Open innovation in Russian firms: an empirical investigation of technology commercialisation and acquisition

Daria Podmetina* and Juha Väätänen

Lappeenranta University of Technology,
P.O. Box 20,
Lappeenranta FI-53851, Finland
E-mail: daria.podmetina@lut.fi
E-mail: juha.vaatanen@lut.fi
*Corresponding author

Marko T. Torkkeli

Kouvola Research Unit,
Lappeenranta University of Technology,
Prikaatintie 9,
Kouvola FI-45100, Finland
E-mail: marko.torkkeli@lut.fi

Maria M. Smirnova

St. Petersburg State University Graduate School of Management,
St. Petersburg 199004, Russia
E-mail: smirnova@som.pu.ru

Abstract: The open innovation paradigm suggests that while the costs of innovation and R&D are rising and, at the same time, the life cycles of products are shortening, firms need new and more open business models (BMs) to gain cost and time saving by using also external R&D and to receive new revenues from internal invention sitting on a shelf by external commercialisation channels. Based on study of R&D oriented Russian companies (survey of over 150 companies, 2008), we investigate BMs companies are applying when trade on technology/innovation. Innovations are developing fast in Russia. This paper aims to classify companies based on their strategies in acquisition and commercialisation of technologies; form and analyse the clusters. Based on the previous survey and the current study, we develop a model, how Russian companies explore for knowledge/innovation/technology circulation.

Keywords: open innovation; Russia; R&D investments; transition economy.

Reference to this paper should be made as follows: Podmetina, D., Väätänen, J., Torkkeli, M.T. and Smirnova, M.M. (2011) 'Open innovation in Russian firms: an empirical investigation of technology commercialisation and acquisition', *Int. J. Business Innovation and Research*, Vol. 5, No. 3, pp.298–317.

Copyright © 2011 Inderscience Enterprises Ltd.

Biographical notes: Daria Podmetina is a Project Manager in the Department of Industrial Management of the Lappeenranta University of Technology, Finland. The current research project deals with innovativeness of Russian companies. Her research interests also focus on the emerging economies (especially Russia), international operation of the companies and innovation and technology management. She has published in journals such as the *Int. J. Innovation Management*, *Int. J. Business Excellence*, *Int. J. Technology Marketing* and *Multinational Business Review*.

Juha Väätänen is an Professor of International Business in the Department of Industrial Management of the Lappeenranta University of Technology, Finland. His research interests focus on doing business in emerging economies, privatisation, internationalisation and innovation management. He has published in journals such as the *Int. J. Innovation Management*, *Int. J. Business Excellence*, *Int. J. Technology Marketing* and *Multinational Business Review*.

Marko T. Torkkeli is a Professor of Technology and Business Innovations at the Lappeenranta University of Technology in Kouvola, Finland. He is a Member of the Editorial Boards of *Int. J. Innovation Management* and *Int. J. Services Sciences*. He is a Visiting Researcher at INESC Porto (Portugal) and serves as the Director of Publications of the International Society for Professional Innovation Management (ISPIM). His work has been published in journals and conferences in the field of technology management, innovation management and information systems.

Maria M. Smirnova is a Senior Lecturer of Marketing in the Graduate School of Management at Saint Petersburg State University, Russia. Her research interests include industrial marketing, relationship marketing, innovations and international marketing. Her teaching activities are mainly devoted to international marketing, the methodology of marketing research (including quantitative methods), SPSS-based research and structural equation modelling.

1 Introduction

The current economic situation is tough for all range of companies, business faces financial problems, competition is tight, knowledge has spread widely and R&D investments are huge. The development sets new requirements, especially to the research and development of companies. Traditional, centralised and tightly closed approach to innovation and R&D processes do not fit in fast changing environment anymore. After Chesbrough (2006) launched a term 'open innovation' that combines the ideas of openness under one term, the open approach has become an essential issue. Open innovation suggests that firms need more open business models (BMs) to gain cost and time saving by using also external R&D, and to receive new revenues from internal invention sitting on a shelf by external commercialisation channels (Christensen, 1997).

Despite the substantial science base and education focused on technology and sciences, innovation activity has been modest in Russia: only about 1.4% of GDP is spend on R&D (Rosstat, 2007). Approximately 60% of R&D is publicly financed and business sector is minor actor in R&D. Only about 10% of industrial enterprises reported technological innovations in 2007, while the average in the European Union is 50%

(OECD, 2005; Rosstat, 2007). The amount of R&D personnel in Russia is relatively high: about 1.3% of total labour force, compared with less than 2% in OECD countries. In theory, this should positively influence level of innovation capacity of companies in Russia, but only half of R&D personnel work as researchers, which means that the share of support personnel is extremely high.

Russia is a country with rich natural resources, with an educated labour force, and a history of major scientific breakthrough. Currently Russia is a resource-dependent economy, exporting mainly natural resources such as oil, gas and metals, and depends on commodity exports for its growth. According to World Bank estimates, the gas and oil sector contributed approximately 20% of the Russian gross domestic product (GDP) and more than 60% of exports in 2006. The prices for oil and other natural resources have dropped dramatically, which has put the whole economy on the risk due to decreased export income. If the Russian Federation wants to achieve sustainable growth in future years, it has to move away from a resource-based economy. The Russian economy has to diversify, embrace innovation and shift to a knowledge-based economy (EIU, 2007).

The open innovation paradigm suggests that while the costs of innovation and R&D are rising and, at the same time, the life cycles of products are shortening, firms need new and more open BMs to gain cost and time saving by using also external R&D and to receive new revenues from internal invention sitting on a shelf by external commercialisation channels.

The current economic situation is tough for all range of companies, business faces financial problems, competition is tight, knowledge has spread widely and R&D investments are huge. Rapid technology progress and advances in communication tools have facilitated existing types of interactions between producers and consumers of technologies on all business hierarchy levels and created new ways of interactions. This has led to fundamental changes in the ways companies interact both within and across firm and industry boundaries (Geoffrion and Krishnan, 2003; Mendelson, 2000). Globalisation process brings fiercer competition. To survive competition, companies need to rethink the way they are doing business – to adapt their BM (Chesbrough, 2006). A BM has two main purposes, creating value and capturing a share of that value (Chesbrough, 2007). Adapting the BM is an innovation itself. However it is essential, especially when companies are not accustomed to evaluate external ideas (Fetterhoff and Voelkel, 2006). The main focus of our paper is the BMs, to specify innovation circulation within company and trough the companies' borders: inward innovation – inside circle of innovation – outward innovations.

We continue the study of R&D oriented Russian companies (survey of over 150 companies, 2008) in order to investigate BMs companies are applying when trade on technology/innovation. The research objective of this paper, based on the previous research, is to classify surveyed Russian companies based on their strategies in acquisition and commercialisation of technologies. Based on the classification, we perform further analyse of the clusters. As a result, we propose model how Russian companies explore for knowledge/innovation/technology circulation.

This paper is structured as follows: Section 1 introduces the research topic and sets the research objectives. Section 2 reviews the literature on open innovation and BMs. Section 3 describes the survey data and presents the results of the analysis. Section 4 develops the model and proposes the matrix for analysing the technology acquisition and commercialisation clusters. Section 5 presents empirical results of the clusters' analysis and describes the case studies. Section 6 presents the conclusions of the study.

2 Literature review

The rapid technology progress together with the globalisation of business processes pressure companies to consider adapting their existing BMs in order to survive the competition fight. The inner-innovation circles of the companies are in the large extent accompanied by the external innovation circles, which include interactions between producers and consumers of technologies on all business hierarchy levels. Rapid technology progress and advances in communication tools have facilitated existing types of interactions and created new ways of interactions, which has led to fundamental changes in the ways companies interact both within and across firm and industry boundaries (Geoffrion and Krishnan, 2003; Mendelson, 2000).

Many companies that formerly accepted their business design as a 'given' now consider it to be a conscious choice and a competitive weapon. They are using creative business designs to enter new markets, attack incumbents and renew their own leadership positions.

This development sets new requirements for companies, especially to research and development operations. Traditional, centralised and tightly closed approach to innovation and R&D processes do not fit in the fast changing environment. Several studies have suggested new approaches to the business already in 1990s' (Chesbrough, 2003; Hagedoorn and Shekenraad, 1994; OECD, 2005; Watkins, 2003), but not until Chesbrough (2006) launched a term 'open innovation' that combines the ideas of openness under one term, the open approach has become an essential issue. Open innovation suggests that firms need more open BMs to gain cost and time saving by using also external R&D, and to receive new revenues from internal invention sitting on a shelf by external commercialisation channels (Christensen, 1997). The variety of the mechanisms of the open innovation paradigm makes the approach difficult to adopt and adapt. On the other hand, there are many companies that have successfully implemented open innovation even before the actual term had been launched.

The open innovation paradigm suggests that while the costs of innovation and R&D are rising and, at the same time, the life cycles of products are shortening, firms need new and more open BMs to gain cost and time saving by using also external R&D and to receive new revenues from internal invention sitting on a shelf by external commercialisation channels.

Traditionally, BM is focused on all elements of the system and system as a whole (Magretta, 2002) and defines customers and their value, business concept, sources of profit, delivery and distribution channels, cost policy, etc. The main idea of BM is how to do business in order to get profit (Rappa, 2001; Turban, 2002) or, in other words, strategic choices for creating and capturing value within a value network (Chesbrough, 2007). BMs define (describe) relationship with main stakeholders (customers, partners, suppliers, etc.), 'connections with factor and product markets' (Amit and Zott, 2001; Elias et al., 2002; Mitchell and Coles, 2003) as well as skills required for success (Rhyne, 2009). One of the newest definitions is proposed by Osterwalder et al. (2005) defining BMs as a "conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm". It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, to generate profitable and sustainable revenue streams. BM is a

mediator between technical domain (feasibility, performance) and economic domain (value, price, profit) (Chesbrough and Rosenbloom, 2002).

Firms adopt a variety of mechanisms for technology acquisition and commercialisation. The strategies of large and small firms are different. Small firms develop technology expertise to gain entry to global markets. For manufacturing companies, high expertise in very precisely targeted niche areas is the key to effective operation in international and global markets. For service companies, knowledge rather than technology acquisition is central and there is a significant and growing outsourced market in product development and delivery to market.

The portfolio approach to technology acquisition is quite common. The portfolio includes: in-house R&D; outsourced R&D; technology licensing; collaborative partnerships with companies; collaborative external partnerships with universities or public research organisations (both formal and informal) and acquisition of specialist technology capability. Essential to the process is an organised search for new ideas (Laursen and Salter, 2006). The search process for innovations is problematic since companies are not accustomed to evaluate external ideas (Dittrich and Duysters, 2007; Fetterhoff and Voelkel, 2006). The performance measurements for research organisations, which can be applied to any research are also problematic (Wonglimpiyarat, 2008).

Typically, the perspective of the innovation commercialisation process is in launching, finding customers or in barriers of commercialisation (Bond and Houston, 2003; Sandberg, 2005). This means that commercialisation is the last phase of the innovation development (Cooper, 1975). Commercialisation of an innovation is encompassed by multiple uncertainties. Uncertainties related to markets, technology and BM are high. The commercialisation of innovation includes many risks. Taking that into account, it is not surprising that most innovations will not achieve commercial success; as a matter of fact, most innovations fail. Commercialisation is often understood to be the final phase of the innovation process: fuzzy front end, the new product development (NPD) process and commercialisation (Aurora, 1995; Chesbrough, 2003, 2006).

The open innovation (Chesbrough, 2003) concept focuses on collaboration between companies to exploit a technological innovation. Not much different from business design thinking, a BM encompasses six functions:

1 articulate the value proposition
2 identify a market segment
3 define the required value chain
4 specify the revenue generation mechanism
5 describe the position of actors within the value network
6 formulate a competitive strategy.

Chesbrough (2006) proposes a categorisation of BMs in six types of varying levels of integration and adaptive capability. In particular the advanced Type 6 – BM, which is capable of adapt to the market. Chesbrough (2007) argues that companies have to develop their BMs by experimenting various strategies. This will develop their capabilities further. Similarly R&D partnerships are important sources to develop BMs, especially the role and nature of partnerships is significant (Chesbrough and Schwartz, 2007; Kock and Torkkeli, 2009).

The role of innovation communities and of the public domain has been stressed by von Hippel and von Krogh (2006). Comparable approaches such as 'creation nets', flexible and temporary business networks at a wide geographical scale, have been suggested by Brown and Hagel (2006). The academic-industry partnerships play also important role of the success of knowledge transfer (Salmi and Torkkeli, 2009).

The concept of open innovation at business level has now widely been accepted as an important paradigm, and empirically based studies are becoming available focusing on key issues such as IPR and patenting strategies. However, the challenge remains, as Chesbrough (2010) states the changing of BM is not easy to achieve even it is considered vital.

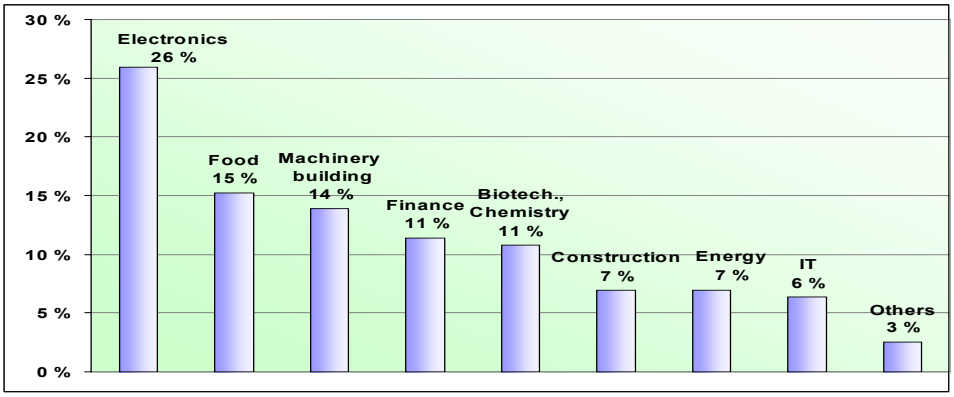
3 Data and methodology

The study is based on the survey of over 150 R&D oriented Russian enterprises, conducted in 2008. The study was designed on a basis of face-to-face structured interviews, with the key respondents representing top management of the firms. Survey of Russian companies was conducted on the regions having the highest impact of foreign direct investment and highest innovation sector development, mainly in St. Petersburg and Moscow.

The composition of data sample is presented in Figure 1. The largest industries are electronics industry (26%), food industry (15%), machine building (14%), finance (11%), biotechnology and chemistry (11%), construction (7%), energy (7%) and IT (6%).

The sample was selected to focus sectors to be innovation-oriented and emphasising R&D as a source of their long-term competitive advantage. About 34% of companies have R&D intensiveness ratio over 5% and 60% of firms over 3%. The average R&D intensiveness is 5.13%, what is significantly higher than other relative studies on Russian companies have reported. This is unusual; because in the prior research shown that the productivity of Russian R&D is very low in international comparison (Schaffer and Kuznetsov, 2007). About 12% of studied companies did not have any R&D operations, 50% conducted single R&D projects and 38% of companies had their own internal R&D department.

Figure 1 Companies by industries, % (see online version for colours)



The majority of surveyed companies are large- or medium-sized, over 250 employees (37%), or medium size, with 50–250 employees (37%) companies. Their R&D operations mainly focus on NPD (3.4), business/manufacturing process development (1.97), the basic research (1.57), derivative research (1.22) and platform development (0.98). The scale is from 5 (most important) to 1 (less important).

3.1 Technology acquisition

While acquiring new technologies, companies aim for improving products (73 answers), for utilisation of 'well tried' technologies/solutions (50 answers), for acquired technologies support the core of company's R&D function (27 answers) and for the development of new breakthrough product/creation of whole new knowledge (25 answers).

The majority of the companies (99) delegate the responsibility of acquisition of external technologies to one person or a team in the R&D department. Only 6.3% of companies utilise the services of intermediaries. It is a responsibility of all employees to follow the development and look for potential technologies in 9% of the companies.

Companies ranked the importance of external sources for looking and acquiring external technologies from 5 (most important) to 1 (not important). Publications and conferences (2.3), patent databases (2) and university and research organisation (1.4) are the main sources for innovation search and acquisition of external technologies. The fact that external sources of technology such as competitors, suppliers, customers, companies in other industries, contract developers, contract manufactures, etc. are not as important for Russian companies, let us suggest, that important link is missing – networking and relationship with company's external stakeholder.

Russian companies acquire external technologies as patents 32%, open sources 25% and licensing 19%. Only 10% of companies acquire the complete technology. The Russian companies seem to have very weak connections with stakeholders, and weak relationship networks. This is supported with the fact that only 19% of studied companies use strategic alliances as a form of collaboration to develop technologies. About 9 companies use 1–2 alliances/coprojects to develop technologies, 14 companies use 3–10 alliances and only 7 companies use over 10 alliances.

Previous studies have shown that companies active in acquisition have more access to new technologies, innovations and flexibility. However, 58% of companies in our survey have not made any acquisition of patents and/or other immaterial property, 11% companies made 1–2 acquisitions, 4.5% of companies made 3–10 acquisitions and 5% of companies made over 10 acquisition. 109 (69%) companies have not made any acquisition of personnel with specialised skills/competences. Russian companies are not very active in licensing technologies as well: 98 companies (62%) answered that they have not licensed technologies/IPR outside from own company.

The largest benefit of buying external technologies, according to companies' estimations, is that product development processes have become faster (59%), products' 'time to the market' shortened (24%), completely new products and technologies emerged (15%), R&D expenditures decreased (12%) and profit increased (9%). The main problem for companies acquiring external technologies is the required time and resources spending to adopt technology (71 answers). However, fear of loosing own innovation ability (41 answers) and lack of supply of adequate technologies (36 answers) are also serious barriers for companies on the way to open technology paradigm.

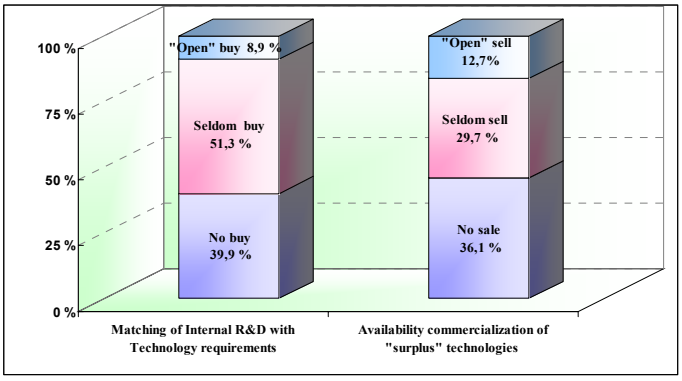
3.2 Technology commercialisation

While taking technology to the market, Russian companies goals are to increase products success potential, improve technologies and products based on them (27 answers); to get reciprocal entry to others' technologies (24 answers) and to gain extra profit (14 answers). The methods how companies find potential buyers for their 'surplus' technologies/IPR are as follows: 25 companies do not have defined selling process/person in charge, 21 companies have particular person/group of people in charge of selling process and 21 companies utilise the services of intermediaries. The external channels (*multiple answers possible*) companies use to take technologies to markets are as follows: 45% of companies use spin-off companies, 40% use joint ventures, 25% use licensing of IPR/technologies and 24% sell IPR/technologies.

Russian companies tend to sell technologies to other companies (70 answers) as patents (69%) as licensing (29%) and as a complete technology (6%). The challenges that companies face are the following: finding the buyer for technology is difficult (59%), lack of the marketplaces for technologies (49%) and the complexity of IPR and fear of infringement of IPR (42%).

The combined results on buying and selling technologies by Russian companies are presented in Figure 2. About 40% of companies tend to be self-sufficient with their in-house R&D and state that their in-house R&D completely matches with technology requirements. The remaining 60% of companies have a need in acquisition of external technologies: sometimes (51%), and 9% of companies do it on the regular basis, stating that 'the utilisation of external technologies is vital for their business'.

Figure 2 Russian companies buying and selling technologies, % (see online version for colours)



4 Model development for open innovation

Firms can capture value from new technology in two basic ways: through incorporating the technology in their current businesses or through launching new ventures that exploit the technology in new business arenas (Chesbrough and Rosenbloom, 2002). Companies take their technology to the market (local or foreign) as set by its BM. The commercialisation of technology is naturally necessary when company considers benefit from the value created within innovation process.

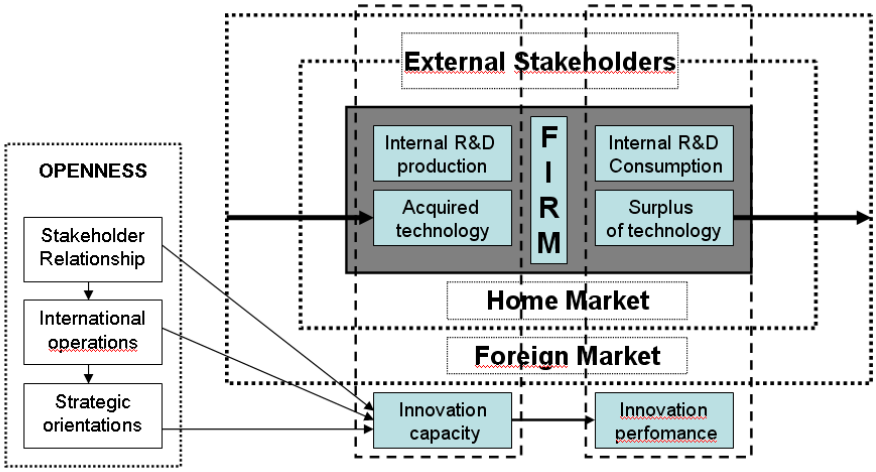
Some companies can successfully imply existing BM when taking the technology to the market. However, in some cases, BM does not fit the requirements of the technology or business environment or companies' technology commercialisation objectives prove that changes in BMs are necessary. A study in Netherlands has revealed that only quite a few companies have BM making them capable of technology acquisition and commercialisation with external partners (van der Meer, 2007). Adapting existing BM or developing a new one is the important factor for successful innovation performance of the company.

Based on the results of the survey of Russian R&D companies conducted in 2008 (Torkkeli et al., 2009) the open innovation BM is proposed (Figure 3). Companies possess *innovation capacity* formed of *internal R&D production capacity* and *acquired external technologies* (purchased and non-commercial channels, spill-over effect). Internal R&D capacity is influenced by the effective/non-effective *cooperation with external and internal stakeholders* both on the home markets and abroad.

The technology can be produced by company itself and in cooperation with local and foreign partners. The *strategic orientation* of the company plays important role on the forming the innovation capacity. The degree of involvement into international operation (international cooperation and international acquisitions) have effect on innovation capacity of the company.

Company's need for technology and innovation (internal R&D production and external technologies purchased) can be over estimated and creates *the surplus of technologies*, which cannot be 'consumed' by the company itself. This surplus is to be commercialised. Some companies produced technologies in order to sell them on the market. The innovation performance of the company depends on the innovation capacity and involves the rate of successful *commercialisation of the technologies* and *internal R&D consumption.*

Figure 3 Open innovation business process (see online version for colours)



4.1 Theoretical support for the proposed model

The role of interaction with external and internal stakeholders is an important factor enhancing innovativeness and contributing to successful new products or services brought to the market. The role of firm's partners and stakeholders as a source of knowledge for enhancing innovativeness has been studied in the literature (Gianella and Tompson, 2007; Kock and Torkkeli, 2008). Intensive relational ties are created as an outcome of interaction between parties that occurs on different levels and in different functional spheres of organisation. Intensity of interaction is one of the constructs used to describe and analyse the interaction process between the firms and potential stakeholders.

The existence of strong relationship between internationalisation and innovation is obvious for technology oriented companies, when international technology transfer is a form of export *per se* (Robinson, 1988). However, the globalisation processes influence companies more often enter foreign markets and acquire specific knowledge enabling them to implement more technology innovations.

Thus

> "innovation has moved from an international reality dominated by the idea of technology transfer, where agents develop knowledge and transfer it to other countries, to a much more complicated situation where, although, that reality has not disappeared, there are also new ways of developing innovation in which the international ambit also affects the creation of knowledge stage and which multinational companies acquire new protagonism." (Molero, 2008)

The successful innovations also depend on macro-economic conditions, e.g. the amount of effective demand within the national economy (Geroski and Walters, 1995). The behaviour of innovating firms depends on their own decision making, but

> "is shaped by institutions that constitute constraints and incentives for innovations, such as laws, health regulations, subsidies, taxes, public expenditures, etc.
>
> Additionally, micro-economic conditions (e.g. market conditions, competition, and price setting) and macro-economic conditions (e.g. wealth, inflation, openness) influence the decisions about innovation taken by firms." (Faber and Hesen, 2004)

The development of a market economy in Russia has to be based on networks of innovative companies utilising (Dyker, 2006).

Dyker studies the process of development and dissemination of technology in Russia through the cooperation between Russian organisations and foreign firms. It is important to understand that FDI in Russia facilitates the technology transfer from abroad. The interesting point is that success of privatisation in Russia can be estimated by 'the diversity of enterprise forms, sizes and strategies which is essential for knowledge diffusion and generation'.

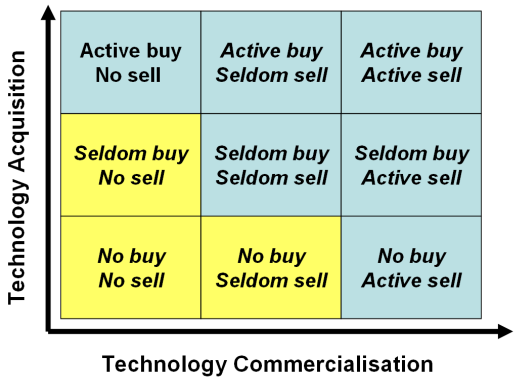
Cooperation and licensing deals with partners from developed economies is one way to speed up the innovation development process in Russia. But for Russian companies and research institutes, it is difficult to find partners when Russian scientists are not educated to prepare business plans or create new ventures. Venture capital industry in Russia is mainly foreign-owned, but on the other hand, foreign direct investments in R&D are quite modest. Probably the highest foreign R&D investment occurs in the ICT sector. At least Sun Microsystems, Motorola, Microsoft and Intel have R&D or

dedicated development centres, with more than 200 workers, in St. Petersburg or Moscow (OECD, 2005).

4.2 Acquisition vs. commercialisation clusters

After the analysis of acquisition and commercialisation of technology of 150 Russian R&D companies, we found out main models of innovations circulation: 'no sell, no buy', 'seldom buy, no sell', 'seldom sell, no buy', 'seldom buy and seldom sell', 'open sell' and 'open buy'. We propose the cluster framework for further analysis (Figure 4).

Figure 4 Technology acquisition vs. technology commercialisation clusters (see online version for colours)



5 Empirical results

The distribution of the companies by clusters (Figure 5) shows us two empty clusters: 'no buy, seldom sell' and 'no buy, active sell'. The only possible combination for companies, who do not sell technology, is the cluster 'no buy, no sell'. This means, that 15.8% of companies who do not sell technology, they do not buy either. Interesting research question is 'Are these companies self-sufficient in the terms of technology and R&D or they just do not have any experience in acquiring and selling technologies?'

The R&D intensity of companies (Figure 6) proves companies with no sales and no acquisition of technology to be the least effective in terms of innovations and R&D. The more companies involved in the acquisition or commercialisation of technology, the higher their R&D intensity is. The synergy effect is observed for companies acquiring and selling technologies: companies who sell and buy technologies have the highest R&D intensity. Slightly lower R&D intensity ration is observed in the 'active sell, active buy' cluster, what can be explained by the limited number of observation. To compare, for the whole survey 34% of companies have R&D intensiveness ratio over 5% and 60% of firms over 3%. The average R&D intensiveness is 5.13%, what is significantly higher than other relative studies show.

Figure 5 Companies distribution in the clusters, % (see online version for colours)

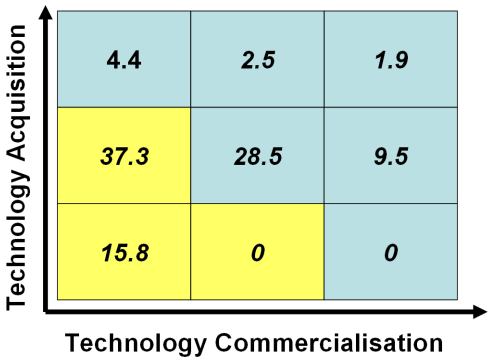
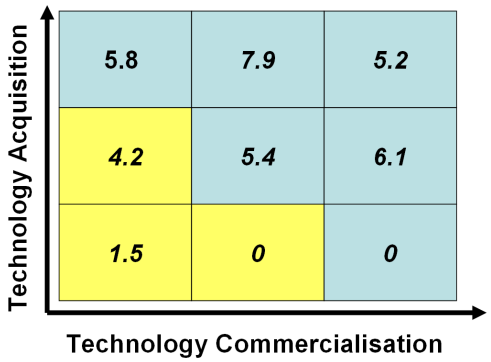


Figure 6 R&D intensity of clusters, % (see online version for colours)



There are both domestic and international companies in the sample. In our model, proposed that international operations influence the innovativeness of the companies, and more specifically, the openness of the companies. We analyse the number of companies with pure domestic sales and companies with both domestic and internationals ales in the clusters (Figure 7). The lowest share of international companies is in the 'no buy, no sell' cluster. The more actively companies become involved in the acquisition and commercialisation of technologies, the higher share of international companies. Companies with experience in international sales are more eager to sell and buy technologies both in Russia and abroad.

The sample was build on the expectation that companies are innovation-oriented and emphasising R&D as a source of their long-term competitive advantage. The top three industries of the companies in the survey are (Figure 1) electronics (26%), food industry (15%) and machine building (14%). The electronics industry is the absolute leader for all clusters except for 'no buy, no sell' (Figure 8).

Figure 7 Domestic vs. international sales in clusters (see online version for colours)

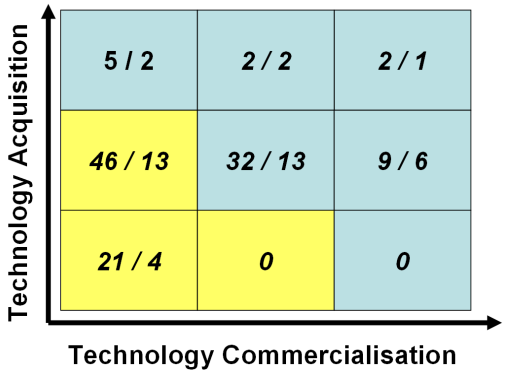
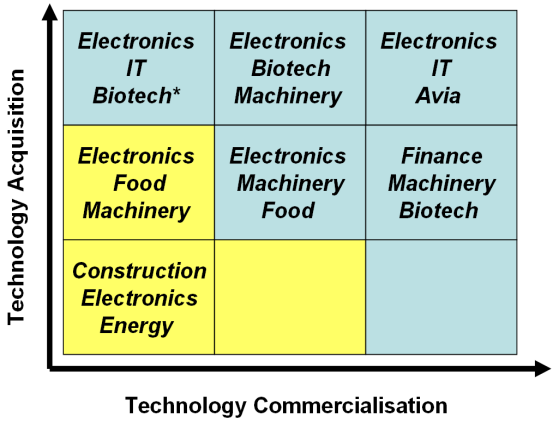


Figure 8 The top 3 industries in the clusters (see online version for colours)



*Biotechnology and chemistry.

While traditional 'Schumpeterian approach' states that small firms are not strong in introducing innovations and increasing productivity, recent research has found that small firms are not any weaker in innovation performance. They spend less on R&D than large firms, but they outperform large firms when considering innovation counts (Pianta and Vaona, 2007). Small- and medium-sized enterprises report that the most important factors hampering their innovative activity include underdeveloped infrastructure in the area of technology commercialisation, incomplete legislation and lack of financing (OECD, 2005). One of authors' previous study proved that *larger innovative companies are more export oriented; the small innovative companies are more domestic oriented* (Podmetina et al., 2009). Based on our survey (Figure 9), we can suggest that small companies are less involved into the acquiring and commercialising technology. However, the small number of observation in some of the clusters makes statistical analysis impossible.

The companies involved in the acquisition and commercialisation of technology are mainly focused on the NPD, the other R&D operations (basic research, platform development, derivative research and business process development) are less important for companies (Figure 10).

Figure 9 Size of companies in the clusters (see online version for colours)

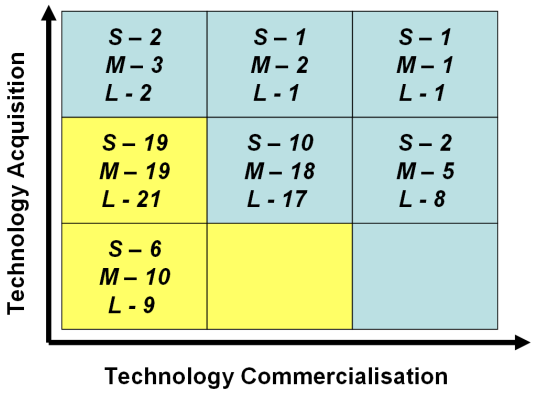
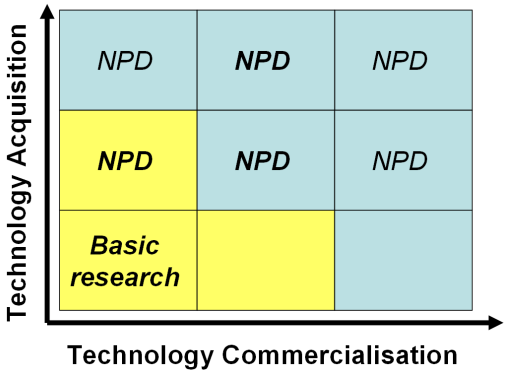


Figure 10 Main focus of R&D in clusters (see online version for colours)



5.1 Case companies implementing open innovation paradigm in clusters

Openness of Russian companies' is very relative concept, high degree of 'openness' of some companies can just mean that they want to sell or buy technology, but not willing to exchange knowledge within an open market.

About 10% of companies in the survey self-reported that they apply open innovation paradigm (self-reported openness). It can be considered that a self-reported openness in terms of technology acquisition is not a very surprising response to receive from firms, as it is reasonably intuitive, and, furthermore, a concept that has been around for quite a while that an integration of external knowledge may help the focal firm to succeed (Komkov and Bondareva, 2006). The positioning these companies into the technology acquisition – commercialisation matrix let us see how well companies estimate their openness. Are these companies active in the acquiring and selling technologies (Figure 11)? Most of these companies just buy technology, but not sell or sell rarely. Just one company is active both in acquiring and selling technology.

Companies with self-reported openness can be characterised as large (Table 1), effective in R&D organisation and with R&D intensity much above average. If most of the companies in our study focus on NPD in their R&D operations, these companies with self-reported openness focus on business process development most.

Figure 11 OI implementation in clusters (see online version for colours)

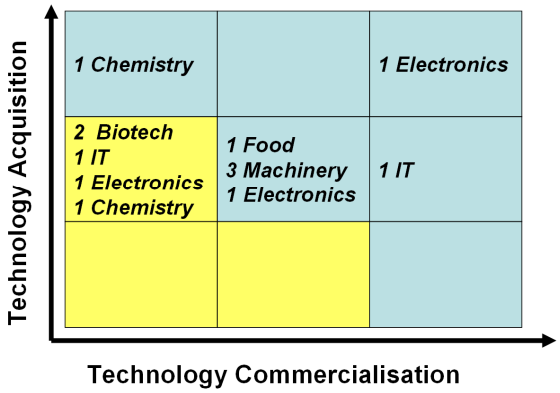


Table 1 Case companies with self-reported openness

Indicators	*Meaning*
Size	Medium (4) to large (7)
Internationalisation	Domestic (7) vs. international (8)
R&D organisation	R&D department (9), 2 departments for R and 4 departments for D
R&D intensity	1.5%–3% (1), 3%–5% (2), 5%–10% (7), over 10% (3)
Focus of R&D	Top 3: business process development, basic research and platform development

6 Conclusions

This paper studied the emergence of phenomena of open innovation in Russia and the development of technology commercialization and technology acquisition strategies. The effect of internal R&D, industry, size of the company and internationalisation on the open innovation are discussed. The results of the previous studies have already indicated significant differences between industry clusters (high-, medium- and low tech companies) and also established a viable matrix for analysing innovation strategies of Russian companies.

The main findings of the currents study show that sufficient internal R&D and technology acquisition is a precondition for implementing Open Innovation business models in Russian companies. The results also clearly show that implementing Open Innovation business model is a stage process also in Russia as referred by Chesbrough (2007). There is also clear evidence that companies with international operations use open innovation business models more actively both for technology acquisition and technology commercialization. Similarly the higher internal R&D performance, more open innovation oriented business model is. The role of industry proved also to be significant. High-tech industries were the most active in external technology acquisition and technology commercialization. This is result of well organised R&D

operations & nature of their business. On the other hand company size is not a significant factor whether company applies open innovation oriented business model. However, small- and medium sized companies are more active in technology acquisition, but large companies are dominant in technology commercialization.

Based on the results of the survey of Russian R&D companies the conceptual model was developed which involved the *innovation capacity* formed of *internal R&D production capacity* and *acquired external technologies* (purchased and non-commercial channels, spill-over effect). Internal R&D capacity is influenced by the effective/non-effective *cooperation with external and internal stakeholders* both on the home markets and abroad. The technology can be produced by company itself and in cooperation with local and foreign partners. The *strategic orientation* of the company plays important role on the forming the innovation capacity. The degree of involvement into international operations (international cooperation and international acquisitions) have an effect on innovation capacity of the company. Company's need for technology and innovation (internal R&D production and external technologies purchased) can be over estimated and creates *the surplus of technologies*, which cannot be 'consumed' by the company itself. This surplus is to be commercialised. Some companies produced technologies in order to sell them on the market. The innovation performance of the company depends on the innovation capacity and involves the rate of successful *commercialisation of the technologies* and *internal R&D consumption.*

The cluster analysis of acquisition and commercialization of technologies have found a significant share (40%) of companies who are self-sufficient in terms of technology – they rely on their own R&D production. And the rest of the companies acquire technology from the external sources sometimes (51%) or on the regular basis (9%). The companies buying technology on the regular basis are of the most interest for the open innovation studies due to the nature of their business concentrated on the utilization of external technologies and intensified cooperation.

The revealing of "empty clusters" (there were no companies who commercialize technology, but do not acquire external technology) have defined the open innovation process development in the Russian companies as the stage process – companies first need to get experience in the utilization of external technologies and then they start getting familiar with the externalizing the own technologies.

The R&D intensity was significantly higher for the companies who do develop open innovations. The results of the cluster analysis show that the more companies get involved into acquiring or commercializing technologies, the higher their R&D intensity is. The synergy effect in the case of combing the buying and selling technologies was also observed when R&D intensity was analysed.

The authors suppose the influence of the international operations on the intensity of open innovation development in the company. The comparison of domestic and international companies within the clusters' matrix proved that there are more companies with international sales among companies, implementing open innovations. The direct effect between the open innovations and internationalization is the subject of future study. However, even now, it is possible to conclude, that companies with more experience in international cooperation, have better performance in implementing open innovation strategies.

We can suggest, openness of Russian companies' is very relative, high degree of 'openness' of some companies can just mean that they want to sell or buy technology, but not willing to exchange knowledge within an open market. Towards the open innovation

concept Russian companies experience many problems both of internal and external character. Like, mentioned in this paper, interaction with external and internal stakeholders (competitors, suppliers, customers, companies in other industries, contract developers, contract manufactures, etc.) is weak for most of the companies, communication is missing and strong ties are not created. With this kind situation, knowledge exchange, transfer of technologies and effective cooperation with partners is rather impossible.

The other problem for effective innovativeness of Russian companies is existing business environment. Russia is falling behind in all indicators measuring innovative output, compared with most developed countries. Russia's innovation performance is disappointing, despite the available stock of human capital and overall investment in R&D. The link between science and business, weak communication with authorities, bureaucracy, corruption and political risks, as well as not sufficient financing of innovations, lack of venture capital, foreign investments, research grants – all these facts make companies' way towards open innovation unsmooth and unsteady.

What should be done in Russia to improve the conditions for innovations? The development of innovative activities requires good macro-economic conditions, attractive investment environment for local and foreign companies, and more easily available financing. These are factors that are also requirements for sustainable growth. In addition, greater competitiveness, better enforced IPR regime, support of commercialisation of R&D outputs, public–private partnerships, well channelled government funding, restructured organisations in research institutes, favourable tax treatment and support for small innovative companies are other means that Russia could use to boost the innovative activity. All steps intended to spur the innovations should be well-planned and carefully targeted.

To summarise, there are companies in Russia that implement Open Innovation oriented business models and their main characteristics are high R&D performance and international orientation. However, as with everything in Russia, differences between good and bad performers are extremely large. This is even can be seen in data which focuses R&D oriented companies. Promising is that best performers are catching up very fast with the best practices in the world in Open Innovation business model implementation

As proposal for future research and consideration for managerial application we would suggest pay more attention on the ties/relationship of companies with their internal and external stakeholders in order to understand better motivations and competences of companies in acquiring technologies on the market. We also consider the analysis the relationship between company's performance, productivity and degree of openness, commercialisation and acquisition of technology.

Acknowledgements

We gratefully acknowledge anonymous referees for constructive comments and suggestions, which helped greatly to improve the earlier version of the manuscript.

References

Amit, R. and Zott, C. (2001) 'Value creation in e-business', *Strategic Management Journal*, Vol. 22, Nos. 6–7, pp.493–520.

Aurora, A. (1995) 'Licensing tacit knowledge: intellectual property rights and the market for know-how', *Economics of Innovation and New Technology*, Vol. 4, pp.41–59.

Bond III, E.U. and Houston, M.B. (2003) 'Barriers to matching new technologies and market opportunities in established firms', *Journal of Product Innovation Management*, Vol. 20, pp.120–135.

Brown, J.S. and Hagel III, J. (2006) 'Creation nets: getting the most from open innovation', *McKinsey Quarterly*, No. 2, pp.40–51.

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

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

Chesbrough, H. (2010) 'Business model innovation: opportunities and barriers', *Long Range Planning*, Vol. 43, Nos. 2–3, pp.354–363.

Chesbrough, H. and Rosenbloom, R.S. (2002) *The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spinoff Companies*. Boston, MA: Harvard Business School.

Chesbrough, H. and Schwartz, K. (2007) 'Innovating business models with co-development partnerships', *Research-Technology Management*, Vol. 50, No. 1, pp.55–59.

Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds.) (2006) *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press.

Chesbrough, H.W. (2007) 'Why companies should have open business models', *MIT Sloan Management Review*, Vol. 48, No. 2, pp.22–28.

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

Cooper, R.G. (1975) 'Why new industrial products fail', *Industrial Marketing Management*, Vol. 4, No. 4, pp.315–326.

Desai, R. and Goldberg, I. (Eds.) (2007) *Enhancing Russia's Competitiveness and Innovative Capacity*. Washington, DC: Finance and Private Sector Development Department, World Bank.

Dittrich, K. and Duysters, G. (2007) 'Networking as a means to strategy change. The case of open innovation in mobile telephony', *The Journal of Product Innovation Management*, Vol. 24, No. 6, pp.510–521.

Dyker, D. (2006) *Closing the EU East–West Productivity Gap*. London: Imperial College Press.

Economist Intelligence Unit (EIU) (2007) *Country Report Russia – June 2007*. London: The Economist Intelligence Unit Ltd.

Elias, A.A., Cavana, R.Y. and Jackson, L.S. (2002) 'Stakeholder analysis for R&D project management', *R&D Management*, Vol. 32, No. 4, pp.301–310.

Faber, J. and Hesen, A.B. (2004) 'Innovation capabilities of European nations: cross-sectional analysis of patents and sales of product innovations', *Research Policy*, Vol. 33, pp.193–207.

Fetterhoff, T.J. and Voelkel, D. (2006) 'Managing open innovation in biotechnology', *Research Technology Management*, Vol. 49, No. 3, pp.14–18.

Geoffrion, A.M. and Krishnan, R. (2003) 'E-business and management science: mutual impacts', *Management Science*, Vol. 49, No. 11, pp.1445–1456.

Geroski, P.A. and Walters, C.F. (1995) 'Innovative activity over the business cycle', *Economic Journal*, Vol. 105, pp.916–928.

Gianella, C. and Tompson W. (2007) 'Stimulating innovation in Russia: the role of institutions and policies', OECD Economics Department Working Papers No. 539, OECD Publishing.

Hagedoorn, J. and Shekenraad, J. (1994) 'The effect of strategic technology alliances on company performance', *Strategic Management Journal*, Vol. 15, No. 4, pp.291–309.

Kock, C. and Torkkeli, M. (2008) 'Open innovation: a 'Swingers' Club' or 'Going steady'?' IE Business School Working Paper WP08-11, 5 February 2008.

Komkov, N.I. and Bondareva, N.N. (2006) 'Problems in the commercialization of scientific research and ways of addressing them', *Studies on Russian Economic Development*, Vol. 18, pp.2–18.

Laursen, K. and Salter, A. (2006) 'Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms', *Strategic Management Journal*, Vol. 27, No. 2, pp.131–150.

Magretta, J. (2002) 'Why business models matter', *Harvard Business Review*, Vol. 80, No. 5, pp.86–92.

Mendelson, H. (2000) 'Organizational architecture and success in the information technology industry', *Management Science*, Vol. 46, No. 4, pp.513–529.

Mitchell, D.W. and Coles, C. (2003) 'The ultimate competitive advantage of continuing business model innovation', *Journal of Business Strategy*, Vol. 24, No. 5, pp.15–21.

Molero, J. (2008) 'The challenges of the internationalization of innovation for science and technology policies', ICEI Paper, Instituo Compluense de Estidios Internacionales.

OECD (2005) Fostering *Public–Private Partnership for Innovation in Russia*. Paris: OECD Publishing.

Osterwalder, A., Pigneur, Y. and Tucci, C.L. (2005) 'Clarifying business models: origins, present, and the future of the concept', *Communications of AIS*, Vol. 16, pp.1–25.

Pianta, M. and Vaona, A. (2007) 'Innovation and productivity in European industries', *Economics of Innovation and New Technology*, Vol. 16, No. 7, pp.485–499.

Podmetina, D., Smirnova, M., Väätänen, J. and Torkkeli, M. (2009) 'Innovativeness and international operations', *Int. J. Innovation Management*, Vol. 3, No. 2, pp.1–23.

Rappa, M. (2001) *Managing the Digital Enterprise*. North Caroline State University. Available at: http://digitalenterprise.org/.

Rhyne, L.C. (2009) 'Business model design for biotechnology firms', *Int. J. Business Innovation and Research*, Vol. 3, No. 3, pp.298–310.

Robinson, R. (1988) *The International Transfer of Technology: Theory, Issues, and Practice*. Cambridge, Massachusetts: Ballinger Publishing Company.

Rosstat (2007) *Russia in Figures 2006*. Moscow: Rosstat, Russian Federal State Statistics Service.

Salmi, P. and Torkkeli, M. (2009) 'Success factors of interorganisational knowledge transfer: a case of a collaborative public–private R&D project', *Int. J. Business Innovation and Research*, Vol. 3, No. 2, pp.109–125.

Sandberg, B. (2005) 'The hidden market – even for those who create it? customer-related proactiveness in developing radical innovations', DSc Economic Dissertation, Publications in the Turku School of Economics and Business Administration Series A-5, Turku, Finland.

Schaffer, M. and Kuznetsov, B. (2007) 'Productivity', in R. Desai and I. Goldberg (Eds.), *Enhancing Russia's Competitiveness and Innovative Capacity*. Washington, DC: Finance and Private Sector Development Department, World Bank.

Torkkeli, M., Podmetina, D. and Väätänen, J. (2009) 'Knowledge absorption in emerging economy –role of foreign investments and trade flows in Russia', *Int. J. Business Excellence*, Vol. 2, Nos. 3/4, pp.269–284.

Turban, E. (2002) *Introduction to E-Commerce*. USA: Prentice Hall.

van der Meer, H. (2007) 'Open innovation – the Dutch treat: challenges in thinking in business models', *Creativity and Innovation Management*, Vol. 16, No. 2, pp.192–202.

von Hippel, E. and von Krogh, G. (2006) 'Free revealing and the private collective model for innovation incentives', *R&D Management*, Vol. 36, No. 3, pp.295–306.

Watkins, A. (2003) 'From knowledge to wealth: transforming Russian science and technology for a modern knowledge economy', World Bank Policy Research Working Paper No. 2974.

Wonglimpiyarat, J. (2008) 'Systematic evaluation of economic and financial impacts in the development and commercialisation of research', *Int. J. Business Innovation and Research*, Vol. 2, No. 4, pp.420–436.