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Simachev, Yuri and Kuzyk, Mikhail and Feygina, Vera

Interdepartmental Analytical Center

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THE NATURE OF INNOVATION CHANNELS AT THE MICRO-LEVEL: EVIDENCE FROM RUSSIAN MANUFACTURING FIRMS

Yuri Simachev

Interdepartmental Analytical Center
31, Povarskaya st., Moscow 121069, Russia

simachev@iacenter.ru

Mikhail Kuzyk

Interdepartmental Analytical Center
31, Povarskaya st., Moscow 121069, Russia

kuzyk@iacenter.ru

Vera Feygina

Interdepartmental Analytical Center
31, Povarskaya st., Moscow 121069, Russia

feygina@iacenter.ru

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ABSTRACT

The main purpose of the paper is to analyze different channels for innovations. We analyze the influence of various incentives for innovation in Russian companies taking into account the organization of industries — vertical or horizontal orientation, peculiarities of corporate demography, role and motives of different owners (including government and foreign investors), demand trends, customers' profile, nature and intensity of competition in relevant markets.

An empirical base for our study is provided by two surveys of Russian industrial companies conducted in 2011 and 2012.

One of our hypotheses: in vertically organized sectors that define innovation activeness in the economy (for example, mechanical engineering), the innovative development of the head producers is constrained by the risk of technological gap with its partners in the supply chain.

We find out that innovations in Russian industry spread in accordance with two main models: vertical through corporate connections, and horizontal, based on the example of foreign companies in the atmosphere of developed competition.

Key Words —innovation, industrial organization, supply chain.

1. INTRODUCTION

Innovations nowadays are widely recognized as a result of cooperation between a company and a number of outside entities. Studying of the environment in which the company operates and the characteristics of its interaction with partners, competitors, and government is a step towards a more complete and comprehensive understanding of patterns of innovative behavior.

At the micro level, each innovative company solves this issue: what kind of knowledge and technology it should develop by itself, and which to outsource, ranging from covering only one link in a chain to companies of full cycle (vertically integrated). Participation in a production chain permits to share responsibility and risks, provides mutual support and also

facilitates the transfer of skills and technology between the "links" companies [7]. The reverse side of the coin is an increase of costs due to a transactional component and a loss of a degree of freedom. The doctrine of "core competence" means that firms that outsource complementary competencies are more successful than the vertically integrated companies [19]. Sets of such solutions make the so-called value chains. According to the theory described in the paper [9], three basic parameters (complexity of knowledge transacted, the extent of codifying that knowledge and the capabilities of suppliers) define the model of the chain. The models differ in the way of knowledge transmission – voluntary or under pressure, formal (through standards and regulations) or face-to-face, direct (between two adjacent chain links) or group (for network and cluster associations). The nature of the product has also an impact on the nature of the interaction within the chains. For example, the production of unique innovative products (specific assets) is associated with increased transactional "coordination" costs, which makes the cooperation in the chain less attractive.

The supply-chain relationships thus represent the issue of special importance explaining why, when, and how companies decide to innovate. The decision-making process is complicated: besides companies' internal managerial strategies and the level of trust between partners, few external factors also influence the buyer-supplier relationships including tacitness of technology, stability of demand, the level of competitive pressure and network connections both within and across industries [22].

In case of developing countries, special attention must be given to the participation of foreign companies in vertically related markets, as they are usually a source of vertical spillovers. Knowledge and technology in developing countries are mostly imported from more developed ones. Integration into the global market in theory should benefit national economy regardless of whether a domestic company buys or sells to the foreign one [4][8][12].

In the paper we focus on analyzing the mechanisms of different incentives for innovation in the companies taking into account industrial organization – vertical or horizontal orientation,

peculiarities of corporate demography, demand and supply patterns and the role of competition on relevant markets.

2. BACKGROUND AND PROPOSITIONS

A number of channels to stimulate innovation have been described in the literature. Incentives to innovate could be born inside a company but sometimes come from the outside, defined by the interaction with different agents of the innovation system. The vertical channel is highlighted, when innovations spread by communication with the chain partners, both backward (i. e. under the influence of suppliers [3][22]) and forward (in response to the changing consumer demand) [13]. In addition the company is also influenced by horizontal incentives through the example of competitors, partners in joint ventures or external experts [11]. Some researchers have considered separately the channel of communication with public organizations and universities [21].

Here are our main hypotheses and propositions about the nature of the influence of various innovative incentives.

Proposition 1. Horizontal channels of innovation are more characteristic of large companies operating in developed competitive environment.

As for the horizontal channel and the impact of competition, the dependence of innovative activities on the intensity of competition is of complex nature. It has been theoretically proven that in case the level of competition is too high it hinders the implementation of innovations [17][25]. Relationship between competition and corporate commitment to innovation can be visualized as a reverse U-shaped curve [1][14][24]. In case the level of competition is low, the company lacks stimuli, and if it is high, corporate resources are limited due to competition. However, in Russia the level of competition is far from the upper part of the curve. Empirical researches led us to the conclusion that in the majority of industries (at least as of early and middle 2000th) the level of competition was not high enough to play a negative role [16][28].

In a developed competitive environment, companies are sensitive to the achievements of competitors, keenly interested in gaining

competitive advantage, and therefore they are open to modernization and learning new technologies. Receptivity of big business to the competitors' best practice is noted in numerous studies [5][6][26]. We assume that big business has sufficient resources for systematic market monitoring for advanced technologies and has more "receptors" to search for innovation supply in the market.

Proposition 2. Vertical channels of innovation are significant in Russian industry, especially in the sectors with weak competitive environment and with significant asymmetry of counterparties' market power.

The level of trust in vertical alliances is significantly higher than in the horizontal [20]. Under conditions of inefficient institutions and high uncertainty, and therefore weak coordination mechanisms, these matters a lot for the formation of market structure. In vertically organized industries there are more mechanisms for monitoring and control, more possibilities to force counterparties to fulfill contractual obligations. So we assume that in weak institutional infrastructure knowledge and technology are mainly transferred through vertical channels. Whereas horizontal spillovers can either increase or decrease the innovative activity and well-being of agents, depending on various external factors, vertical spillovers always have a positive effect [2].

It should be noted that companies in production chains have different bargaining power (that is called "the asymmetry of market power"). For example, the monopolistic position in the market or, for example, possession of a special, inimitable knowledge, increases the weight of the company in the chain. On the other hand, the number of buyers is also significant: the fewer they are, the better their bargaining power is. The presence of strong imbalances in the economy, including monopolies of either sellers or buyers, promotes appearance of vertical chains with strong leaders.

If the institutional structure is not mature enough, the networks of subcontracting are underdeveloped, and trade barriers are numerous, especially in the decentralized sectors of the economy, the horizontal inter-firm cooperation is difficult [18]. Lack of competitive pressure weakens typically more "soft" horizontal stimuli.

In this sense, the “vertical integration” process can be seen as a natural response to the ineffectiveness of institutions and low culture of contractual relationships.

Proposition 3. In vertically organized sectors with innovation potential (for example, mechanical engineering), the innovative development of the leaders is constrained by the risk of technological gap with their partners in the supply chain.

The interaction between the partners in the production chain has a significant potential of generation of innovation and its distribution. Thus, some researchers show that in Russia the greatest impact on firms’ selection of more "advanced" innovation models is made by collaboration with consumers in the development of innovation. However, if there exist rigid (i. e. not adjusted to the rapid reorientation to other counterparties) industrial relations between the supplier and the consumer, then the innovation inertia of the first holds back the development of the second.

Proposition 4. For exporting companies a significant incentive to innovate is the tightening of the requirements of technical regulations and standards.

The possibility of codifying production norms and traditions is one of the conditions for "understanding", that is, for effective coordination between the partners in the supply chain [9][10][18]. Technical regulations and standards are designed to reduce uncertainty and information asymmetries, enhance the level of confidence between agents and thereby reduce transaction costs [27]. The adoption of technical standards also alleviates the problem of the gap in the level of technology with suppliers that Gereffi et al. considered as a major obstacle to the implementation of joint projects and collaborations.

At the same time, additional difficulties arise when firms from developing countries enter global value chains, as they often do not meet the requirements of partners from more developed countries [15]. In particular, widely known are the differences between Russian and European technical regulations that create barriers to successful export of Russian goods to foreign

countries [23]. Discrepancy in standards forces the foreign buyers to use additional mechanisms to monitor and control the quality of products, and thus to bear the additional costs. In this regard, it can be assumed that the tightening of domestic regulations and standards reduces the gap between countries and allows exporting companies enter foreign markets less painfully.

3. METHODOLOGY AND DATA

The empirical base of the research was formed as a result of two questionnaire surveys of Russian industrial enterprises, conducted in September and October 2011 and August-September 2012. In the first case the sample included 602 companies, in the second – 652 companies, representing mainly the manufacturing industry (Appendix Table I). The panel formed by the results of two surveys consists of 415 companies.

Organizations were asked about the main incentives for the implementation of technological innovations. Stimuli of different nature were presented among the options:

- Market demand and the example of other companies;
- Diffusion of innovation in value added chains;
- Technical regulation;
- Innovation supply.

The frequency of the incentives is presented in Table 1. The most popular options are examples of leading companies (equally Russian and foreign), as well as demand for the products, both from major customers in the value added chains and from the final consumers (households).

In this paper we propose the following classification of incentives:

- (1) by the "direction" of the impact
 - vertical, connected to technological changes in the main suppliers and (or) consumers. Such incentives are expected to be of importance for vertically organized sectors;
 - horizontal, determined by the examples of other companies. These incentives seem to be detected on horizontally organized sectors that are open for competition with foreign companies;

Table 2. Classification of incentives for technological innovation

	External channels / incentives for innovation at the firm level	Percentage of companies	Horizontal / vertical	Diffusion / enforcement	Public policy / environment
Market demand and the best example of other companies					
1.	Examples of leading foreign companies	30%	Horizontal	Diffusion	Environment
2.	Examples of leading Russian companies	30%	Horizontal	Diffusion	Environment
3.	Changes in consumer demand	27%	Horizontal	Diffusion, enforcement	Environment
Diffusion of innovation in supply chains					
4.	Transition of the main users to new products and technologies, tightening their requirements for suppliers	35%	Vertical	Enforcement, diffusion	Environment
5.	Transition of the main suppliers to production of materials (or components) with new properties, creating new innovation opportunities for their users	18%	Vertical	Diffusion, enforcement	Environment
Technical regulation					
6.	Development of standards and tightening of the technical regulations	22%	Horizontal / Vertical	Enforcement	Public policy, environment
7.	Tightening of the technical requirements for products in the public procurement	4%	Vertical / Horizontal	Enforcement	Public policy
Innovation supply					
8.	R&D of research institutes	11%	Horizontal	Diffusion	Environment, public policy
9.	R&D of universities	1%	Horizontal	Diffusion	Environment, public policy
10.	Recommendations (including informal) of public authorities	3%	Vertical	Enforcement, diffusion	Public policy
11.	Proposals from external consultants and experts	7%	Horizontal	Diffusion	Environment

(2) by the “rigidity” of the impact
 – diffusion, when the company is receptive to new knowledge and technologies and either receives them as spillover effects or finds interesting solutions on the market on its own;

– enforcement, when the company is forced to move to a new technology by its partners in the supply chain or the regulator;

(3) by the source of the impact

– public policy, when the changes are caused by the actions of the state, either direct or indirect (through stimulating the innovation technologies’ supply by universities and research organizations);
 – environment, when the innovations are caused by changes in market conditions.

The data was processed with factor analysis in order to emphasize some basic innovation channels. Factor analysis was followed by regression analysis, which was aimed to connect these basic models with firms’ characteristics and peculiarities of industrial organization.

4. RESULTS

General analysis of the prevalence of various channels to distribute and to stimulate innovation has shown that there are significant imbalances:

(1) among horizontal channels – the low significance of innovation supply channels (a consequence of the low receptivity of companies

and their focus on imitating and adapting existing technologies). The role of universities in the innovation supply channels is very low (a low level of integration of science and education);

(2) among vertical channels – the essential role of the transfer of “modernization shifts” from the bottom of the supply chains (a consequence of the dependence on suppliers because of their uniqueness and codification expenses of changing a supplier).

(3) small public demand for innovation (though the state is widely involved in the economy through public procurement system, as for 10% of the sample enterprises the state is the major buyer).

Note that there is a relation between the importance of various innovation channels and the duration of the innovation activities carried out by the companies:

– for companies that began innovation in the last 3 years, the example of leading Russian companies and the tightening of technical regulation are of great significance;

– for companies that have been implementing innovation for a long time, the example of foreign companies and the perspective developments of Russian research organizations are of great significance. This could be regarded as a consequence of the accumulation of practices and knowledge, and, therefore, their wider horizontal “mental outlook”.

The obtained empirical results indicate that the role of various incentives for companies’ innovation is largely dependent on industrial organization, the place which the company occupies in the supply chain, exports etc. The systematic analysis of the innovation channels let us identify the following regularities, sometimes obvious and sometimes not:

– the example of leading companies, both foreign and Russian, as an incentive to innovation is more common for companies operating in developed competitive environment;

– the tightening of the requirements of technical regulations and standards as an incentive of innovation is more characteristic of exporting companies which have recently started to innovate;

– the integration of the company is positively related to the diffusion of innovation upstream by

cooperation chain and horizontally from research organizations.

The significance of different channels and incentives for innovation varies substantially depending on the place of the company in a cooperation chain:

– examples of Russian companies is more significant for firms supplying raw materials, while the producers of products with a higher degree of processing apprehend mostly the example of leading foreign companies;

– the tightening of the requirements of technical regulations and standards has a bigger impact on the innovation activity of producers of final goods.

We now proceed from the analysis of individual relations to distinguishing some basic models of the innovative channels at the firm level. Basing on factor analysis and taking into account the significance (prevalence) of various incentives to innovation among the companies in the sample, we can select two basic models related to the first and the third factors (Table 2):

1. The first model of companies’ incentives to innovate is determined by the example of the leading companies, both Russian and foreign, as well as the changes on the market (for example, due to changes in the preferences of the population). This model is close to the well-known “demand-driven innovation” or the “user-driven innovation”;

2. The second model is related to the technological modernization and development of capabilities of suppliers, as well as to possible applications of perspective R&D of Russian research organizations. This model can be attributed to the “supply-driven innovation”.

Both models include horizontal and vertical innovation channels and enforcement mechanisms as well as diffusion, but there is a fundamental difference: the first model (“pull”) is associated with a certain following of the firms in their innovation to the market, to the competitors and so on, and the second (“push”) – with the implementation of innovations that is based on new scientific and technological and cooperative opportunities of the firm. Usually the “pull” model is connected with proactive scientific and technological policy of the state, although the state can also contribute in the “push” model using the mechanism of public procurement.

Table 2. Factor analysis

Incentives for technological innovation	Factors			
	1	2	3	4
Examples of leading foreign companies	.674	.268	.064	-.036
Examples of leading Russian companies	.620	.073	-.053	.189
Changes in consumer demand	.495	-.130	-.048	-.341
Transition of the main users to new products and technologies, tightening their requirements for suppliers	.547	-.290	.182	.154
Transition of the main suppliers to production of materials (or components) with new properties, creating new innovation opportunities for their users	-.013	-.164	.787	-.019
Development of standards and tightening of the technical regulations	.353	.069	-.034	.596
Tightening of the technical requirements for products in the public procurement	.018	.173	.505	.430
R&D of research institutes	.147	.408	.517	-.253
R&D of universities	-.074	.648	.138	.065
Recommendations (including informal) of public authorities	-.048	-.076	-.014	.646
Proposals from external consultants and experts	.105	.697	-.137	.002

Comparing the selected models of innovation incentives of the 2012 survey with the results of 2011 one, we can see that the picture changed significantly: there is a stronger aggregation of vertical and horizontal channels of influence on the company, as well as combining of enforcement and diffusion. In our opinion, this may be related to the dynamic and intense process of increasing sensitivity of Russian companies to best practices and knowledge in the post-crisis period.

Let's consider the question of how the selected models are related to the characteristics of the companies, their position in the supply chain and the specifics of industrial organization.

Comparing the results of linear regression analysis of the first and the third factors, we got the following results:

1. Companies following the first model of innovation, as a rule, face strong competition both from overseas and from Russian producers. These are mostly producers of intermediate goods and consumer goods, not integrated and therefore more receptive to the horizontal market signals such as the experience and practices of other companies.
2. As is well known, the possibilities of perception and adaptation of technologies

are positively related to the scale of the business, and to its export orientation. Within the analyzed sample, we see the similar result – the first model of innovation is more common for large companies with more than 1,000 employees, as well as for companies exporting to far-abroad countries.

3. The first model is close to adaptive approach to innovation: firms follow their competitors and market trends. Thus, in this model, it is a catching-up development, compounded by a weak receptivity to the results of research and development.
4. A group of companies following the second model is distinct by their vertical integration. This determines their stronger response to the channels of "innovation supply" (diffusion of innovation upstream the production chain or from research organizations). It is important that these companies are often relatively old, have the state among shareholders, focused primarily on sales to the state, and traditionally engaged in innovation and R&D funding. These companies are usually placed in a less fierce competition.

Table 3. Characteristics of firms following two main models

	1. Best practice and market pull (examples of other companies and changes in market demand)	3. Innovation supply and push (diffusion of innovative changes upstream the supply chain and from research organizations)
The scale of the business	+ large companies (more than 1,000 employees)	
Age		+ "old" companies (over 20 years)
Ownership		+ state participation
Integration		+ vertical
Type of main products	+ intermediate goods and consumer goods	
The main consumer	- state	+ state
Level of competition	+ high	- high
Export	+ to far-abroad countries	
R&D expenses	+	
The novelty of innovative products	+ new for the enterprise, Russia and world	+ new for enterprise and Russia

Thus, the first model is more oriented to the market, but its companies are not yet receptive enough to innovative proposal and they are more concentrated on imitating existing technologies. The second model continues to some extent the tradition of the Soviet planned economy in those sectors which, because of various reasons, were strategic to the state. Through the holdings and the influence on the public research organizations the state is trying to solve the problem of proactive modernization in sectors with underdeveloped competition and to maintain global competitiveness of certain sectors of the economy.

The results suggest that our hypotheses were confirmed only partially. Moreover, some results seem surprising, and we will give them additional explanation.

First. We assumed the essential role of vertical channels (which was confirmed), but we thought that their influence will be more negative (but actually found the opposite).

Therefore, let's consider in some detail the question of what determines the firms' choice between the following, in general, mutually exclusive statements:

(1) one of the external obstacles to innovation in the enterprise is that the introduction of new technologies will result in appearance (or

increase) of the technological gap with partners in the supply chain;

(2) the transition of suppliers of the enterprise to producing materials and components with new properties has been an incentive for technological innovation in the enterprise over the past three years.

Our regression analysis showed that the first statement (negative) appears to be fair to the companies that are relatively young, in fierce competition with other Russian companies, and focused on the sales to households. The second (positive) one is typical of old companies, integrated firms, and ones focused on the state. Thus, the choice of positive statement is to a large extent due to vertical integration, which promotes coordination of the companies in the cooperation chain and technological planning.

Second. The Russian government seeks to make public procurement more innovative and to strengthen the state's role in stimulating demand for innovative products. However, the effect of public procurement for stimulation of innovation in the framework of the analyzed sample is very local. So let's again try to compare the characteristics of the two groups of companies who agree with one of the following statements:

(1) one of the external obstacles to innovation of the enterprise is the limited amount of public procurement of innovative products;

(2) the tightening of the technical requirements of the public procurement has been an incentive to encourage technological innovation in the enterprise over the last three years.

Our regression analysis showed that companies included in the vertical holdings have more optimistic view to public procurement (because the change in the requirements of the state is easier transformed into modernization plans for supply chain). However, a more important result, in our opinion, is that a mechanism of public procurement affects in, positively or negatively, the old companies to a greater extent. This defines its limited applicability as a driver of deep technological changes in the economy, of the formation of new sectors and, moreover, of the constant temptation for officials to use it not only for development, but also for the stabilization of the situation in individual, often inefficient enterprises.

Third. We noted earlier the limited receptivity of Russian companies to the perspective R&D of Russian research organizations. Generally speaking, the problem may be somewhere in between and may be connected not only with predominantly imitative nature of innovation in companies, but also with the quality of innovation supply from the Russian research sector. The analysis showed that there are signs of a potential expansion of the interest of Russian companies in the medium term to interaction with foreign research organizations. This shift is often observed when the firms are competing with foreign firms, and are focused on the development and manufacture of globally new innovative products (not only new for the enterprise). So we can talk about the globalization of innovation demand of Russian companies not only for technologies but also for the results of research and development, as well as about the preconditions for international partnership in the research field.

Fourth. We talked about how the position of the firms in cooperation chains impacts on innovation. On the basis of the analyzed sample of companies, we can see that Russian companies are focused on enhancing the processes of integration into global value chains in the medium term. It is

important that regardless of the place of the enterprises in the cooperation chain there is a shift of their preferences concerning the directions of such integration to a more flexible and technology-intensive forms, in particular to the expansion of imports of technology, as well as to joint research with foreign companies.

5. CONCLUSION

Generally, we can see that innovations are mainly spread in accordance with two main models: vertical – through corporate connections, and horizontal – based on the example of both foreign and Russian companies in the atmosphere of developed competition.

Incentives for innovation at the company level depend to a large extent on the characteristics of the industrial organization of the sector and on the company's position in the supply chain.

The main incentive to innovate is competition, and its role is very significant not only in terms of pressure on the company, but also for horizontal dissemination of advanced technologies through the example of others. This learning effect is typical of larger companies and more noticeable when there is a competition with foreign companies (but not too strong), when the company has export to far abroad countries, as well as for larger companies. In the face of increasing competition, there are prerequisites to the globalization of innovation demand of Russian companies, not only for technology but also for the results of research and development.

A significant and substantial factor of the impact of innovation signals to Russian companies is their involvement in vertical holdings. Historically holding forms of business organization spread widely in the Russian economy in the 90s, as some palliative response of the business to the challenges in contract discipline, ensuring control over the domestic prices in the value chain, reducing transaction costs. The government also shaped actively integrated companies using its stakes to consolidate the property and to reduce the burden on the administrative management system, as well as to coordinate changes and implementation of long-term development programs in specific sectors.

Vertical integration has a dual effect on company's innovative behavior. Such companies are innovative enough, they innovate in a strategic way, but are much less susceptible and sensitive to external horizontal market signals.

Two basic models of the incentives to innovate of Russian companies have been outlined in the paper. The first deals mainly with the horizontal diffusion of technologies through the example of other companies in competitive conditions. The second is based on the innovation supply (from the bottom of the cooperation chain and from research institutes) and is more typical of integrated, state-oriented companies. The first model is more susceptible to changes and demands of the market, but it also defines a lower receptivity to the results of research and development.

The second model originally emerged in sectors with underdeveloped subcontracting networks and weak standardization, where self-regulation mechanisms do not work in due measure, and in a mixed economy. In this case a big failure appears in the coordination of innovation (technological) changes. This failure is compensated by vertical integration and participation of the state in coordinating changes. However, the situation, when the state acts simultaneously as the consumer, the regulator of the market, the customer of R&D and technology, and the direct owner of several companies, leads to the problem of the internal contradiction of the state's role (as the purchaser, the regulator and the owner) and the risk of introducing significant distortions in the competitive environment and application of double standards.

The significantly varying picture of the dependence of incentives and innovative channels on the industrial organization defines the high heterogeneity of the impact of different instruments to stimulate innovation in the economy on specific sectors and industries. In fact, basing on the analysis of innovation incentives at the micro level in the light of the value chains organization one can get quite a practical approach to link and combine innovation policy with industrial one.

The innovation policy toolkit should be tailored to the industry specifics (vertical or horizontal, open or closed). The choice of the tools on overcoming barriers to innovation is

better to be in sync with the market structure and the "profile" of different channels.

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APPENDIX

Table I. Structure of samples

	Percentage of companies, %	
	in the sample of 2011	in the sample of 2012
Age of company		
less than 5 years	9.0	10.7
5-10 years	18.6	18.3
10-20 years	24.6	25.3
over 20 years	47.8	45.7
Industry		
extraction of crude petroleum and natural gas	6.5	6.7
manufacture of food products, including beverages	16.7	15.6
manufacture of textiles and textile products	13.1	13.8
manufacture of wood, wood products, pulp, paper and paper products	13.3	11.3
manufacture of chemicals and chemical products	11.0	10.3
manufacture of rubber and plastic products	7.6	6.7
manufacture of other non-metallic mineral products	-	6.7
manufacture of basic metals	8.1	7.5
manufacture of machinery and equipment	9.1	8.0
manufacture of electrical machinery and equipment	6.6	6.1
manufacture of transport equipment	8.0	7.1
Number of employees		
up to 250 employees	35.8	49.8
251-500 employees	28.1	18.6
501-1000 employees	18.8	15.8
over 1,000 employees	17.3	15.8
Annual revenue		
not more than 100 million rubles	19.4	20.9
more than 100 million rubles, but not more than 500 million rubles	29.1	25.2
more than 500 million rubles, no more than 1 billion rubles	20.6	19.0
more than 1 billion rubles, but not more than 5 billion rubles	22.6	24.5
more than 5 billion rubles	8.0	10.1
Ownership		
participation of foreign owners	21.4	18.9
participation of foreign owners more than 10%	15.3	13.8
participation of government and / or municipalities	11.1	10.7
Exporting		
to the former Soviet Union (FSU) countries	49.8	48.2
to other countries	29.5	28.2
Financial condition		
poor	14.5	11.0
satisfactory	65.7	65.2
good	19.8	23.3

Table II. Characteristics of firms following two main models of innovation channels – results of linear regression parameters estimation

	Best practice and market pull			Innovation supply and push		
	1.1	1.2	1.3	2.1	2.2	2.3
Age_ Under 5 years	,035	,198	,171	-,183	-,183	-,172
Age_ Over 20 years	,029	-,052	-,090	,210**	,160*	,152*
Number of employees_ Up to 100 people	-,287**	-,096	-,070	-,168	-,172	-,160
Number of employees_ 101-250 people	-,262**	-,145	-,129	-,092	-,095	-,096
Number of employees_ 501-1000 people	,111	,044	-,054	,002	-,084	-,128
Number of employees_ Over 1,000 people	,451***	,377***	,241**	-,040	-,092	-,154
Government stske_ Yes	-,035	,020	-,061	,366***	,217*	,224*
Foreign owners stake_ No	-,248	-,163	,002	-,027	-,071	-,022
Foreign owners stake_ More than 10%	-,089	-,164	,026	-,107	-,110	-,035
Integration_ Russian vertically integrated holding	,112	,078	,022	,524***	,503***	,472***
Integration_ Multinational	-,210	-,212	-,154	,211	,145	,177
Financial condition_ Poor	-,121	-,163	-,078	-,024	,013	,038
Financial condition_ Good	-,082	,003	-,107	,008	-,065	-,116
Main product_ Raw materials		-,079	,042		,024	,077
Main product_ Intermediate goods		,307***	,207**		,079	,048
Main product_ Capital goods		,203	,113		,029	-,018
Main product_ Finall durable goods		,244**	,115		-,051	-,095
Main product_ Finall non-durable goods		,273**	,243**		,049	,032
Competition with Russian firms_ No		-,094	,053		-,151	-,106
Competition with Russian firms_ Tough		,338***	,288***		-,117	-,127
Competition with foreign firms_ No		-,027	-,070		-,008	-,029
Competition with foreign firms_ Tough		,285***	,175**		-,160*	-,201**
Key customer_ Government		-,226*	-,201*		,657***	,607***
Key customer_ Households		-,061	-,063		-,054	-,030
Exports_ No		-,258**	-,086		-,012	,070
Exports_ To far abroad countries		,296***	,173*		,179	,114
Spending on R&D_ Yes			,152*			,068
Innovative products_ New for company			1,046***			,325***
Innovative products_ New for Russia			,902***			,561***
Innovative products_ New globally			,691**			,468
Constant	,136	-,261	-,678	-,276	-,156	-,319
Industry dummies	yes	yes	yes	yes	yes	yes
N	646	646	643	646	646	643
R ²	,136	,245	,460	,147	,197	,235

* significant at 0,10 level

** significant at 0,05 level

*** significant at 0,01 level