (+)
and technological const (1) part of a group ((1) high tech medium tech
information public funding industry (1) external P & P	(+), mgn-tech, medium-tech
a Horizontal cooperation:	(+), public funding (+)
5. Holizontal cooperation.	ent R (+) high-tech
(+), (+), (+), (+) risk ((+) public funding $(+)$

De Faria, Lima and Santos, 2010	Cooperation in innovation activities: The importance of partners	Portugal, 1998-2000	 Cooperation decision in innovation activities Importance of cooperation partners 	Size, Industry; Export share; Part of a group; Engagement R&D Employees education; Innovation intensity; Incoming knowledge spillovers; Appropriability; Cooperation within the same group, suppliers, clients or customers, competitors, consultants, commercial labs or R&D labs, universities and government research institutions	1) Selection probit model 2) Probit model	 Statistically significant variables: 1) Const (-); Size (+), Export share (+); Part of a group (+); Engagement R&D (+); Employees education (+); Innovation intensity (+); Appropriability (+) 2) Const (-); Engagement R&D (+); Innovation intensity (+); Cooperation within the same group (+), suppliers (+), High-tech (+)
Abramovsky, Kremp, Lopez, Schmidt, Simpson, 2008	Understanding co- operative innovative activity: evidence from four European countries	France, Germany, UK, Spain, 1998- 2000	Cooperation types: research base; suppliers or customers; competitors	Incoming spillovers; Appropriability; Industry- level legal protection; Constraints; Public support; R&D intensity; Size; Industry	OLS regression	Statistically significant variables: Incoming spillovers (+); Public support (+); Appropriability (+); Industry-level legal protection (-); Constraints (+); R&D intensity [with the research base] (+); Size (+); Industry (+)
Srholec, 2014	Persistence of cooperation on innovation: Econometric evidence from panel micro data	the Czech Republic, 5 waves of CIS: 1999-2001; 2008-2010	Cooperation types: suppliers, customers, competitors, consultants, research institutes, universities	Past cooperation on innovation (1-3 lags); characteristics of the firm: continuous R&D activity; part of a group; age; size; industry; period of observations;	Multivariate Probit Model	Statistically significant variables: past cooperation on innovation (+); continuous R&D activity (+); part of a group (+); size (+)

Tether, 2002	Who co-operates	United	Cooperation	Size, ownership, part of a	Logistic	Statistically significant variables:
	for innovation, and	Kingdom,	types:	group, sector, R&D	regression	1. Cooperation with suppliers:
	why. An empirical	1997	customers,	intensity, type of innovation,	C	const (-), size (+), utilities (+), low-tech-services (-),
	analysis		suppliers,	obstacles (risk, cost, internal,		R&D at least on an occasional basis (+), continuous
			competitors,	regulations), lack of		and high intensity R&D (+), lack of customers
			universities,	information on market and		responsiveness to innovation (+), lack of technology (-
			consultants,	technology, lack of qualified), obstacles risk and finance (+)
			other	personnel		2. Cooperation with customers:
						const (-), foreign (+), high-tech manufacturing and
						services (+), R&D at least on an occasional basis (+),
						continuous R&D (+), 'new to the market' innovations
						(+), lack of customers responsiveness to innovation (+),
						lack of information on markets (+)
						3. Cooperation with competitors:
						const (-), size (+), utilities (+), high and low-tech
						services (+), R&D at least on an occasional basis (+),
						continuous R&D (+), 'new to the market' innovations
						(+), lack of customers responsiveness to innovation (+)
						4. Cooperation with universities:
						const (-), size (+), part of a group (+), utilities (+),
						high-tech manufacturing (+), low-teck services (-),
						R&D at least on an occasional basis (+), continuous
						R&D and high intensity (+)
						5. Cooperation with consultants:
						const (-), size (+), foreign (+), utilities (+), high and
						low-tech services (+), R&D at least on an occasional
						basis (+), continuous R&D (+), obstacles risk and
						finance (+)
						6. Other cooperation types:
						const (-), new firm (+), size (+), utilities (+), medium-
						tech manufacturing (+), high-tech services (+),
						obstacles risk and finance (+)

Sample characteristics

Manufacturing sector	Innovation- active	Has at least one cooperation partner
Food and Beverages	83	81
Textiles, clothing and shoes	58	58
Wood and paper	50	47
Printing and Publishing	47	46
Petrochemistry, coal and nuclear fuel	21	20
Rubber, plastics and nonmetallic goods	55	53
Chemical production	54	53
Pharmaceuticals	41	40
Metallurgy	51	50
Metallic products	60	60
Machinery and Equipment	94	93
Precision instruments and computers	44	44
Railway transport and shipbuilding	43	43
Automobiles	27	27
Aircraft and space	23	22
Other manufacturing	54	53
Total	805	790

	Variable	Туре	Construction			
	Size	Continuous	Log of the average number of employees in 2013 (at least 10)			
	Age_less 5	Dummy	One, if a firm was established after 2010			
	Industry					
	High-tech	Dummy	One, if a firm belongs to high technology manufacturing based on NACE Rev. 1.1 codes			
	Medium-high-tech	Dummy	One, if a firm belongs to a medium-high technology industry based on NACE Rev. 1.1 codes			
	Medium-low-tech	Dummy	One, if a firm belongs to a medium-low technology industry based on NACE Rev. 1.1 codes			
	Base level: Low-tech	Dummy	One, if a firm belongs to a low technology industry based on NACE Rev. 1.1 codes			
	Ownership	•				
ics	Foreign	Dummy	One, if a firm has foreign ownership			
rist	State	Dummy	One, if a firm has state ownership			
cter	Rate of business growth		· · · · · · · · · · · · · · · · · · ·			
charae	> 30% decrease	Dummy	One, if the average annual changes in the number of employees (in the past 3 years) are more than 30% decrease			
Firm-specific	10-30% decrease	Dummy	One, if the average annual changes in the number of employees (in the past 3 years) are 10-30% decrease			
	minor variation (+/- 10%)	Dummy	One, if the average annual changes in the number of employees (in the past 3 years) are in interval +/- 10%			
	10-30% increase	Dummy	One, if the average annual changes in the number of employees (in the past 3 years) are 10-30% increase			
	> 30% increase	Dummy	One, if the average annual changes in the number of employees (in the past 3 years) are more than 30% increase			
	Base level:DummyAmbiguous changesDummy		One, if One, if the average annual changes in the number of employees (in the past 3 years) were ambiguous			
	Profitability of sales					
	0-2%	Dummy	One, if the return on sales in 2013 (before tax) was 0-2%			
	2-5%	Dummy	One, if the return on sales in 2013 (before tax) was 2-5%			
	5-10%	Dummy	One, if the return on sales in 2013 (before tax) was 5-10%			
	>10%	Dummy	One, if the return on sales in 2013 (before tax) was more than 10%			
	<i>Base level:</i> Negative	Dummy	One, if the return on sales in 2013 (before tax) was negative			
	Market structure					
	Monopoly	Dummy	One, if a firm has no direct competitors or has less than 2			
	Oligopoly	Dummy	One, if a firm has 2-5 principal competitors			
tion	Base level: Competition	Dummy	One, if a firm has more than 5 principal competitors			
peti	Markets for future development					
ivel of comp	Regional	Dummy	One, if prospects for company development are associated with regional markets			
	National	Dummy	One, if prospects for company development are associated with nation markets			
Ĺ	Foreign	Dummy	One, if prospects for company development are associated with foreign markets			
	Base level: Local market	Dummy	One, if prospects for company development are associated with local markets			

	Competitors' advantages							
	Price	Dummy	One, if prices of products are the most explicitly represent advantages of competitors					
ition	Quality	Dummy	One, if quality of products are the most explicitly represent advantages of competitors					
ompet	Novelty	Dummy	One, if novelty of products are the most explicitly represent advantages of competitors					
el of ce	Customization	Dummy	One, if adaptation of products according to customers' requirements are the most explicitly represent advantages of competitors					
Leve	Delivery	Dummy	One, if prices of products are the most explicitly represent advantages of competitors					
	Services	Dummy	One, if prices of products are the most explicitly represent advantages of competitors					
	Other	Dummy	One, if competitors have other advantages					
	Investment intensity in i	nnovation						
	High	Dummy	One, if the share of total expenditure on innovation activities in the total turnover in 2013 is less than 2.5%					
Opportunities	Medium	Dummy	One, if the share of total expenditure on innovation activities in the total turnover in 2013 is from 2.5 to 10%					
	Low	Dummy	One, if the share of total expenditure on innovation activities in the total turnover in 2013 is more than 10%					
	Base level:DummyLack of investmentDummy		One, if there were no costs for implementation of new products in 2013					
cal	Importance of innovation types for business success							
nologi	Regular R&D	Dummy	One, if regular research and development is important for firm's business success					
chi	Product innovation	Dummy	One, if product innovation are important for firm's business success					
Te	Process innovation	Dummy	One, if process innovation are important for firm's business success					
	Long_product innovation	Dummy	One, if the period of product innovation development / implementation is more than 3-5 years					
	Long_process innovation	Dummy	One, if the period of process innovation development / implementation is more than 3-5 years					
	Staff_high	Share	Number of graduated employees and employees with a Candidate of Sciences, Doctor of Sciences (or PhD) degree					
	Culture_coop external	Dummy	One, if executives and the management welcomes the involvement of external partners and cooperation at various stages of development and implementation of innovations					
e Capacity	Culture_standard procedures	Dummy	One, if the enterprise has developed standard procedures for interaction with the implementing partners of research and development (including the regulatory framework, the criteria for assessing the quality of results, etc.)					
sorpti	Culture_coop internal	Dummy	One, if an exchange of ideas is practiced among the various units of the company without the direct involvement of the management					
Ab	Own effort	Dummy	One, if the majority of implemented innovations were developed predominately by firms' own					
	Importance of information	on sources						
	Internal R&D	Dummy	One, if internal R&D are important sources of information					
	Manufacturing departments	Dummy	One, if manufacturing departments are important sources of informat					

ity	Marketing and/or client services	Dummy	One, if marketing departments and/or client services are important sources of information			
Capac	Management team and/or stakeholders Dummy		One, if company's management team and/or stakeholders are important sources of information			
sorptive	Informal sources of information Dummy		One, if informal sources of information (ex. scientific literature, patent information, trade fairs and other professional events) are important sources of information			
Ab	Outbound knowledge flow Dummy		One, if the company performed technology acquisition/transfer in 2011-2013			
riability itions	Formal methods of IP protection	Dummy	One, if the firm uses formal methods of intellectual property protection			
Appropi Condi	Informal methods of IP protection	Dummy	One, if the firm uses informal methods of intellectual property protection			
ic ort	Horizontal Dummy		One, if the firm received horizontal public support between 2011-2014			
ldu pp(Targeted	Dummy	One, if the firm received targeted public support between 2011-2014			
P Su	Networking	Dummy	One, if the firm received networking public support between 2011-2014			

Appendix 4

Cooperation partner		Consumers/ Clients	Suppliers of raw materials	Related value- chain members	Providers of services	Competitors	Research organizations	Universities	Consulting firms	Public authorities
Cooperation ^a	No	22.0	25.7	62.5	66.8	80.7	72.9	77.8	90.9	77.1
	Yes	78.0	74.3	37.5	33.2	19.3	27.1	22.2	9.1	22.9
Location ^b	Regional	67.8	61.0	64.6	79.0	56.8	59.2	70.9	58.9	79.3
	National	53.7	56.5	50.0	39.7	55.5	62.8	45.8	41.1	37.5
	Foreign	14.2	23.7	8.3	11.6	17.4	7.8	3.4	12.3	1.6

Distribution of surveyed firms by the fact of innovation cooperation and its location (%)

^a Percentage of the total innovation active firms operating in the manufacturing sector (N = 805)

^b Percentage of the total innovation active firms in the manufacturing sector involved in innovation cooperation

Table A5

Descriptive	statistics	for	dependent	variables
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	Total sample Russia N ^a =805		
	Mean	SD	
Firm-specific characteristics			
Log_Size	5.4383	1.4881	
Age_less5	0.0547	0.2274	
Industry			
High-tech	0.1491	0.3564	
Medium-high-tech	0.2584	0.4380	
Medium-low-tech	0.2286	0.4202	
Ownership			
Foreign	0.0696	0.2546	
State	0.1304	0.3369	
Rate of business growth (Number of employees)			
> 30% decrease	0.0335	0.1801	
10-30% decrease	0.1329	0.3397	
Minor variation (+/- 10%)	0.5081	0.5002	
10-30% increase	0.1528	0.3600	
> 30% increase	0.0398	0.1955	
Profitability of sales			
0-2%	0.1652	0.37161	
2-5%	0.3019	0.45935	
5-10%	0.2708	0.44465	
>10%	0.1925	0.39455	
Level of competition	•	·	
Market structure			
Monopoly	0.1963	0.3974	
Oligopoly	0.3081	0.4619	
Markets for future development			
Regional	0.2435	0.4294	
National	0.4745	0.4997	
Foreign	0.1913	0.3936	
Competitors' advantages	•	·	
Price	0.29	0.452	
Quality	0.09	0.284	
Novelty	0.19	0.394	
Customization	0.07	0.259	
Delivery times	0.05	0.217	
Services	0.09	0.293	
Other	0.06	0.235	
Technological Opportunities			
Investment intensity in innovation			
Low	0.3081	0.4619	
Medium	0.3193	0.4665	
High	0.1354	0.3424	
Importance of innovation types for business success			
Regular R&D	0.7466	0.4352	
Product_innovation	0.9217	0.2687	
Process_innovation	0.9876	0.1108	
Long_product innovation	0.2261	0.4186	

Long_process innovation	0.1888	0.3916						
Absorptive capacity								
Staff_high	33.5202	23.5879						
Culture_coop external	0.4236	0.4944						
Culture_standard procedures	0.3863	0.4872						
Culture_coop internal	0.4273	0.4950						
Importance of information sources								
Internal R&D	0.1615	0.3682						
Manufacturing departments	0.1578	0.3647						
Marketing and/ or client services	0.3404	0.4741						
Management team and/ or stakeholders	0.2522	0.4345						
Informal sources of information	0.2870	0.4526						
Outbound knowledge flow	0.4733	0.4996						
Own effort	0.6373	0.4811						
Appropriability conditions								
The firm uses formal methods of IPP	0.6112	0.4878						
The firm uses informal methods of IPP	0.5988	0.4904						
Public support	Public support							
Horizontal measures	0.2435	0.4294						
Networking measures	0.0944	0.2926						
Vertical measures	0.2708	0.4446						

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