

Pekka Torvinen

CATCHING UP WITH COMPETITIVENESS IN EMERGING MARKETS – AN ANALYSIS OF THE ROLE OF THE FIRM’S TECHNOLOGY MANAGEMENT STRATEGIES

Thesis for the degree of Doctor of Science (Technology) to be presented with due permission for public examination and criticism in the Auditorium of the Student Union House at Lappeenranta University of Technology, Lappeenranta, Finland on 15 April 2016 at noon.

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Abstract

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Emerging markets have experienced rapid economic growth, and manufacturing firms have had to face the effects of globalisation. Some of the major emerging economies have been able to create a supportive business environment that fosters innovation, and China is a good example of a country that has been able to increase value-added investments. Conversely, when we look at Russia, another big emerging market, we witness a situation in which domestic firms struggle more with global competitiveness.

Innovation has proven to be one of the most essential ingredients for firms aiming to grow and become more competitive. In emerging markets, the business environment sets many constraints for innovation. However, open strategic choices in new product development enable companies in emerging markets to expand their resource base and capability building. Networking and close inter-firm cooperation are essential in this regard. In this dissertation, I argue that technology transfer is one of the key tools for these companies to become internationally networked and to improve their competitiveness. It forces companies to reach outside the company and national borders, which in many cases, is a major challenge for firms in emerging markets.

This dissertation focuses on how companies can catch up with competitiveness in emerging markets. The empirical studies included in the dissertation are based on analyses of survey data mainly of firms and their strategies in the Russian manufacturing industry. The dissertation contributes to the current strategic management literature by further investigating technology management strategies in manufacturing firms in emerging markets and the benefits of more open approaches to new product development and innovation.

Keywords: technology management, strategic management, technology transfer, networks, cooperation, innovation, open innovation, emerging markets, Russia, competitiveness, firm performance

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Abbreviations

BEEPS	Business, Environment and Enterprise Performance Survey
EBRD	European Bank of Reconstruction and Development
EM	Emerging markets
ETA	External technology acquisition
ETC	External technology commercialisation
FDI	Foreign direct investment
IP	Intellectual property
MNE	Multinational enterprise
NPD	New product development
R&D	Research and development
SME	Small or medium-sized enterprise

Publications

This dissertation is based on the research papers listed below, including descriptions of their role in the dissertation. The publications have been authored in collaboration with other authors, and thus, the authors' contribution to each publication has been described in detail below. Complete versions of these publications are included in Part II of the dissertation. The rights have been granted by the publishers to include the papers in the dissertation.

Publication 1

Torvinen, P. and Väättänen, J. (2013) 'Review of the competitiveness of Russian manufacturing industry', *International Journal of Business Excellence*, vol. 6, no. 3, pp. 293–309.

Publication 1 examines the development of Russian manufacturing industry competitiveness on the basis of statistical data. This publication describes the setting in Russian manufacturing and the motivation for future research. The paper was accepted for publication in the *International Journal of Business Excellence* following a double-blind review process. The publication was planned together with the co-author. The first author was responsible for coordinating the writing process, the literature review and the data analysis. The conclusions were written in conjunction with the co-author.

Publication 2

Torvinen, P. and Väättänen, J. (2014) 'Building competitiveness of emerging market firms: The role of interfirm technology transfer', proceedings of the 40th Annual Conference of the European International Business Academy (EIBA), 11–13th December 2014, Uppsala, Sweden.

Publication 2 is conceptual and examines the importance of inter-firm technology transfer in improving firm competitiveness and catching up in emerging markets. The paper was accepted for the Annual Conference of the European International Business Academy (EIBA) and was presented at the conference session. It followed a double-blind review process. The publication was planned together with the co-author. The first author was responsible for the coordination of the writing process, the literature review and the conceptual development. The discussion and conclusions were jointly written with the co-author.

Publication 3

Torvinen, P., Podmetina, D., Hinkkanen, J.J. and Väättänen, J. (2014) 'External technology acquisition in Russian firms', *International Journal of Procurement Management*, vol. 7, no. 3, pp. 257–278.

Publication 3 investigates the exploitation of external technology acquisition in the Russian manufacturing industry and uses firm-level survey data from Russian manufacturing. The paper was accepted for publication in the *International Journal of Procurement Management* following a double-blind review process. The publication was planned together with the co-authors. The first author was responsible for the coordination of the writing process, the literature review and the data analysis. The conclusions and discussion were written in conjunction with the co-authors.

Publication 4

Torvinen, P. and Väättänen, J. (2015) 'External technology commercialisation and markets for technology in Russian manufacturing industry', *International Journal of Technology Marketing*, vol. 10, no. 1, pp. 4–24.

Publication 4 assesses the exploitation of external technology commercialisation and the functioning of technology markets in the Russian manufacturing industry. It uses firm-level survey data from Russian manufacturing. The paper was accepted for publication in the *International Journal of Technology Marketing* following a double-blind review process and was planned together with the co-author. The first author was responsible for the coordination of the writing process, the literature review and the data analysis. The conclusions and discussion were written jointly with the co-author.

Publication 5

Torvinen, P. and Väättänen, J. (2015) 'Technology management strategies in emerging markets', proceedings of the XXVI International Society for Professional Innovation Management (ISPIM) Conference – Shaping the Frontiers of Innovation Management, 14-17 June 2015, Budapest, Hungary.

Publication 5 examines the use of different management strategies between groups of countries based on their level of competitiveness. It uses firm-level survey data from manufacturing companies in developing and developed EU, Eastern European and Central Asian countries. The paper was accepted for the International Society for Professional Innovation Management (ISPIM) conference and was presented at the conference session. It followed a double-blind review process based on an extended abstract. The publication was planned together with the co-author. The first author was responsible for the coordination of the writing process, the literature review and the data analysis. The conclusions and discussion were written jointly with the co-author.

Part I: Overview of the thesis

1 Introduction

1.1 Background, motivation and objectives

Globalisation and the attendant increase in global competition variously impact companies, their operations and decisions more than ever. The world has become smaller for many companies operating globally due to rapid technology and infrastructure development. For some companies, increasing global competition is creating barriers to internationalisation as well as to success in the domestic market. Companies have to be able to develop their international competitiveness as well as their operations. In today's competitive environment, this requires companies to develop new and more agile strategies, especially for innovation, and to increasingly network with other companies. In this dissertation, I argue that this is especially beneficial for manufacturing companies in emerging markets with regards to new product development processes and performance. In this thesis, the Russian manufacturing industry is empirically investigated to ascertain the manner in which more open technology management strategies and networking support companies in becoming more competitive.

Firm competitiveness is dependent on firm, industrial and national structures. At the firm level, the successful coordination of strategically important activities can lead to competitive advantages (Porter, 1980; 1985; 1990). Innovation and technology management strategies are also vital for manufacturing firms to improve their innovation performance and competitiveness. Firms need to implement strategies that can complement the results of internal R&D and improve the efficiency and speed of new product development (Cassiman and Veugelers, 2006; Granstrand et al., 1992; Pavitt, 1990). Technology transfer and functioning technology markets are key tools for improving new product development performance and access to international networks (Tsai, 2001; Arora et al., 2001). The acquisition of external technologies is essential to complementing internal R&D and improving the efficiency of new product development. The commercialisation of internally developed technologies can offer companies additional income and help them establish new inter-organisational connections. However, all this requires that firms develop internal capabilities to succeed (Cohen and Levinthal, 1989). International expansion and networking can help companies reduce home market constraints (Turnbull et al., 1996; Luo and Tung, 2007). Many companies in emerging markets are domestically focused, and the environment, for example, for intellectual property protection, remains challenging. Notwithstanding, this may further support technology transfer and the acquisition of external technologies.

Emerging markets are an interesting research setting to further analyse this issue. The current literature, still mostly focused on developed markets, has begun the conversation about firms in emerging markets. Many manufacturing firms have faced international competition in domestic markets; they also aim to become more internationalised and to match the level of competitiveness in international markets. However, companies continue to be challenged on a global scale, and an underdeveloped business environment

presents many constraints for manufacturing companies. It does not encourage companies to innovate or internationalise, incidentally two key components for improving performance. This thesis aims to ascertain how change could occur and what actions would help companies in emerging markets to overcome current challenges, especially concerning innovation, and become more prepared for global markets.

Russia and other emerging markets have experienced significant economic progress. In Russia, however, the main source of this progress has been rising energy prices rather than vibrant industries (Hanouz and Prazdnichnykh, 2011). This makes the Russian manufacturing industry an interesting subject for further research on innovation. There is an indication of attempts at modernising the Russian economy to become more competitive, but local companies still lack competitiveness and generally remain on the domestic market. However, the situation in domestic markets is becoming increasingly competitive (Desai and Goldberg, 2007; Filippov, 2011). Markets are continuously opening up to foreign imports and foreign direct investment, which offer ever better and cheaper products on the Russian market (Hanouz and Prazdnichnykh, 2011; Trifilova, 2009; Valdaytsev and Sergeyev, 2011). Local companies need to meet these growing requirements by increasing their competitiveness. Key issues in the future success and productivity growth of Russia are technology and innovation development. Russian companies need to become more sensitised to the fact that they will lose their market position even in the domestic market if they do not introduce radical technological product and process innovations (Dirks and Keeling, 2009; Valdaytsev and Sergeyev, 2011). Russia has well-educated industry and business specialists and researchers who can potentially create an excellent source for innovation and R&D. However, the innovation output is still weak in Russia. Russian companies are still quite closed when it comes to business models and innovation, and they have relatively insufficient R&D and NPD processes (Podmetina et al., 2011).

The business environment, with the attendant market competition, sets constraints on firm competitiveness. Building management and innovation capabilities can help companies overcome these challenges (Hoskisson et al., 2000; Khanna et al., 2005; Peng et al., 2008; Xu and Meyer, 2013; Wright et al., 2005). For companies, competition and external pressure have had a positive effect on competitiveness, forcing local companies to focus on their core competences (Dunning, 1993; Porter 1990; Prahalad and Hamel, 1990; Duysters and Hagedoorn, 2000). Competition also puts pressure on domestic companies to focus on productivity. This is important as Russian companies need to reduce the technology and innovation gap that exists in comparison to companies in developed countries (Desai and Goldberg, 2007; Filippov, 2011) if they wish to survive increasing levels of competition, even in the domestic markets. Companies create knowledge and technologies through R&D and new product development (NPD) processes. Russian companies tend to be domestically oriented, and only international competition forces them to develop processes and collaborate (Hinkkanen et al., 2013). They are also relatively closed with regards to the use of external technologies and innovations, which limits their access to international networks (Podmetina et al., 2011). International cooperation and technology acquisition may be one of the key factors to enhance firm

competitiveness. Moreover, external sources of knowledge are often important for the entire innovation process (Cohen and Levinthal, 1990). Even technologies that are not necessarily aligned with the company's core business and business models can create great value for companies through successful technology transfer and commercialisation (Anokhin et al., 2011; Frishammar et al., 2012). Increasing innovativeness and more open business models are a necessity for Russian companies aiming for growth and international competitiveness. Open business models are also vital when companies cooperate with external partners. Inbound and outbound open innovation are essential in the case of technology acquisition and commercialisation where focal companies or external partners actively pursue external technology exploitation (Chesbrough, 2003). This kind of development is needed in emerging market companies and their technology management strategies.

1.2 Research scope, questions and research gap

This dissertation aims to contribute to the current management literature by examining the link between competitiveness – on the firm, industry and national levels – and the technology management strategies that firms select in the manufacturing industry in emerging markets. The external business environment and a firm's internal capabilities and resource base are critical prerequisites for the positive or negative development of the firm's competitiveness and performance.

In manufacturing, strategic choices in technology management concerning innovation activities and new product development are vital in facilitating firm performance. Outbound and especially inbound technology transfer can be seen as one of the most viable tools to enable firms in emerging markets to catch up and improve their performance and competitiveness. This also encourages firms to cooperate and be more networked domestically and internationally.

This dissertation focuses mainly on the Russian manufacturing industry in its endeavour to find empirical evidence on the topic and contribute to current research. The publications incorporated in the thesis analyse the development of competitiveness in the Russian manufacturing industry. The papers also focus on the role of technology management and technology transfer in improving firm competitiveness. This is more closely empirically investigated in the case of Russian manufacturing firms focusing on technology acquisition, technology commercialisation and the functioning of the technology markets in Russia. The use of different technology management strategies is also compared at the national level between countries at different stages of economic development and competitiveness. The empirical research spans different levels, including the firm, industry and national levels, with the aim of illustrating a more complete picture of the research topic.

Research problem and gap

Competitiveness has been a leading topic in international business for many years. The competitive advantage of a firm is dependent on firm, industrial and national structures (Porter, 1980; 1985; 1990). This topic has now become essential for companies, especially in fast growing emerging economies where the institutional and market environment and constraints affect the firm's strategies (Peng, 2002; Yiu et al., 2007). This research field contributes to this study, especially in discussions of the firm's competitiveness on the industry and national levels.

The previous literature on strategic management has highlighted the role of technology management strategies in improving firm performance and competitiveness (Cassiman and Veuglelers, 2006; Tsai 2001; 2009; Stuart, 2000). The firm's resource base has been recognised as one of the most essential factors affecting its competitive advantage (Barney 1991; 2001; Grant, 2002; Peteraf, 1993). The resource base can be developed within the firm, but it can also be extended by exploiting external sources (Dyer and Singh, 1998). This requires an open approach to innovation, including the exploitation of technology transfer, cooperation and networking (Cassiman and Veugelers, 2006; Arora et al., 2001; Tsai, 2001; Stuart, 2000; Fu et al., 2011). Altogether, innovation and a firm's technology and innovation management strategies have been recognised as essential in improving firm competitiveness (Pavitt, 1990; Chesbrough, 2003; Radosevic, 1999). The development of the firm's internal capabilities is a prerequisite for the positive development and commercialisation of innovation (Cohen and Levinthal, 1989). These are ultimately critical factors enabling firms to catch up with competitiveness. These fields of research contribute to the current study, especially research on the firm level.

Local industries and enterprises in emerging markets have been faced with global competition whereby only the most competitive companies survive and grow. This has put many companies in a difficult situation. These countries and industries do have hidden potential to become more competitive. Developing companies' capability to innovate and exploit technologies can enhance company competitiveness to meet international standards. It places significant requirements on company management but offers unlimited opportunities. The research context of emerging markets contributes to research on large and growing economies that play an important role in the future development of the global economy. This research field has been paying increasing attention to emerging markets, with many topics being extensively investigated. In many cases, this research focus creates an interesting research setting in comparison to the majority of research on developed countries (Mayer and Peng, 2005; Hoskisson et al., 2000; Wright et al., 2005). There is clearly room for further research, especially in the case of Russia where the historical background, rapid economic development and manufacturing-related challenges in becoming globally competitive create an interesting research setting that can potentially contribute to current research in strategic management and international business. Figure 1 presents the gap in this research.

Literature streams	
Strategic management	Competitiveness
Resource-based view and relational view	Market-based view
Research areas	
Technology and innovation management	Firm capabilities
Technology transfer	Cooperation and networks
Research context	
Emerging and developing markets	
Research gap	
How can manufacturing firms in emerging markets catch up with competitiveness? – An analysis of the role of the firm's technology management strategies	

Figure 1. Literature streams and research gap

This research assesses the firm competitiveness in emerging markets by contributing on two theoretical approaches. First is the market level where the constraints of the business environment create gap in competitiveness (Hoskisson et al., 2000; Peng, et al., 2009). This is also evident in the case of Russia (Desai and Goldberg, 2007; EBRD, 2012). The second is the firm level where the interfirm cooperation and technology transfer enables companies to expand their resource base and catch up in the competitiveness (Barney 1991; 2001; Dyer and Singh, 1998; Lavie, 2006; Chesbrough, 2003; Fu, et al., 2011). This study contributes mostly on the second theoretical approach by providing empirical evidence on the preconditions and implications of more open technology management strategies.

The main research question of this thesis is: How can manufacturing firms in emerging markets catch up with competitiveness? I aim to answer this question with support from the current research literature as well as by means of the evidence presented in the publications included in the thesis.

The first sub-question relates to publication 1: How has the competitiveness of the Russian manufacturing industry developed, and is there a gap in competitiveness? This sub-question and corresponding publication describe the motivation and background for the research leading to the other publications, which utilise empirical industry-level evidence.

The second sub-question is related to publication 2: How can companies in emerging markets increase their competitiveness through inter-organisational technology transfer? This sub-question and corresponding publication review the current literature and conceptualise

the main notions of the thesis regarding the exploitation of technology transfer and inter-organisational cooperation to catch up with competitiveness.

The third sub-question relates to publication 3: How can external technology acquisition (ETA) improve firm competitiveness? This sub-question and corresponding publication address the exploitation of ETA as a strategy in the context of empirical evidence from the Russian manufacturing industry.

The fourth sub-question corresponds to publication 4: How can external technology commercialisation (ETC) and technology exchange improve firm competitiveness? This sub-question and corresponding publication address the use of ETC as a strategy in the context of empirical evidence drawn from the Russian manufacturing industry.

The fifth sub-question relates to publication 5: How does the business environment affect technology management strategies? This sub-question and corresponding publication address the application of different technology management strategies in manufacturing firms located in Central and Eastern European countries with different levels of host country competitiveness.

Altogether, the publications cover the essential themes and assess the main research question, from a variety of angles, with a focus on the application of technology management strategies. The path followed by this research and the corresponding research questions are presented in Table 1. The sub-questions correspond to each publication included in the thesis.

Table 1. Research questions and corresponding publications

Research question:	
How can manufacturing firms in emerging markets catch up with competitiveness?	
Publication 1: Review of the competitiveness of Russian manufacturing industry	Sub-question 1: How has the competitiveness of the Russian manufacturing industry developed, and is there a gap in competitiveness?
Publication 2: Building competitiveness of emerging market firms: The role of interfirm technology transfer	Sub-question 2: How can companies in emerging markets increase their competitiveness through inter-organisational technology transfer?
Publication 3: External technology acquisition in Russian firms	Sub-question 3: How can ETA improve firm competitiveness?
Publication 4: External technology commercialisation and markets for technology in Russian manufacturing industry	Sub-question 4: How can ETC and technology exchange improve firm competitiveness?

Publication 5: Technology management strategies in emerging markets	Sub-question 5: How does the business environment affect technology management strategies?
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1.3 Definition of key terms

This section defines the basic terms used in this dissertation. These definitions are closely connected to the concepts and theories described later in this introductory part of the dissertation.

Competitiveness and competitive advantage

Competitiveness is one of the key notions in this dissertation. In discussions about the different levels of competitiveness, the works of Michael Porter (1980; 1985; 1990) can be seen as foundational. His frameworks have also been used as a foundation for measuring competitiveness in the *Global Competitiveness Report* (Schwab, 2015), which is one of the most extensive comparative studies, published annually, measuring competitiveness on the national level.

Competitiveness can be measured on different levels (product, firm, industry and country) using different indicators (e.g. growth, profitability and market share) (Buckley et al., 1988). The *Global Competitiveness Report* defines competitiveness as ‘the set of institutions, policies, and factors that determine the level of productivity of a country’ (Schwab, 2015: 4). This notion follows the concepts developed by Porter whereby productivity ultimately depends on the sophistication of local competition and the development of the microeconomic capability of the economy. This includes the quality of the business environment, the state of cluster development and the sophistication of company operations and strategy. Microeconomic development is based on macroeconomic competitiveness, which is based on sound monetary and fiscal policies, human development and effective political institutions. This is supported by the endowments of a certain location, which thereby create the foundation for prosperity. Ultimately, prosperity is about the use of the location’s human, capital and natural endowments to create value (HBS, 2015).

One source defines competitiveness as ‘the ability of a region to export more in value added terms than it imports’ (Atkinson, 2013: 2). This calculation takes into account artificially low currencies, suppressed wages in export sectors, artificially low taxes and direct export subsidies. It also controls for tariff and non-tariff barriers to imports. Productivity growth in trade sectors is one of the key factors enabling the improvement of competitiveness. Productivity itself is more easily defined. It is measured as economic output per unit of input. The unit of input can be labour hours in the case of labour productivity or all production factors, including labour, machines and energy, when calculating total factor productivity (Atkinson, 2013).

Barney (1991: 102) defines competitive advantage when a firm implements a value-creating strategy that is not simultaneously being implemented by current or potential competitors. It can be called sustained competitive advantage in cases when other firms are unable to duplicate the benefits of this strategy (Barney, 1991). This also relates to the *strategic assets* of a company, defined as ‘the set of difficult to trade and imitate, scarce, appropriable and specialized *resources and capabilities* that bestow the firm’s *competitive advantage*’ (Amit and Schoemaker 1993: 36).

Firm performance

Firm performance is most commonly assessed by reviewing and analysing the financial indicators of a firm. However, in this dissertation, firm performance is measured through indicators based on the responses of firm managers in the surveys (publications 3 and 4). Innovation performance is mainly measured through the survey questions regarding the new product development results (e.g. the number of new products developed in the last 3 years). Financial performance is measured through indicators based on the responses of firm managers to questions on how they assess changes in their company’s performance against competitors or previously set goals in, e.g. market share, sales growth, profitability and return on investment.

Innovation

There are many definitions of innovation. Common among most of these definitions is that innovation is not only a conception of ideas or inventions; it also requires the commercial and practical application of these ideas and inventions. Innovation can also be radical (new and major innovations) or incremental (minor technological advances). It is also often accompanied by organisational changes (Trott, 2012). In what follows, I present definitions from the *Oslo Manual* (OECD/Eurostat, 2005) because the empirical analysis and methodology are based primarily on the application of these definitions. The manual was consulted in developing the surveys for the empirical data used in the publications included in the dissertation.

‘*An innovation* is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations’ (p. 46). ‘*Innovation activities* are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Some innovation activities are themselves innovative, others are not novel activities but are necessary for the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation’ (p. 47). ‘*An innovative firm* is one that has implemented an innovation during the period under review’ (p. 47).

‘*A product innovation* is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant

improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics' (p. 48). Following this definition, the *Oslo Manual* has defined process, marketing and organisational innovations more closely. This dissertation focuses on product innovation and does not examine the other innovation types.

Technology transfer

In this dissertation, the term technology transfer is used as a concept in relation to innovation. The term has been used quite widely in the literature throughout the years. Even though technology transfer includes both outward and inward technology flows, very often, inter-organisational technology transfer involves only one-directional transactions (Amesse and Cohendet, 2001; Radosevic, 1999).

Seaton and Cordey-Hayes (1993: 46) define technology transfer as the process of promoting technical innovation through the transfer of ideas, knowledge, devices and artefacts from leading edge companies, R&D organisations and academic research to a more general and effective application in industry and commerce.

According to UNCTAD (2014: 1), the term 'transfer of technology' can

be applied to the process by which a technology developed for a specific use or sector becomes applicable in a different productive setting. Transfer of technology may refer to a process that takes place within or across national boundaries, and on a commercial or noncommercial (concessionary) basis. It may refer to the physical movement of assets or to immaterial elements such as know-how and technical information, or most often to both material and immaterial elements. Transfer of technology may be linked to the movement of physical persons or more specifically to the movement of a specific set of capabilities.

Emerging markets

Emerging markets is widely used term which is often used interchangeably with emerging and developing economies. The term is often used with countries undergoing rapid economic growth, industrialization, structural changes, and having weak legal systems (Luo and Tung, 2007). Kvint (2009: xxiv) defines the term as follows:

Emerging market country is a society transitioning to a free-market-oriented-economy, with increasing economic freedom, gradual integration with the Global Marketplace and with other members of the GEM (Global Emerging Market), an expanding middle class, improving standards of living, social stability and tolerance, as well as an increase in cooperation with multilateral institutions.

1.4 Outline and structure of the thesis

Figure 2 summarises the structure and outline of the thesis. It presents the input and motivation and the output and main results for each section. This first section of the thesis presents the motivation, basic idea and concept behind the study. It also delineates the research scope and research questions. The second section focuses on the theoretical background and previous research seen as essential for the study and illustrates the study's contribution to current research. The third section describes the research design, methodology and the data used. The fourth section summarises the objective, main findings and role of the publications included in the thesis. The fifth section concludes the results, implications and study limitations and discusses future research directions.

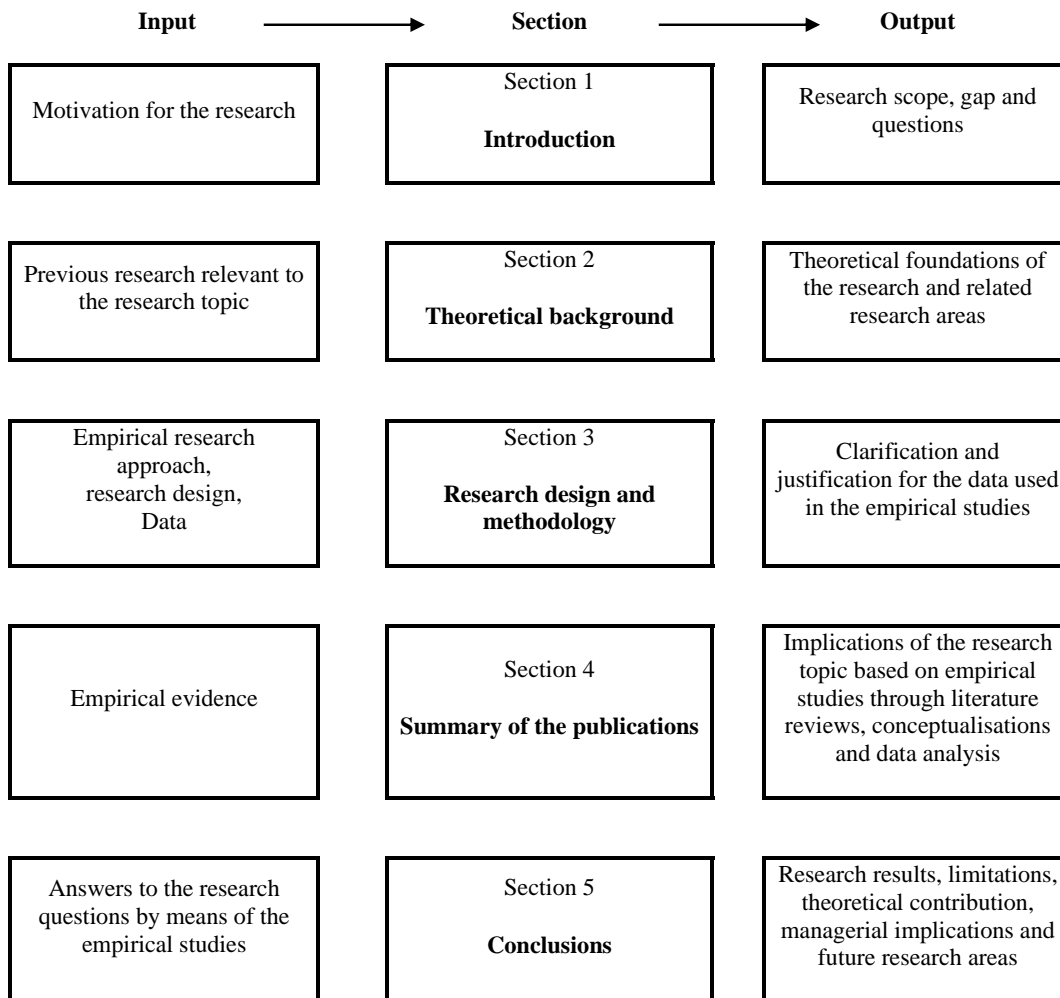


Figure 2. Structure of the thesis

2 Theoretical background

This section of the thesis presents the theoretical background and foundation for the study. This is mainly divided into two main topics. The first relates to the market-driven factors that are essential for building a firm's competitive advantage in emerging markets. It discusses the market constraints that firms have to overcome to catch up with competitiveness in domestic and international markets. The second main topic concerns firm-related factors and how firms can expand their resource base to gain competitive advantage. A synthesis and conceptual framework are presented upon covering these main foundations for this research.

2.1 The basis of firm competitiveness in emerging markets

2.1.1 The decisive role of the business environment – market- and industry-based views

The market-based view explains the competitiveness and competitive advantage of firms in the context of the structures of the external environment, industry and firms' competitive position within the industry. In this approach, the location and business environment of a firm play a decisive role in shaping the firm's strategies in building competitiveness (e.g. Porter, 1998; 1980). The market-based view has its foundation in industrial organisation (IO) economics and the works of Mason (1939) and Bain (1956; 1968) and has been further developed by Porter (1980; 1985; 1990).

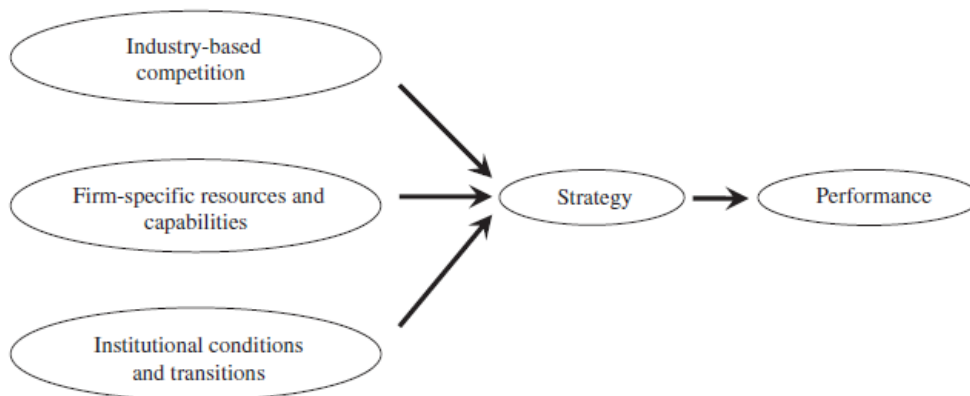
According to Porter (1980; 1985; 1990), the competitive advantage of a firm is dependent on the firm, industrial and national structures. At the level of the firm, the successful coordination of strategically important activities can lead to competitive advantages for focal firms if they are able to better organise activities than competitors. Porter also highlights that besides the coordination of activities within the value chain, coordination with vertical linkages – suppliers and channels – is important for the firm's performance. The interrelationships and role of horizontal strategies and cooperation with related business units have also become vital for firms. This can take place in the form of tangible, intangible or competitor interrelationships (Porter, 1980).

There are competitive market forces within the industry and at the national level that influence the strategies firms adopt. The industry structure affects firm strategies through different competitive forces. A firm's strategic choices are essential to its position within the industry. By responding to industry-set market forces with the right strategies, firms may be able to sustain competitive advantages in their industry. There are also factors on the national level that affect firm competitiveness. These factors are difficult to control but may be critical to the firm's development and competitiveness (Porter, 1980).

Even though this research mainly focuses on the Porterian approach to analyse the industry structure and market environment, it can be acknowledged that recent

discussions in the strategy literature also highlight the role of institutions and institutional conditions as an important variable in influencing firm strategy and performance. This applies especially in the emerging market context (Peng, 2002). Peng et al. (2008; 2009) suggest that the institution-based view is ‘a third leg’ in the strategy tripod, adding to the industry- and resource-based views. The institutional approach has been recognised as one of the most discussed theoretical perspectives in the strategy literature regarding emerging markets research (Hoskisson et al., 2000). ‘Institutions govern societal transactions in the areas of politics (e.g., corruption, transparency), law (e.g., economic liberalisation, regulatory regime), and society (e.g., ethical norms, attitudes toward entrepreneurship)’ (Peng et al., 2008: 922). Thus, institutions and the institutional environment can be seen as a driving force for firm strategy and performance, especially in emerging markets where the institutional environment and support are still developing (Peng et al., 2008).

Figure 3. The institution-based view: A third leg of the strategy tripod (Peng et al., 2009)



While the market-based view (MBV) has been widely used in the strategic management literature, it has some shortcomings. It places little emphasis on firm-level attributes and their effects on the firm’s competitive position. It assumes high resource heterogeneity and mobility between firms in an industry. It also assumes that firms have similar strategic goals (Barney, 1991). The approach focuses on responding to changes in the markets and improving a firm’s market position and competitiveness vis-à-vis competitors. The business strategy is based on the environment and competitors. Thus, the MBV is primarily a reactive and defensive approach and does not take innovation into account. Noteworthy, it is also difficult for firms to influence the markets and business environment. Thus, it is critical for companies in emerging markets to also develop their capabilities internally and to expand their boundaries and open their strategical views to improve their performance and competitiveness by reducing the constraints set by the home environment.

2.1.2 Catching-up competitiveness in emerging markets

The home market environment and the opportunities it offers are important for emerging market companies. In the case of emerging markets, domestic rivalry, networks and the business environment usually set constraints for companies. This plays an important and facilitating role in the international expansion and development of firms (Yiu et al., 2007). International expansion is critical for companies to reduce home market constraints (Luo and Tung, 2007). The institutional setting, low resource availability and continuous economic liberalisation present challenges for companies in emerging markets, which in turn affect the strategies that companies employ (Khanna et al., 2005; Peng et al., 2008; Xu and Meyer, 2013; Wright et al., 2005; Yiu et al., 2007; Peng, 2002). From a theoretical perspective, the MBV enables insights into these business environment-related issues which are vital for the growth and development of emerging market firms. These factors are also critical when analysing the competitiveness gap between developed and developing markets. Emerging markets create an interesting context in which to study firms' management strategies. These markets have faced major economic changes that have impacted on companies' management strategies. Increasing competition and market constraints force companies to be efficient and develop their processes to catch up with competition.

The current literature on emerging markets has a strong focus on internationalisation and international business, especially regarding how firms from developed countries can manage their business in emerging markets (Hoskisson et al., 2000; Wright et al., 2005). The role of emerging market firms and their competitiveness and performance remains under-studied in the current international business and strategic management literature. In particular, the strategic management literature has not focused much attention on the emerging markets context despite many well-known authors recognising that there are major differences in discussions about management and business in emerging markets (Xu and Meyer, 2013). For this section, I have selected articles from leading management and international business journals that illustrate current and future research topics regarding emerging market firms as well as differences in doing business in emerging markets. The selected articles have been divided into two tables. The first (Table 2) presents the conceptual and literature review papers which have played an important role in discussions about future research directions and topics. The second table (Table 3) presents empirical papers regarding evidence of the current situation and developments in emerging market firms.

Table 2. Selected conceptual studies and literature reviews on emerging market research

Publication	Topic and focus	Data and context	Results
Fu, X., Pietrobelli, C. and Soete, L. (2011) 'The role of foreign technology and indigenous innovation in the emerging economies: Technological change and catching-up', <i>World Development</i> , vol. 39, no. 7, pp. 1204–1212.	The role of indigenous and foreign innovation in technological change and catching up in emerging economies	Literature review and statistical analysis	The study supports the notion that indigenous and foreign innovation efforts are complementary. The benefits of international technology diffusion can only be delivered with parallel indigenous innovation efforts. This also requires the presence of modern institutional and governance structures and supporting innovation systems.
Khanna, T., Palepu, K.G. and Sinha, J. (2005) 'Strategies that fit emerging markets', <i>Harvard Business Review</i> , vol. 83, no. 6, pp. 63–74.	Adapting to the different business environments and institutional contexts when doing business in emerging markets	Review article	Multinational companies depend on specialised intermediate firms and regulatory systems which are lacking in emerging markets. Successful businesses recognise institutional voids and work around them. Critical issues in different institutional contexts include political and social systems, openness to foreign investment and the quality of the product, labour and capital markets.
Hoskisson, R.E., Eden, L., Lau, C.M. and Wright, M. (2000) 'Strategy in emerging economies', <i>Academy of Management Journal</i> , vol. 43, no. 3, pp. 249–267.	Analyses different theoretical perspectives and their insights into firm strategies in the context of emerging markets	Literature review	Discusses institutional theory, transaction cost economics and the resource-based view in an emerging market context and points to methodological and empirical challenges as well as the need for emerging markets research.
Jormanainen, I. and Koveshnikov, P.C. A. (2012) 'International activities of emerging market firms', <i>Management International Review</i> , vol. 52, no. 5, pp. 691–725.	Analyses conventional theories on micro and macro levels and how sufficient they are in explaining the internationalisation of emerging market firms	Literature review	Research on the internationalisation of emerging market firms can be improved with a broader range of methodologies such as longitudinal and mixed-methods studies. The geographic focus of studies also needs to be widened. Current research is biased towards China.

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<p>Kumar, V., Mudambi, R. and Gray, S. (2013) 'Internationalization, innovation and institutions: The 3 I's underpinning the competitiveness of emerging market firms', <i>Journal of International Management</i>, vol. 19, no. 3, pp. 203–206.</p>	<p>Discusses three main themes concerning firm competitiveness in emerging markets: innovation, internationalisation and institutions</p>	<p>Literature review</p>	<p>Innovation, internationalisation and institutions are very much interconnected and are the key issues in building competitiveness among emerging market firms.</p>
<p>Luo, Y. and Tung, R.L. (2007) 'International expansion of emerging market enterprises: A springboard perspective', <i>Journal of International Business Studies</i>, vol. 38, no. 4, pp. 481–498.</p>	<p>Expansion of emerging market MNEs</p>	<p>Conceptual</p>	<p>By expanding, emerging market firms are able to acquire strategic resources and reduce their institutional and market constraints. The acquisition of critical assets from mature MNEs compensates their competitive weaknesses and helps them overcome their latecomer disadvantages.</p>
<p>Peng, M.W., Wang, D.Y. and Jiang, Y. (2008) 'An institution-based view of international business strategy: A focus on emerging economies', <i>Journal of International Business Studies</i>, vol. 39, no. 5, pp. 920–936.</p>	<p>Drivers of firm strategy and performance in international business</p>	<p>Conceptual</p>	<p>The paper argues that an institution-based view of international business strategy has emerged alongside the industry- and resource-based views. Strategic choices are driven by industry conditions, and firm resources and capabilities, but also constrains the institutional framework.</p>
<p>Pietrobelli, C. and Rabellotti, R. (2011) 'Global value chains meet innovation systems: Are there learning opportunities for developing countries?' <i>World Development</i>, vol. 39, no. 7, pp. 1261–1269.</p>	<p>The role of global value chains in accessing knowledge and enhancing learning and innovation</p>	<p>Conceptual</p>	<p>Global value chains and inter-firm cooperation are important for firms in developing countries. The characteristics and governance of value chains have an impact on learning and innovation. A well-structured and efficient innovation system helps to reduce the complexity of transactions and risks. Global value chains and their governance are dynamic and continuously changing.</p>
<p>Wright, M., Filatotchev, I., Hoskisson, R.E. and Peng, M.W. (2005) 'Strategy research in emerging economies: Challenging the conventional wisdom*', <i>Journal of Management Studies</i>, vol. 42, no. 1, pp. 1–33.</p>	<p>Future of strategy research in emerging markets</p>	<p>Conceptual</p>	<p>Institutional theory is the most prominent in emerging markets research, but it should be combined with other dominant perspectives such as transaction cost theory, resource-based theory and agency theory. Current research has focused mainly on firms from developed economies entering emerging economies and domestic firms competing within emerging economies; however, future studies should focus more on firms from emerging economies entering other</p>

			emerging economies and those from emerging economies entering developed economies.
<p>Xu, D. and Meyer, K.E. (2013) 'Linking theory and context: "Strategy research in emerging economies" after Wright et al. (2005)', <i>Journal of Management Studies</i>, vol. 50, no. 7, pp. 1322–1346.</p>	<p>Future emerging markets research and new theoretical perspectives</p>	<p>Literature review</p>	<p>Emerging economy contexts challenge some of the assumptions of theories originally developed for relatively stable and efficient markets. In emerging markets research, institutional theory is still the most commonly utilised theoretical viewpoint; however, new theoretical concepts have emerged, focusing on learning, relationships, real options and spill-over.</p>

The theoretical discussion regarding research in emerging markets highlights an understanding of the institutional and business environment in which domestic and foreign firms have to adapt. Emerging economy contexts challenge some of the theoretical assumptions originally developed for relatively stable and efficient markets. In emerging markets research, institutional theory is still the most common theoretical viewpoint alongside transaction cost economics and the industry- and resource-based views; however, new theoretical concepts have emerged, and the most prominent theories are also incorporating other dominant theoretical perspectives. Strategic choices in emerging market firms are driven by industry conditions, as well as firm resources and capabilities, but are also constrained by the institutional framework (Hoskisson et al., 2000; Khanna et al., 2005; Peng et al., 2008; Xu and Meyer, 2013; Wright et al., 2005). Current research is also notably geographically uneven, with much of the current research focusing on China while other emerging markets have received less attention and remain under-studied. Future studies should also focus more on firms from emerging economies entering other emerging economies as well as firms from emerging economies entering developed economies (Jormanainen and Koveshnikov, 2012; Wright et al., 2005).

The recent literature has also alluded to many important factors and actions, especially when discussing emerging market firms and their development. Technological change, innovation, internationalisation and institutions are very much interconnected and are the key issues in industrialisation, increased productivity, competitiveness building and catching up of firms located in developing countries (Fu et al., 2011; Kumar et al., 2013). Involvement in global value chains and inter-firm cooperation has been observed as important for firms in developing countries. Value chains have a major impact on learning and innovation within emerging market firms. The benefits of international technology diffusion can only be delivered with parallel indigenous innovation efforts. This also requires the presence of modern institutional and governance structures and supporting innovation systems. Indigenous innovation is important as a reinforcement. Local capability building and innovation are extremely important for the catching up of emerging market firms; here, the excessive use of foreign innovation can decrease internal R&D and capability building (Fu et al., 2011; Pietrobelli and Rabellotti, 2011). For emerging market firms, international expansion also facilitates the acquisition of strategic resources and reduces their institutional and market constraints at home. With aggressive strategies, firms may be able to overcome their latecomer disadvantage by acquiring critical assets from mature MNEs to compensate for their competitive weaknesses (Luo and Tung 2007).

Table 3 presents empirical papers regarding evidence of the current situation and developments in emerging market firms, especially, regarding technology management strategies and issues which create the gap or support in decreasing the gap in competitiveness. These papers support the above mentioned literature and research which have highlighted the critical issues in business in emerging markets.

Table 3. Selected empirical studies on emerging markets research

Publication	Topic and focus	Data and context	Results
Dyker, D.A. (2001) 'Technology exchange and the foreign business sector in Russia', <i>Research Policy</i> , vol. 30, no. 5, pp. 851–868.	Technology exchange and collaboration of Russian firms	Secondary data and case studies	There is a strong basis to develop R&D collaboration and technology transfer between firms in Russia and those in advanced economies. Russian firms benefit from collaborations that are still challenged by the Russian business environment.
Filatovchev, I., Liu, X., Buck, T. and Wright, M. (2009) 'The export orientation and export performance of high-technology SMEs in emerging markets: The effects of knowledge transfer by returnee entrepreneurs', <i>Journal of International Business Studies</i> , vol. 40, no. 6, pp. 1005–1021.	Export performance of high-technology small and medium enterprises (SMEs) in an emerging economy	Survey of 711 SMEs in China	A firm's export orientation and performance in emerging market SMEs depend not only on the development of capabilities through R&D and technology transfer but also on entrepreneurial issues, such as the founder's international experience which supports knowledge transfer, internationalisation and joining global networks.
Guan, J.C., Mok, C.K., Yam, R.C., Chin, K.S. and Pun, K.F. (2006) 'Technology transfer and innovation performance: Evidence from Chinese firms', <i>Technological Forecasting and Social Change</i> , vol. 73, no. 6, pp. 666–678.	Studies the relationship between technology transfer and innovation performance	Nationwide survey covering 2,334 Chinese industrial firms	Capability building and management are essential in technology transfer. Technology transfer has both positive and negative impacts and involves high risk. Technology transfer generally improve firm innovation performance but not in the case of high-technology firms.
Liu, X. and Buck, T. (2007) 'Innovation performance and channels for international technology spillovers: Evidence from Chinese high-tech industries',	Innovation performance and technology spillovers in Chinese high-tech industries	Panel data from 21 sub-sectors of high-tech industry in	Foreign R&D activities by MNEs in host countries significantly affect the innovation performance of domestic firms. Indigenous innovation is also required to take advantage of international technology spillovers.

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<p><i>Research Policy</i>, vol. 36, no. 3, pp. 355–366.</p>		<p>China from 1997 to 2002</p>	
<p>London, T. and Hart, S.L. (2004) 'Reinventing strategies for emerging markets: beyond the transnational model', <i>Journal of International Business Studies</i>, vol. 35, no. 5, pp. 350–370.</p>	<p>MNEs aiming to enter emerging markets have to be able to adapt and develop new business strategies</p>	<p>An exploratory analysis based on interviews, case studies, and archival material</p>	<p>Strategies that exploit the strengths of the existing market environment outperform those that focus on overcoming weaknesses. These strategies include developing relationships with non-traditional partners, co-inventing custom solutions and building local capacity. MNCs need to develop global capability in social embeddedness.</p>
<p>Wu, J. and Pangarkar, N. (2006) 'Rising to the global challenge: Strategies for firms in emerging markets', <i>Long Range Planning</i>, vol. 39, no. 3, pp. 295–313.</p>	<p>How local firms in emerging markets can counter the threat posed by the entry of multinational corporations</p>	<p>Primary and secondary data about 155 listed Chinese firms</p>	<p>Firms following internationally-oriented strategies targeting either near-by or global markets outperform others. Large size helps the performance of most strategy types.</p>
<p>Yiu, D.W., Lau, C. and Bruton, G.D. (2007) 'International venturing by emerging economy firms: the effects of firm capabilities, home country networks, and corporate entrepreneurship', <i>Journal of International Business Studies</i>, vol. 38, no. 4, pp. 519–540.</p>	<p>Outward FDIs by emerging market firms</p>	<p>Two questionnaire surveys from 2003 and 2014, including 565 companies in China</p>	<p>Home country network ties facilitate emerging market firms in pursuing international expansion. Firms' technological capabilities and R&D intensity depend on domestic industry competition, which leads to internationalisation. Corporate entrepreneurship also mediates the abovementioned factors, thus facilitating internationalisation.</p>

Empirical studies have also shown that emerging market firms following internationally-oriented strategies that target either near-by or global markets seem to perform better than domestically-oriented competitors. Large size typically helps companies to adapt to new strategies (Wu and Pangarkar, 2006). Research shows that innovation activities, venturing and strategic renewal are critical for emerging market firms aiming to expand operations and become competitive (Yiu et al., 2007). The development of capabilities through R&D, technology transfer and the institutional environment are found to drive the internationalisation of companies in emerging markets. FDI and trade are important for firms to expand their operations and be part of global networks; moreover, knowledge transfer and the mobility of people are important factors in the future development of firms (Filatotchev et al., 2009).

Empirical studies also show that technology transfer contributes to the innovation performance and competitiveness of firms as well as the economic development of a country. In emerging market firms, technology transfer requires possession of absorptive and transformative capabilities to succeed. Evidence from Chinese firms shows that technology transfer involves high risk and does not necessarily improve the performance of high-technology firms (Guan et al., 2006). Russian firms continue to be challenged by the domestic business environment but are benefiting from technology transfer and collaboration with firms located in developed markets (Dyker, 2001). MNEs and their innovation spillovers in emerging markets have a significant impact on the innovation performance of domestic firms. However, indigenous innovation efforts and absorptive capacity are needed to fully exploit the benefits (Liu and Buck, 2007). Firms operating in and aiming for emerging markets have to be ready with new strategies that build on the strengths of the market environment. There is also a need for them to develop relationships with non-traditional partners (London and Hart, 2004).

According to the recent literature, there is room for further research on firms in emerging markets, especially in the Russian context. Previous studies on emerging markets highlight an understanding that the institutional and business environments have a major impact on firm development and competitiveness. The literature also suggests that innovation and modern technology management strategies are one of the most critical tools for firms aiming to catch up and become more competitive.

2.2 Building competitive advantage within the firm

2.2.1 Resource-based view

According to the resource-based view (RBV), firms' internal resources and capabilities are the basis of their competitive advantage and performance (Penrose, 1959; Wernerfelt, 1984; Barney 1991, 1997; Grant, 2002; Peteraf, 1993). The RBV complements the previously presented MBV by looking inside the firm and focusing on internal resources and capabilities as the competitive force and foundation for competitive advantage.

The RBV is based on the idea that a firm has resources that are valuable, rare, imperfectly imitable and non-substitutable. These non-tradable and imperfectly mobile resources are the key in protecting the firm's sustained competitive advantage (Barney, 1991; 1997). Barney (1991) suggests that a firm's strategically relevant resources can include physical capital resources (technology, plants, equipment, location and access to raw materials), human capital resources (training, experience, judgement, intelligence, relationships and individual insights) and organisational capital resources (reporting structures, planning, controlling and coordinating systems and informal relations inside the firm and with the outside environment).

According to Grant (1991), the RBV can be applied to a firm's strategy analysis by first identifying the resources that the firm has relative to its competitors and, second, identifying the company's capabilities. According to the RBV, the role of the firm's internal capabilities and competences is essential in gaining competitive advantages in changing markets (Prahalad and Hamel, 1990). The landscape and business environment in which firms operate change over time, and firms need to react and alter their strategies. They also need new resources and to develop and acquire new capabilities. Capabilities cannot easily be transferred or assembled through markets; they must be built inside the company (Teece and Pisano, 1994; Kogut and Zander, 1992; Teece et al., 1997; Winter, 2003; Eisenhardt and Martin, 2000). Here, the RBV literature discusses the concept of dynamic capabilities, which Eisenhardt and Martin (2000: 1107) define as: 'The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die'. In the literature, dynamic capabilities has its roots in Schumpeter's (1934) *Theory of Economic Development* (Teece and Pisano, 1994).

Responsiveness, rapid and flexible product innovation and management's capability to coordinate internal and external competences are critical factors for firm success. Besides capabilities and competences, other essential factors are a firm's processes and current position in relation to technology endowment, intellectual property as well as its customer base and relations with suppliers. The firm's position and future strategic paths are shaped by the paths it currently pursues. This path dependency affects the strategic choices between the different alternatives and opportunities available for the firm, particularly in relation to technological opportunities (Teece and Pisano, 1994).

The management literature also recognises knowledge-based theory building in the RBV (Grant, 1991; Kogut and Zander, 1992; Spender, 1996). This approach can be seen as complementing but also critiquing the RBV. For example, Conner and Prahalad (1996) highlight the role of the knowledge-based view as the essence of RBV, recognising knowledge as a firm's most critical resource. Knowledge can be information or know-how and can appear in different forms and at different levels (individual, group, organisational and network) (Kogut and Zander, 1992; Conner and Prahalad, 1996).

The RBV has been recognised as one of the most widely utilised theories in the case of emerging markets research where competition and the institutional context create differences in firm strategies and innovation compared to developed economies (Hoskisson et al., 2000; Peng, 2001).

2.2.2 The relational view

The relational view offers a complementary approach to the RBV and was developed on the backdrop of the RBV. Here, a firm's access to external as well as internal resources represents the source of its competitive advantages (Dyer and Singh, 1998). The MBV and RBV regard firms as autonomous entities that gain their competitive advantage from either external industry sources (e.g. Porter, 1980) or from internal resources and capabilities (e.g. Barney, 1991). However, the world has changed, and firms are increasingly embedded in networks and horizontal and vertical relationships with other organisational actors across industries and nations (Gulati et al., 2000).

The relational view discusses the competitive advantage of firms or the dyad/network of firms where the advantages or disadvantages of an individual firm are often connected to those of the network of relationships in which the firm is involved. The relational view explains that to understand the competitive advantage of firms, we need to increasingly take the relationships between firms into account. The essential resources of firms can extend beyond firm boundaries. Inter-organisational relationships allow companies to access and gain, for example, new relation-specific assets, shared knowledge, complementary resources and capabilities and effective governance (Dyer and Singh, 1998).

The relational approach extends the RBV and discusses the competitive advantage gained through the alliances and networks of interconnected firms when resources are pooled (Lavie, 2006; Das and Teng, 2000). Besides technological or resource-based competitive advantages, a company's ability to develop and manage its networks and relationships has been recognised as an important source of its competitiveness and performance (Das and Teng, 2000). Firms with viable network structures are able to efficiently exploit their internal capabilities to improve their performance. Network contacts alone do not necessarily improve performance without developed network-enabled capabilities. Firms can also complement their structure by using networks (Zaheer and Bell, 2005). The central network position and the ability to exploit external knowledge are the most decisive factors affecting the firm's innovation and performance (Tsai, 2001). Stuart (2000) also highlights that large companies with leading technological resources are the most valuable partners in alliances. In particular, young and small firms benefit in many ways by partnering with large and innovative partners (Stuart, 2000). Lavie (2006) suggests that the nature of the relationships may be more important than the nature of the resources in the networked environments.

Firms' embeddedness in networks gives them access to external network resources which offer them strategic opportunities, thereby affecting their decisions and performance.

Prior alliance experience affects firms' decision to enter into new alliances (Gulati, 1999). Gulati (1998: 293) defines strategic inter-firm alliances as 'voluntary arrangements between firms involving exchange, sharing, or co-development of products, technologies, or services'. Alliances can be formed through different organisational forms. These inter-firm ties form networks which lead to new opportunities that may also constrain and lead to unproductive relationships or prevent partnering with other firms (Gulati et al., 2000).

The application of open management strategies in firm operations has been one of the most prominent current research areas in innovation management (Gassmann, 2006). Many of the current research topics, such as the open innovation approach, rely on the foundation laid by the relational view. The ownership of resources and different assets has become less critical for companies as business models have become more open. The utilisation of these strategies is essential, especially in the case of emerging markets when companies need to catch up with competitiveness.

2.2.3 Technology transfer and inter-firm cooperation

Successful companies know their technology portfolio well and understand how their technologies relate to the requirements of others. Technologies are often the basis of companies' existence although, in themselves, they have no value until they are commercialised or transmitted over a process of interaction between companies. Many companies, especially large firms, even have surplus technologies as a result of internal R&D that they neither utilise internally nor commercialise (Turnbull et al., 1996). Open approaches to innovation and new product development have engendered new realities, which have gained attention in the recent strategic management literature and among practitioners. Knowledge does not have to be created or exploited within the firm, and it is not linked to where innovation is created. Firms should seek new ways to commercialise ideas developed in-house as well as ideas that can be created outside the firm. These realities have led to three core process archetypes that companies follow in their technology strategies: the outside-in process where external sources are exploited to improve a firm's innovation performance, the inside-out process where a firm's ideas are exploited and commercialised externally and the coupled process where firm combine these and work in networks complementing their resources and knowledge base (Gassmann and Enkel, 2004).

Increased interest and demand in external sources of technology are mainly driven by increased global competition, which in turn forces companies into shorter development cycles. Another driving force is the increasing pressure on operating margins and profits. Companies are also interested in further networking and collaborating to share the risk in business and product development. There are also many success stories in innovation that lend support to this phenomenon. On the supply side, the drivers include increased levels of scientific and engineering knowledge that create new sources of knowledge and innovation. Increased levels of available venture capital are also driving many technology-based start-ups. There is also an increasing pool of capable and experienced people available for new companies (Chatterji, 1996).

Technology transfer is closely connected to the RBV (e.g. (Wernerfelt, 1984; Barney 1991) and the KBV (e.g. Grant, 1996; Kogut and Zander, 1992; Spender, 1996). It focuses on resources and knowledge as a firm's most critical resources and sources of competitiveness. Knowledge and technologies can be transferred between companies, but in many cases, they appear in many different forms. Technology transactions might involve very detailed contracts or form different technological alliances. Technology and technology-related knowledge can be more tangible (e.g. in the form of licenses or embodied in existing products) or intangible intellectual property (e.g. design, knowhow). It is also difficult to define the distinction between physical products and technology in relation to technical knowledge. In the case of technology, Radošević (1999) highlights the clear distinction between technology as information and technology as knowledge. In this case, knowledge is regarded as a firm-specific asset rooted in the specific organisational context and is more difficult to transfer than information and techniques that can be easily accessed and transferred to other firms. This process also requires already developed internal capabilities for companies to be able to transfer and successfully apply external technologies for their own use (Cohen and Levinthal, 1990; Zahra and George, 2002). Firms have to develop internal processes to identify and manage external technologies and the outcomes of internal R&D. Inter-organisational technology transfer offers companies a way to acquire new technologies without heavy R&D investments. By commercialising developed technologies, firms can gain additional financial benefits and revenues from their R&D outcomes and technologies from which they do not otherwise profit (Amesse and Cohendet, 2001).

Knowledge and technology transfer traditionally deal with the dyadic relationship and exchange of technology between the technology developer and recipient. However, studies have shown that the focus should move from dyadic stakeholder research to studying multiple stakeholders, business networks and wider business structures (Rowley, 1997; Turnbull et al., 1996; Ritter and Gemünden, 2003). It can also be noted that the open innovation concept is widely used in current research on the area. However, Trott and Hartmann (2009) note that this concept overlooks research on technology transfer and absorptive capacity by focusing, e.g. on the accessibility of outside technologies and neglecting research on R&D and capabilities that allow the exploitation of external technologies. This thesis discusses both inbound and outbound technology transfer, which also relate closely to inter-firm cooperation. These topics are discussed in greater detail below.

Technology acquisition

The successful innovation process has its foundation in the internal capabilities of the organisation. This enables firms to diversify their innovation activities and search for external innovations. To succeed, firms also have to be able to integrate and exploit the acquired external knowledge (Cassiman and Veugelers, 2000; Chesbrough, 2003). At the organisational level, internal R&D contributes to the development of absorptive capacity, which is a prerequisite for supporting the assimilation of external knowledge (Cohen and Levinthal, 1990). R&D cooperation and contracted R&D are also proven to have positive

effects on the internal R&D of firms if they have an R&D department which guarantees the level of absorptive capacity (Veugelers, 1997).

Cassiman and Veugelers (2006) highlight that internal R&D and ETA are complements rather than supplements and that innovating firms perform better when they combine internal R&D and technology acquisition activities. They further maintain that the degree of complementarity is dependent on the firm's strategic environment. Studies have shown that the technological knowledge and technologies acquired increase companies' economic performance and innovation outputs (Granstrand et al., 1992; Pavitt, 1990; Cohen and Levinthal, 1989; Chatterji, 1996; Lambe and Spekman, 1997).

Today, one of the most important issues in a firm's innovation management is the ability to integrate external knowledge into the innovation process. Firms often face the situation whereby they have to evaluate whether to produce or purchase what they need (Williamson, 1999). Technology acquisition, also referred as the buy decision, has become one of the most essential choices in firms' technology strategies. Technology can be embodied in acquired assets such as personnel, other firms or equipment. It can also be disembodied through licensing or by outsourcing the technology development. Better legal protection, in general, favours disembodied technology transactions while strategic protection favours more embodied transactions. This affects the strategy, the mode of how technologies are acquired and the buy decision (Cassiman and Veugelers, 2000). External sourcing can lead to more specialised knowledge, lower costs and time savings in new product development. However, it can create considerable transaction costs in searching, negotiating and executing and reinforcing contracts (Veugelers and Cassiman, 1999).

There are many organisational modes for acquiring technologies and knowledge. Different modes allow different levels of cooperation and organisational interdependence. This also varies between different forms of targeted technologies and knowledge. Firms can have modest organisational interdependence through one-directional technology flows, e.g. licensing and sourcing. Interdependence increases when companies co-create technologies through contractual modes. Even higher levels of interdependence often require joint R&D agreements, cross-licensing or mutual second-sourcing of technologies. The highest levels of interdependence emanate from direct investments (minority or majority shares) in other companies or in the creation of joint ventures and research corporations. Different organisational forms have their benefits and challenges; they also affect and depend on firms' strategies for the companies involved (Hagedoorn, 1990; Chatterji, 1996).

Technology commercialisation and markets for technology

All technology transactions between companies have increased; however, outward technology transfer has proven to be more challenging for companies. Companies also have strategic reasons not to commercialise. They are fearful of creating competitors and cannibalising markets, or they perceive that costs are higher than returns. The transfer and

commercialisation of technology have proven to be much more complex than the commercialisation of products (Arora et al., 2001).

Successful external technology commercialisation can offer companies additional revenues from technologies from which they do not otherwise profit. As in technology acquisition, companies also have to be able to identify the opportunities for external knowledge exploitation. The firm's ability to externally exploit knowledge can be called *desorptive capacity* (Lichtenthaler and Lichtenthaler, 2009).

For functional inter-organisational technology transfer, both commercialisation and acquisition are crucial in enabling real market supply and demand. Technology markets have made knowledge and technology more accessible, and different technology transactions play a central role in fostering innovation. Without the opportunity to benefit from trading in developed technologies, many firms would not innovate or invest in R&D and create new technologies (Arora et al., 2001). Functioning markets for technology and networks are essential for supporting technology transfer. However, this is challenged, especially in emerging markets, by the institutional environment and difficult IP protection frameworks. Market intermediaries and public intervention play a major role and can support companies in ultimately transferring their technologies (Howells, 2006). External intermediaries are a complement rather than a substitute for firms' internal activities. Internal capabilities and competences play the most critical role in the technology exchange (Arora et al., 2001).

Inter-firm cooperation and networks

Increased inter-firm cooperation and involvement in business networks have become necessary for companies and their competitiveness. Networks enable companies to learn and access new knowledge, technologies and resources. Networks can span across borders, connecting different firms, industries and markets. Central network position and absorptive capacity play an essential role in improving firms' innovation results and performance (Tsai, 2001). Companies' involvement in networks and their network position are also important for their internationalisation (Johanson and Mattsson, 1988). Network advantages are also linked to network partners' resource profiles. Large and innovative high-technology firms, in particular, are usually the most valuable associates in networks (Stuart, 2000).

Different institutional environments in emerging markets affect the behaviour of firms and their partner selection (Hitt et al., 2004). Domestic networks in emerging markets may lack global competitiveness; thus, strategic alliances, cooperation and partner selection have become increasingly important for emerging market firms. The extant literature suggests that a partner's characteristics, as well as its access to resources and organisational learning opportunities, affect partner selection, which in turn helps firms build their capabilities (Hitt et al., 2000). A firm's competitiveness is affected by various factors, particularly its home country network connections and internal capabilities (Yiu et al., 2007). Networking and vertical and horizontal cooperation have positive effects on

a firm's performance (Alvarez et al., 2009; Lechner and Dowling, 2003). A suitable network structure and the firm's capabilities enhance its performance (Zaheer and Bell, 2005). Network connections and involvement are critical for learning and building the firm's capabilities. The extent of cooperation and a firm's network position in domestic and international networks affect its performance, capabilities and future development. Building the firm's capabilities is vital and, to some extent, represents a prerequisite for accessing competitive international networks (Lee et al., 2001; Zaheer and Bell, 2005; Zahra and George, 2002).

Companies use a variety of organisational forms to cooperate and transfer knowledge and technology. Different modes are dependent on the industry, the technology and the level of a country's development. FDI and licensing are commonly used, but there are also more networked organisational forms, such as subcontracting and alliances, whereby technology is embedded in inter-firm relationships. Successful technology transfer results in combining appropriate modes and channels (Radosevic, 1999). Different organisational arrangements have different requirements that impact performance and inter-firm relationships (Hagedoorn, 1990).

Companies should be able to gain access to knowledge and retain it from inter-firm relationships and within their network. Their ability to retain knowledge outside their organisational boundaries can be called *connective capacity*. This is also affected by prior knowledge gained through relationships and cooperation (Lichtenthaler and Lichtenthaler, 2009).

2.3 Synthesis and conceptual framework

The competitive advantage of manufacturing firms in emerging markets is largely affected by the business and institutional environments, which are difficult to control, and the internal capabilities and resource base of the firm, which can be expanded by reaching outside the firm's boundaries. This thesis is based largely on the theme of competitiveness and the building of competitive advantage in emerging market firms. The research topic is analysed through the MBV, the RBV and the relational view. These theories are applied and discussed in an emerging market context whereby market competition, industry structures and the business and institutional environments create a challenging setting where the rules of Western management studies do not necessarily apply. These theoretical foundations are illustrated in figure 4.

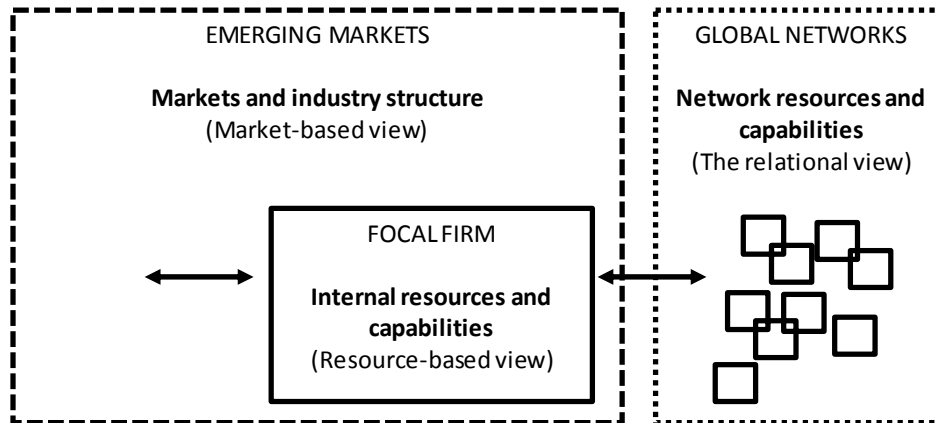


Figure 4. Theoretical foundation of the thesis

The MBV and RBV approaches have been widely recognised and are largely established in the academic literature. They also form the theoretical basis of the thesis. These selected theoretical approaches are often presented as oppositional in evaluations of the firm's competitive advantages; however, they also complement each other in many ways, especially when studying firms in rapidly changing environments such as in emerging markets. The relational view further develops the ideas of RBV by expanding the concept to discuss the benefits of networked firms and their combined resources and capabilities. Through networked business models and open approaches to product development, firms can improve their performance and gain new competitive advantages.

The management literature has discussed the benefits of implementing open management strategies for new product development (e.g. Cassiman and Veuglelers, 2006; Tsai, 2001; 2009; Stuart, 2000). Firms can be very agile in acquiring and incorporating external technologies to support their NPD process or in commercialising their own technologies. However, this is still a new strategy for the majority of companies in many emerging economies. Openness of technology and innovation management differ between industries and firms. Many industries still have a relatively closed approach to innovation, mainly due the nature of their products or the constraints set by the challenging business environment. The driving forces in open approaches can be, for example, globalisation, technology intensity, technology fusion, new business models and knowledge leveraging (Gassmann, 2006). Technology intensive industries face increasingly strong market competition, and their attempts to become more competitive require the development of internal capabilities through investments in R&D and innovation. Through this, they can have the capacity to acquire and commercialise technologies and be more involved with other companies (Amesse and Cohendet, 2001). Technology acquisition is one of the most effective methods to complement a firm's own R&D output and NPD process (Cassiman and Veuglelers, 2006). Companies have to be able to also commercialise their R&D and innovation outcomes on the markets. Otherwise, they would not be able to capture the value created in internal development and innovation processes (Chesbrough,

2003; Zahra and Nielsen, 2002). Figure 5 describes the conceptual framework and the most essential themes of this study.

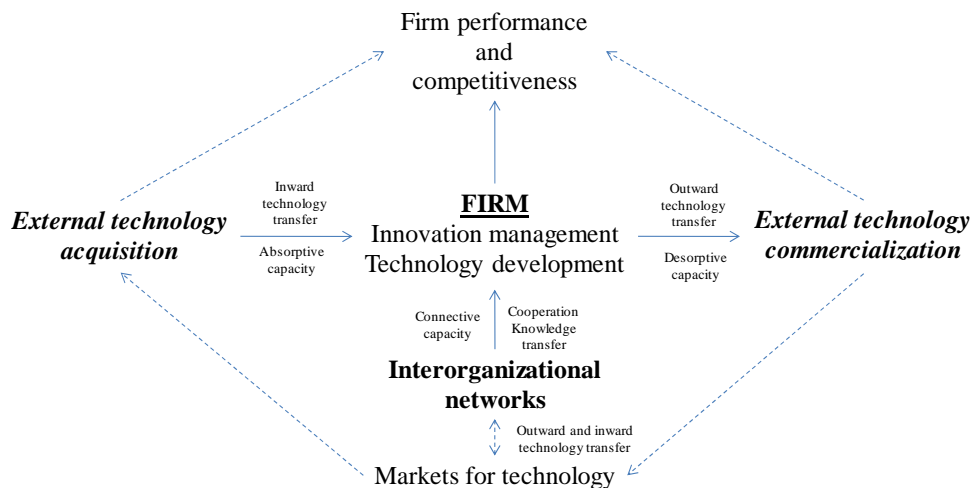


Figure 5. Conceptual framework (publication 2)

Approaches to product development and technology and innovation management have evolved and developed rapidly. Successful innovation outcomes require firms to be able to handle and apply a spectrum of technology management strategies (Trott and Hartmann, 2009). Today's technology development is rapid, is characterised by rising costs, and firms ought to tap into external technologies and inter-organisational networks that enable them to improve their innovation and new product development performance. Instead of heavy internal R&D and closed product development, firms are forced to become more open in their strategies. Some of the most important motivations for companies are shorter innovation cycles, rising costs of industrial research and development and lack of available resources (Gassmann and Enkel, 2004).

Open business models and management strategies, networking and technology and knowledge transfer are customary activities for many companies today and are proven to improve competitiveness (Chesbrough, 2003; Tsai, 2001; Stuart, 2000). However, this is not necessarily the case for firms in emerging markets (Fu et al., 2011). Figure 6 describes the rationale behind the research conducted for this thesis.

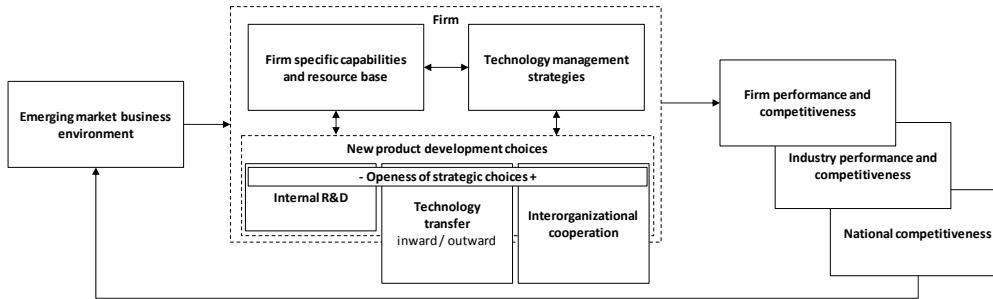


Figure 6. Rationale for technology transfer and open technology management strategies

The mechanism how the emerging market companies can catch up in competitiveness is based on the literature and previous research presented in this section of this dissertation. The historical economic structures and special characteristics of business environment create constraints for companies in rapidly developing and changing emerging markets which is also evident in the case of Russia (Desai and Goldberg, 2007; EBRD, 2012). These factors and constraints have negative impact on firm operation and competitiveness in emerging markets (e.g. Hoskisson et al., 2000; Peng, et al., 2009). However, firms can overcome these constraints by developing their capabilities through internal R&D investments and expanding their technology and resource base by exploiting external sources and cooperation (e.g. Dyer and Singh, 1998; Lavie, 2006; Chesbrough, 2003; Fu, et al., 2011). These strategic choices have positive impact on innovation and firm performance on firm level which ultimately affect industry and national development and competitiveness.

This study was formulated to first identify current developments in the competitiveness of the Russian manufacturing industry; second, to identify the best tools and methods to improve firm competitiveness in emerging markets; third, to study the inward and outward technology transfer operations in innovative Russian manufacturing firms and, fourth, to study technology management strategies in connection with home nation competitiveness. Altogether, these studies will answer the research questions and contribute to the current research.

3 Research design and methodology

3.1 Research approach and strategy

This section details the research approach and strategy. It describes the data used in the publications, the methods of analysis used and the main limitations of the studies. It also describes the ontological and epistemological basis of the research and presents the chosen research methodologies.

The epistemological orientation refers to what is, or should be, considered as acceptable knowledge. This thesis follows the doctrine of positivism in which phenomena confirmed by science can be recognised as knowledge. In this approach, the purpose of theory is to generate hypotheses that can be tested, offering explanations of laws to be assessed, through which knowledge is created. This standpoint also highlights that science must be conducted objectively and that the distinction should be made between scientific and normative statements (Saunders et al., 2011; Bryman and Bell, 2005). Regarding its ontological orientation, the thesis follows the position of objectivism, which stresses that social phenomena and their meanings have existence independent of social actors. The ontological orientation considers whether social entities can and should be considered objective entities or whether they should be considered social constructions emanating from the perceptions and actions of social actors (Saunders et al., 2011; Bryman and Bell, 2005).

This research employs a quantitative research strategy. This approach emphasises quantification in the data collection and analysis (Bryman and Bell, 2005) and follows a deductive approach and reasoning by testing current theories. When using quantitative research methods and data, reliability and validity are important in relation to the evaluation of the measurements of different concepts. Reliability requires measurement stability over time, internal reliability of indicators and their interconnections and inter-observer consistency in the recording of observations when more than one observer is involved. Validity refers to the issue of whether or not different indicators actually measure the central concept. There are different types of validity which assess the validity of a measure or a concept: face validity, concurrent validity, predictive validity, construct validity and convergent validity. Quantitative research is also concerned with other preoccupations involving measurement, causality, generalisation and replication (Bryman and Bell, 2005). The data analysis in this thesis has taken these issues and preoccupations into account and follows the guidelines and recommendations for conducting innovation surveys by the *Frascati Manual* and the *Oslo Manual* (OECD, 2015; OECD/Eurostat, 2005).

Secondary data sources are often used to overcome the challenges of data collection in emerging markets (Hoskisson et al., 2000; Meyer and Peng, 2005; Wright et al., 2005). Secondary data gathered by international organisations and domestic institutions have been important for this thesis' search for holistic answers to the research questions. The

data was used in the publications of the thesis to illustrate the developments and current state of firms and markets. While the data allowed access to a large and reliable data sample, secondary data does not always fit optimally with research topics, which may create challenges. Thus, the publications in this thesis also use primary data collected from Russian manufacturing companies. This primary data focused on the innovativeness of manufacturing firms in Russia and thus fit the research questions of the thesis. This unique data allowed access to and an investigation of this research topic on the firm level and to answer the research questions leading to the contribution of this thesis.

Publication 1 uses secondary statistical data to illustrate the development and current state of Russian manufacturing industry competitiveness. Publication 2 is conceptual in nature and reviews the relevant literature by linking the different topics studied in the thesis (i.e. firm competitiveness and technology management strategies). Publication 3 applies primary survey data and focuses on technology acquisitions in Russian manufacturing firms. Publication 4 discusses external technology commercialisation and technology markets in the Russian manufacturing industry and uses mixed-methods research by combining descriptive quantitative analysis based on the primary data and the case study. The case study is used to support the data analysis and further illustrate the research topic. Publication 5 uses a large secondary dataset and describes the application of different technology management strategies in firms located in countries of varying competitiveness levels. Table 4 shows the research design in the publications included in the thesis.

Table 4. Research design in publications

Publication	Research topic	Analysis methods and	Data source
Publication 1: Review of the competitiveness of Russian manufacturing industry	National level analysis of the development of the competitiveness of Russian manufacturing industry	Descriptive quantitative analysis	Secondary data from WIIW (data from years 2000–2008) and other secondary data sources
Publication 2: Building competitiveness of emerging market firms: The role of interfirm technology transfer	Conceptual paper on inter-firm technology transfer and its effects on firm performance and competitiveness	Literature review and conceptual development	Conceptual
Publication 3: External technology acquisition in Russian firms	Analysis of the exploitation of external technology acquisition and its benefits to the Russian manufacturing industry	Descriptive quantitative analysis <i>ANOVA</i> <i>Cross-tabulation</i>	Primary survey data of 206 Russian manufacturing firms

Publication 4: External technology commercialisation and markets for technology in Russian manufacturing industry	Analysis of exploitation of external technology commercialisation and viability of markets for technology in Russian manufacturing industry	Descriptive quantitative analysis and case study	Primary survey data of 206 Russian manufacturing firms Case study
Publication 5: Technology management strategies in emerging markets	Comparison between manufacturing firms on the openness of technology management strategies between host economies at different levels of competitiveness	Descriptive quantitative analysis <i>Multinomial logistic regression</i> <i>Correlations</i> <i>ANOVA</i>	EBRD data on 6,267 manufacturing firms from 30 countries

3.2 Sampling and data

The publications in this thesis employed three different data sources. The research is mainly quantitative and is based on longitudinal statistical data (publication 1) and cross-sectional data gathered from structured interviews and questionnaire surveys (publications 3, 4 and 5). The data sources and survey data allowed us to cover the research topic from different levels and perspectives, thus resulting in comprehensive knowledge on the research topic as a whole and enabling us to answer the research questions. The SPSS software was employed to analyse the data (publications 3, 4 and 5). The fourth paper also includes one case-study method (Yin, 2003, Eisenhardt, 1989) based on the detailed survey data and public company information to further illustrate the topic. The indicators used to measure the issues are described more in detail in the separate publication.

The first paper utilised longitudinal statistical data (2000–2008) from The Vienna Institute for International Economic Studies (WIIW). This main data source (WIIW) relies on the Russian Federal State Statistics Service and Eurostat statistics. The publication uses production, unit labour cost, labour productivity and exports and imports as primary indicators to evaluate the development of competitiveness of the Russian manufacturing industry. This publication also uses other statistical sources to present the state and development of the Russian economy, such as the World Bank, the World Economic Forum (WEF), UNCTAD and Eurostat.

The main data source for the third and fourth papers was a university survey data of 206 innovative Russian manufacturing companies, offering a highly valuable data sample to examine the innovativeness of Russian manufacturing companies. This unique data was gathered in a joint project between Lappeenranta University of Technology and Saint Petersburg State University Graduate School of Management. The survey was conducted

between December 2009 and February 2010, before this dissertation project, in nine regions in Russia (Saint Petersburg, Nizhny Novgorod, Rostov-on-Don, Saratov, Samara, Perm, Yekaterinburg, Novosibirsk and Krasnoyarsk). It was organised through structured face-to-face interviews with top management company representatives. The initial sample was 1,000 companies, from which 206 interviews were granted. The companies were randomly selected by employing the SPARK Business Database, Russia's largest company database, managed and updated by Interfax. The questionnaire consisted of 110 questions (some questions included two or more sub-questions). The main topics in the questionnaire were about company strategy, innovations, cooperation of companies in innovation process, internationalization and exports, and product markets. The publications 3 and 4 exploit especially the parts related to innovation by focusing product innovations, technology search and acquisition, technology commercialization, and innovation costs and output. The questions generally related to the previous three years of business activity. The average age of the companies in the sample was 27 years, with the founding year varying from 1720 to 2009. The sample consisted mainly of large companies: more than 44% of firms had more than 500 employees. The industrial distribution was as follows: electronics and optics equipment (18.5%), metallurgy (17.5%), machine building (13.6%), IT and telecommunications (10.2%), chemical industry (10.2%), electronic equipment (7.3%), oil industry (5.3%), rubber and plastic industry (3.9%), aircraft (3.9%) and other industries (9.6%).

The questionnaire structure was developed according to the recommendations for conducting innovation surveys in the *Frascati Manual* and the *Oslo Manual* (OECD, 2015; OECD/Eurostat, 2005). To ensure the reliability of the survey, we used structured interviews in the same manner as the survey method. Structured interviews are considered one of the best methods to guarantee the reliability and validity of research data (Lindlof and Taylor, 2002). The sampling method was based on the stratified sampling approach to improve the representativeness of the sample. This is because of the large variation between the companies and regions included in the overall population. To obtain more homogenous subgroups, a number of criteria (strata) were applied based on the region (e.g. regional GDP), industry and annual revenue of the company. A comparable approach to data collection was applied, for example, by the World Bank and the European Bank for Reconstruction and Development (EBRD) when conducting the Business Environment and Enterprise Performance Survey (BEEPS) and the Management, Organisation and Innovation Survey (MOI). Data from the Saint Petersburg area were collected by the research team while, the data collection in the other eight regions was outsourced to a third party. All interviews were recorded and transcribed to ensure the reliability of the responses.

The data source for the fifth paper was the fifth round of the BEEPS conducted in 2011–2014 by the EBRD and the World Bank. The survey offers firm-level data on a representative sample of an economy's private sector. BEEPS is conducted using face-to-face interviews with business owners and top managers. Typically, 1200–1800 interviews are conducted in larger economies, 360 in medium-sized economies and 150 for smaller economies. This data made it possible to analyse the operations and enterprise

management of manufacturing companies with the use of a large sample. Altogether, the survey analysed 15,883 enterprises in 30 countries from Eastern Europe and Central Asia, including 4,220 enterprises in 37 regions in Russia. In this study, we employ data only from manufacturing companies. These data comprise of 6,267 manufacturing companies from 30 countries. The survey includes an innovation module – the focus of the fifth publication – covering product, process, organisational and marketing innovation as well as management practices in manufacturing enterprises with at least 20 employees (50 employees in Russia). The publication 5 focused especially on the share of companies using internal R&D, external technology acquisition, and cooperation in new product development to assess the level of technology management strategies.

BEEPS follows the World Bank's established Enterprise Surveys Global Methodology and uses stratified random sampling whereby all population units are homogeneously grouped and simple random samples are selected from each group. This method allows the computation of estimates for each of the strata, with a specified level of precision, while population figures can also be estimated by properly weighting individual observations. The sampling weights account for the varying probabilities of selection across different strata. Under certain conditions, the precision of estimates under stratified random sampling will be higher than under simple random sampling (lower standard errors may result from the estimation procedure). The strata for BEEPS are firm size, sector and geographic region within a country. Firm size levels are 5–19 (small), 20–99 (medium) and 100+ employees (large-sized firms). In most economies, the majority of firms are small and medium-sized, hence BEEPS over-samples large firms since larger firms tend to be engines of job creation. Sector breakdown is usually manufacturing, retail and other services. For larger economies, such as Russia, Ukraine and Turkey, specific manufacturing sub-sectors are selected as additional strata on the basis of employment, value-added and total number of establishment figures (EBRD, 2015).

3.3 Analysis and limitations

There are many challenges regarding the reliability, sampling, collection and gathering of data in emerging markets (Hoskisson et al., 2000; Meyer and Peng, 2005; Wright et al., 2005). To ensure the reliability and validity of the research, this study combined large secondary and primary data sources. The data sources followed the guidelines and recommendations for conducting innovation surveys by the *Frascati Manual* and the *Oslo Manual* (OECD, 2015; OECD/Eurostat, 2005).

The study used both primary and secondary data, and the analysis in the five publications employed various methods of analysis such as descriptive statistics, ANOVA, cross-tabulations, correlations, multinomial logistic regression and the case-study method. The data used was mainly cross-sectional. The secondary data sources allowed the use of one statistical longitudinal industry level dataset and one very large firm-level dataset, thus allowing a more general analysis of the research topic. One limitation concerns the data analysis of the studies, which while mainly quantitative, remained largely descriptive. In

the case of the primary data, the small number of companies conducting observed strategies made it challenging to apply statistically more advanced analysis methods, which would have been possible with larger representative samples. Descriptive data analysis was supported by one brief case study in publication 4 as a way of adding reliability to the study.

4 Summary of the publications

This section summarises the publications included in the thesis. The thesis consists of five publications on different aspects of the research topic. The research themes of the papers are based on the research questions presented in the first section. Together, these studies answer the main research question: How can manufacturing firms in emerging markets catch up with competitiveness? Figure 7 illustrates how the different papers contribute to the different themes discussed in the thesis.

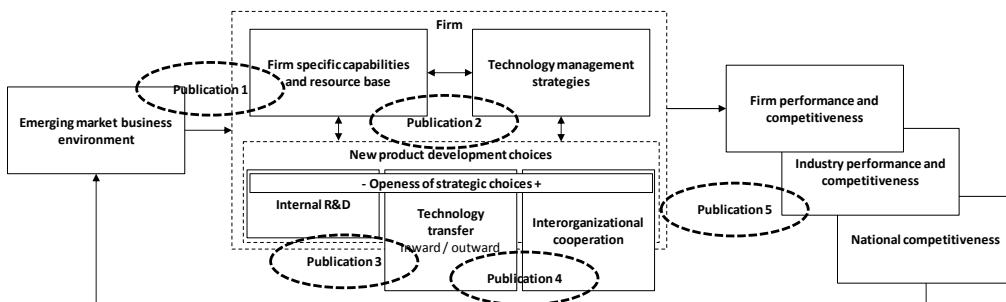


Figure 7. Research themes and publications

Table 5 shows the research aims, theory background, methods and data, main results and main contribution of the research papers. The following sections more closely present the publications and their main objective, findings and role in the thesis.

Table 5. Summary of the publications

Publication	Research aim	Theory background	Methods and data	Main results	Main contribution
Publication 1: Review of the competitiveness of Russian manufacturing industry	To study the development of competitiveness in the Russian manufacturing industry.	National and industrial competitiveness (Porter)	Analysis of longitudinal statistical data (secondary data from 2000 to 2008)	The Russian manufacturing industry generally faces major challenges in keeping up and catching up with competitiveness. However, some fields show some indication of the potential that Russian industries have.	Explains the current state and development of Russian manufacturing industry competitiveness.

<p>Publication 2: Building competitiveness of emerging market firms: The role of interfirm technology transfer</p>	<p>To study the role of technology management strategies and especially inter-firm cooperation and technology transfer in building firm competitiveness</p>	<p>Resource-based view; relational view</p>	<p>Conceptual; literature review</p>	<p>Technology management strategies play a critical role in building firm competitiveness and performance. This requires internal capabilities that ultimately allow technology transfer and increased inter-firm cooperation, which then lead to improved firm performance and catching up.</p>	<p>Highlights the decisive role of technology management, capability building, technology transfer and cooperation in building competitiveness, especially in emerging markets</p>
<p>Publication 3: External technology acquisition in Russian firms</p>	<p>To investigate technology transfer in the Russian manufacturing industry and how it affects the economic and innovation performance of firms</p>	<p>Resource-based view; technology management</p>	<p>Survey data from 206 Russian firms (primary data)</p>	<p>ETA has positive effects on the innovation performance of a firm. This however requires internal R&D and capabilities which allow firms to exploit more open technology management strategies. ETA seems to be an efficient method for improving firm competitiveness, product development and the</p>	<p>Reports the motivation, preconditions and outcomes of the implementation of ETA and open technology management strategies in the Russian manufacturing industry</p>

				modernisation of production.	
Publication 4: External technology commercialisation and markets for technology in Russian manufacturing industry	To study the commercialisation of technologies and markets for technologies in Russian manufacturing firms	Technology management	Survey data from 206 Russian firms (primary data)	Small share of firms recognise or commercialise their surplus technologies. Only few firms have the capabilities to exploit the possibilities that ETC can offer. The low level of ETC also leads to imbalances in supply and demand in Russian technology markets.	Illustrates the opportunities and challenges in firms in the commercialisation of technologies and recognises the demand and supply imbalance in Russian technology markets
Publication 5: Technology management strategies in emerging markets	To study the level of the business environment and host country competitiveness in relation to the managements strategies of manufacturing firms	Technology management	Survey data from 6,267 manufacturing firms from Eastern-Europe and central Asia (secondary data)	Firms in low competitiveness economies are active in R&D and are exploiting open technology management strategies to catch up. A significant gap can be seen in the level of ETA and NPD cooperation between firms in the second most competitive group of countries compared to those in the most competitive countries.	Illustrates the role of national competitiveness and the business environment in the technology management strategies of manufacturing firms

4.1 Publication 1: Review of the competitiveness of Russian manufacturing industry

Torvinen, P. and Väättänen, J. (2013) 'Review of the competitiveness of Russian manufacturing industry'. *International Journal of Business Excellence*, vol. 6, no. 3, pp. 293–309.

Objective

The first paper analyses the development and challenges of Russian manufacturing industry competitiveness. The aim was to identify the most competitive fields in the Russian manufacturing industry. The paper analyses the development of competitiveness in Russian manufacturing at the industry and national levels. It uses longitudinal data from the years 2000 to 2008 to follow and analyse the development of indicators such as production, productivity, unit labour costs and exports to European Union markets. The analysis of the development of these indicators enabled us to further analyse how different industries have been able to manage their competitive position when markets become more globalised. The paper also highlights the role of the manufacturing industry in developing national competitiveness.

Main findings

Trade balances in manufacturing have faced increasing deficits even though exports and domestic production have increased. High-technology exports, including more value-added products, have also decreased dramatically. The Russian trade balance relies mainly on the high volume of low value-added products from natural resource-based industries. The results of the study show that the Russian manufacturing industry is in a difficult situation, characterised by increasing imports and global competition. Most firms in the Russian manufacturing industry are faced with problems regarding the improvement of their competitiveness. Productivity has improved in all industries, but unit labour costs have doubled, on average, compared to the productivity experienced during the entire period, which indicates that overall competitiveness has decreased. However, three fields were able to increase their competitiveness: machinery and equipment, electrical and optical equipment and leather and leather products industries. Despite being small in size, the electrical and optical equipment industry, in particular, grew rapidly and managed to increase its share in exports, which shows potential future development.

Role in the thesis

The publication illustrates the challenges faced by the manufacturing industry in emerging markets. It addresses the main research question and sub-question 1 of the thesis and tries to explain the current situation of the manufacturing industry and why there is a gap in competitiveness in emerging markets. It also explains the economic developments

4.2 Publication 2: Building competitiveness of emerging market firms: The role of interfirm technology transfer

and structures of the Russian manufacturing industry, which are also the focus of the other publications included in the dissertation.

4.2 Publication 2: Building competitiveness of emerging market firms: The role of interfirm technology transfer

Torvinen, P. and Väättänen, J. (2014) 'Building competitiveness of emerging market firms: The role of interfirm technology transfer', proceedings of the 40th Annual Conference of the European International Business Academy (EIBA), 11–13th December 2014, Uppsala, Sweden.

Objective

The second publication included is conceptual in nature. It reviews the relevant literature and focuses on the importance of technology transfer and involvement in competitive business networks for firm competitiveness in emerging market firms. The publication highlights the role of firms' technology management and of building the capabilities for successful technology transfer (commercialisation and acquisition). Technology transfer can be used as a tool to access competitive business networks, which should positively affect firm performance and competitiveness.

Main findings

Networking and inter-firm technology transfer together represent an efficient method for modernising production in industries lacking in competitiveness. Emerging market firms have obvious challenges regarding achieving parity in competitiveness compared to firms in developed markets and reach out from domestic markets. The business environment is one of the decisive factors in building competitiveness, and in emerging markets, it challenges companies to support innovation.

The prerequisite for improving competitiveness is the firm's ability to develop internal capabilities to exploit the opportunities offered by inter-firm cooperation and technology transfer. By passing this threshold, firms are able to connect more competitive networks beyond national borders. This requires them to have open strategies for technology and innovation.

Role in the thesis

This publication addresses the main research question and sub-question 2. It demonstrates the need for emerging market firms to improve their strategies and innovativeness to enable them to compete in domestic and international markets. It also shows that there is a research gap in the case of emerging markets with regards to understanding the challenges of the business environment and the role of technology management strategies in the competitiveness of firms.

4.3 Publication 3: External technology acquisition in Russian firms

Torvinen, P., Podmetina, D., Hinkkanen, J.J. and Väätänen, J. (2014) 'External technology acquisition in Russian firms', *International Journal of Procurement Management*, vol. 7, no. 3, pp. 257–278.

Objective

The third publication analyses the Russian manufacturing industry and how active firms are in acquiring external technologies to complement their R&D and innovation activities. The aim of the paper was to analyse the motivations behind external technology acquisition and its effects on the innovation and economic performance of the firm.

Main findings

The results show that technology, market turbulence and cooperation are that which motivate firms to acquire external technologies. There are also differences in the background and R&D intensity of firms for ETA. Sufficient levels of internal R&D are a precondition for implementing open technology strategies. The results show that higher levels of internal R&D generally lead to higher levels of ETA. However, the most R&D intense firms seem to use less external technologies and rely more on internal R&D. This may be due to the higher risks of open strategies in the case of innovative high-technology firms. The results also show that firms in emerging markets are still more domestically focused when acquiring technologies from outside and that ETA positively effects NPD performance and reduces the risk and time-to-market of product development.

Role in the thesis

The publication addresses the main research question and sub-question 3 and highlights the benefits of ETA for firms in emerging markets in becoming more competitive and improving NPD performance. It also indicates that access to new networks and knowledge is a key motivation in ETA.

4.4 Publication 4: External technology commercialisation and markets for technology in the Russian manufacturing industry

Torvinen, P. and Väätänen, J. (2015) 'External technology commercialisation and markets for technology in Russian manufacturing industry', *International Journal of Technology Marketing*, vol. 10, no. 1, pp. 4–24.

Objective

The fourth publication analyses the Russian manufacturing industry and how active firms are in commercialising their technologies. It also studies technology markets and

highlights the imbalance between the commercialisation and acquisition of technologies that create challenges to technology markets in matching supply with demand.

Main findings

The results of this publication show that ETC is used in a small number of firms and that not many firms recognise the positive aspect of commercialisation of internally developed surplus technologies. This leads to the assumption that there is a lack of capabilities in identifying opportunities for technology commercialisation. Many of these companies, however, are active in R&D and the acquisition and implementation of external technologies. The results show that ETC can lead to improved economic performance by providing additional returns for R&D outputs. It can also increase firms' transparency and cooperation. These companies seem to generally have open business models and to be active in technology transfer.

The domestic focus of firms in ETA and ETC creates a circle whereby low technology supply creates challenges for functioning technology markets. More active and functioning technology markets could lead to improved NPD performance and increased competitiveness in many industries. Active ETC could also help in new venture creation.

Role in the thesis

This publication addresses the main research question and sub-question 4. It highlights the potential benefits that ETC can offer for emerging market firms and industries. It shows that the level of ETC in Russian technology markets is low, which limits the technology supply. It also discusses how functioning technology markets, where supply and demand are more balanced, can enable an improvement in the competitiveness of firms and industries.

4.5 Publication 5: Technology management strategies in emerging markets

Torvinen, P. and Väättänen, J. (2015). 'Technology management strategies in emerging markets', proceedings of the XXVI International Society for Professional Innovation Management (ISPIM) Conference – Shaping the Frontiers of Innovation Management, 14–17 June 2015, Budapest, Hungary.

Objective

The fifth publication examines whether technology management strategies regarding internal R&D, ETA and NPD collaboration vary between manufacturing firms in countries at different stages of development and competitiveness.

Main findings

The results show that the level of R&D does not vary significantly between manufacturing companies at the different development stages. However, it appears that ETA and NPD collaboration are more dependent on the business environment and the development stage of the host economy. The results shows that the manufacturing firms in less competitive economies are active in exploiting open technology management strategies to catch up with competitiveness. The most significant gap is between firms in two of the most competitive groups of countries at the level of ETA and NPD collaboration. The results also indicate that open strategies are effective in catching up, but companies in the most developed environments still have to rely heavily on internal R&D. Lower levels of internal R&D in less developed countries can also be linked to the weak institutional environment in emerging markets, which does not encourage and support companies to innovate, thus pushing them to rely more on external technologies.

Role in the thesis

The publication addresses the main research question and sub-question 5. It compares the use of technology management strategies in manufacturing firms in countries at different levels of national competitiveness. It compares the share of internal R&D, and ETA and NPD cooperation.

5 Conclusions

5.1 Answering the research questions

The aim of this thesis was to study firm competitiveness in the Russian manufacturing industry and to draw upon methods regarding how firms can decrease the competitiveness gap compared to firms operating in more developed markets. The main research question was formulated as follows: *How can manufacturing firms in emerging markets catch up with competitiveness?* The empirical analysis in this thesis showed that firms can improve their competitiveness by employing different technology management strategies. Outbound and especially inbound technology transfer have proven to be two of the most viable tools enabling higher levels of firm competitiveness. This is also linked to the building of internal capabilities for improved NPD processes and higher levels of inter-firm cooperation. The topic is discussed in greater detail by answering the following sub-questions linked to the publications included in this thesis.

The first sub-question, linked primarily with publication 1, was: *How has the competitiveness of the Russian manufacturing industry developed, and is there a gap in competitiveness?* This research question was also one of the main motivations for the entire research project and the subsequent studies. The empirical evidence shows that the Russian manufacturing industry experiences challenges regarding keeping up with competitiveness due to rising wages, even when the general level of productivity has not been improving at the same pace. The manufacturing industry is still heavily reliant on large basic industries with relatively low value-added. At the same time, the share of high-technology exports has decreased dramatically. Notwithstanding, there are indications of positive developments in some industries. For example, the electrical and optical equipment industry has experienced strong growth and has been able to improve competitiveness by improving productivity. This empirical evidence suggests that there is a competitiveness gap and that the general level of competitiveness of the Russian manufacturing industry is on the decrease. The indicators suggest that there are positive developments in the case of more value-adding and innovative industries that have been able to improve their competitiveness.

The second sub-question – *How can companies in emerging markets increase their competitiveness through inter-organisational technology transfer?* – is mostly linked to publication 2, which conceptually discusses the linkages between technology transfer and firm competitiveness. Based on the existing literature, the publication highlights the role of firms' capability building as enabling the exploitation of more diverse technology management strategies. Emerging market firms are challenged by underdeveloped business environments that do not encourage inter-firm cooperation. Through internal R&D, firms are able to develop capabilities that allow them to apply technology management strategies involving external partners. With these capabilities, technology transfer can be seen as one of the most viable tools for emerging market companies to catch up with competitiveness. It enables companies to decrease R&D costs, enhance their NPD process and modernise

production. It can also provide additional revenues from technologies which firms would not otherwise profit. Technology transfer also enables closer inter-firm collaboration and involvement in more developed (international) networks, thus further improving access to external resources and knowledge.

The third sub-question – *How can ETA improve firm competitiveness?* – is mostly linked to publication 3 and uses survey data to analyse the use of external technology acquisition in innovative Russian manufacturing firms. Technology, market turbulence and cooperation propel companies towards acquiring external technologies. As a strategy, ETA is relatively well exploited (around 30% of the companies); however, most of the companies acquire less than 25% of their technologies from external sources. Domestic technology sources seem to be more common than foreign ones. Firms are in many ways benefiting from ETA in NPD processes. The results also indicate better innovation and economic performance against companies' objectives for using ETA as a strategy. The results further demonstrate that more high-technology oriented companies use ETA more frequently; however, high-technology companies turn towards a more closed approach and rely more heavily on internal R&D.

The fourth sub-question – *How can ETC and technology exchange improve firm competitiveness?* – is linked primarily to publication 4, which utilises survey and case study data to analyse the use of technology commercialisation as a strategy in innovative Russian manufacturing firms. Among the surveyed companies, only 6.3% reported selling their surplus technologies sometimes or often. The results indicate that if firms embrace ETC as an essential part of their strategy, they can increase their returns and spread of technologies. Companies conducting ETC also seem to be forerunners in many fields, such as inter-firm cooperation and technology development and acquisition, which indicates a high level of internal capabilities for new business and technology strategies. The study also shows that the Russian business environment does not support commercialisation, most likely due to IP protection issues, and that many companies choose to keep their developed technologies in-house. This creates an imbalance in technology markets, with firms preferring domestic (in this case, Russia) technology sources.

The fifth sub-question – *How does the business environment affect technology management strategies?* – is mainly linked to publication 5, which analyses technology management strategies from a sample of over 6,000 manufacturing firms. The results show that manufacturing firms in less competitive countries, compared to Russia, are more agile in their greater use of open strategies to catch up. Firms in countries belonging to the group, of which Russia also belongs, has the largest gap in ETA-focused strategies and strategies involving NPD cooperation when compared to the reference group of firms in innovation-driven economies. It indicates that in these economies, there is still a gap in the business environment regarding support for innovation in manufacturing firms. On a country level, the results are similar to those of the previous study on the firm level, which indicated that the innovative firms in most competitive locations are still heavily reliant on internal R&D-focused strategies.

Altogether, the results of the five publications illustrate the role of a challenging and still-developing business environment in emerging markets as well as firm-level challenges regarding catching up with competitiveness. Internal R&D continues to be important for companies to develop internal capabilities to exploit different technology management strategies. Technology transfer and inter-firm cooperation in new product development are vital and well-exploited tools with which companies in emerging markets can catch up. These strategies provide additional economic benefits and more efficient new product development processes. The most innovative companies in most competitive locations seem to continue to exploit strategies that mainly rely on internal R&D accompanied by technology acquisition and cooperation.

5.2 Theoretical contribution

This research assesses the firm competitiveness in emerging markets by contributing on two theoretical approaches. First is the market level where the constraints of the business environment create gap in competitiveness (theoretical background: enterprise and industry competitiveness, and market-based view). This study evaluates the current situation and development of competitiveness within Russian manufacturing industry (see publication 1) and how management strategies varies between manufacturing industries in countries in different levels of competitiveness (see publication 5). The second is the firm level where the interfirm cooperation and technology transfer enables companies to expand their resource base and catch up in the competitiveness (theoretical background: strategic management, resource-based view, and relational view) (see publications 2, 3, and 4). This study contributes primarily on the second theoretical approach by providing empirical evidence and describing the preconditions and implications of more open technology management strategies.

This thesis contributes to the strategic management and technology and innovation management literature by examining firms' strategies in an emerging market context. The previous literature notes that firms in emerging markets have to develop their strategies to be able to gain competitive advantages (Hoskisson et al., 2000; Wright et al., 2005; Wu and Pangarkar, 2006; London and Hart, 2004; Khanna et al., 2005). This study expands the current strategy literature in emerging markets by using empirical data from innovative manufacturing companies in Russia. The research has its foundations in the resource-based view, according to which a firm's resources determine its competitive advantages (Barney, 1991; Grant, 2002; Peteraf, 1993). This view is also developed by the relational view, which posits that the firm's resource base expands by exploiting inter-firm cooperation and networks (Dyear and Singh, 1998; Lavie, 2006). This research also assumes a strong background in the market-based view, specifically, that the market environment sets the constraints for industrial competitiveness and the development of firms' competitive advantage, which is especially evident in the emerging market context (Porter, 1980; Hoskisson et al., 2000; Peng et al., 2009).

The results add to the understanding of the capabilities and activities of innovative manufacturing firms in emerging markets in terms of opening up their innovation process, organising firm activities and exploiting new opportunities beyond firm boundaries (Chesbrough, 2003; Gassmann, 2006). The results of this thesis contribute towards understanding the level and preparedness of capability building in manufacturing firms in emerging markets. The changing business environment and increasing market competition require firms to develop capabilities for technology and innovation management (Eisenhardt and Martin, 2000). Technology transfer requires capability building, which is mainly enabled by internal R&D investments and processes. Inbound technology transfer (Granstrand, et al., 1992; Lambe and Spekman, 1997; Cassiman and Veugelers, 2006) and the development of absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002; Spithoven, et al., 2010) allow firms to seek technologies and new technological opportunities from markets and external partners to complement internal R&D efforts. The results of the thesis have proven this to be beneficial for emerging market firms in catching up and improving their R&D and NPD processes. This thesis has also examined the functioning of technology markets and the ability of emerging market firms to engage in outbound technology transfer activities (Arora, et al., 2001; Zahra and Nielsen, 2002). The results show that for manufacturing firms in emerging markets, these capabilities are less developed than outbound activities. Only a few firms are willing or able to successfully commercialise their technologies and exploit the benefits of this process.

This study also contributes to the literature on inter-firm cooperation and networks (Hagedoorn, 1990; Gulati, 1998; Stuart 2000; Tsai, 2001). For emerging market firms, network position and partner selection are critical (Zaheer and Bell, 2005; Hitt et al., 2000; Hitt et al., 2004) and also affect the international expansion of firms (Lue and Tung, 2007; Kumar et al., 2013). However, the results indicate that together with active internal R&D, successful technology transfer enables effective innovation and new product development processes, thus allowing firms in emerging markets to confront the constraints set by their challenging business environments, become more international and catch up and become more competitive. The empirical results of this thesis add valuable insights and new information to the current literature on emerging market companies, through the evidence from Russian manufacturing industry, by studying their technology management strategies, level of innovativeness, and ability to cooperate and exploit knowledge and technology transfer (e.g. Radosevic, 1999; Fu et al., 2011; Desai and Goldberg, 2011; Valdaytsev and Sergeev, 2011; Podmetina et al., 2011, Hinkkanen et al., 2013).

5.3 Managerial implications

This dissertation contributes towards enhancing the current understanding of technology management strategies and the development of firm competitiveness in emerging markets. The study also clarifies the level of openness and inter-firm cooperation of companies in new product development and innovation. The results rely primarily on

empirical evidence from innovative Russian manufacturing firms, but it can also be somewhat extended to analyse firms other than in emerging markets that are at a similar stage of industrial development.

According to Global Competitiveness Report Russian overall national competitiveness ranks all time high at the moment. However, lately there has been notable negative development in case of macroeconomic environment and previous positive development in business sophistication and innovation has stopped. (Schwab, 2015) This dissertation proves that Russian manufacturing is still heavily reliant on basic industries struggling to maintain competitiveness. However, there are some positive indications that, for example, the electronic and optical equipment industry has been able to improve on global competitiveness (see publication 1). The studies show that innovative manufacturing firms in Russia are already relatively open to acquiring external technologies and collaborating with external partners in new product development and that they possess the required capabilities to do this. The firms doing this are able to enhance their NPD process and decrease the R&D risks leading to improved market share, innovation and economic performance (see publication 3). However, very few of them still commercialise their internally developed technologies, which are not fit for their current product strategies. This creates imbalances in Russia's domestically-oriented technology markets. The firms commercializing their technologies are, however, able to improve their economic performance and gain revenues for R&D investments. Technology commercialization enables companies to become more networked and open providing new business opportunities. (see publication 4). The results also show that the innovation and technology management strategies in manufacturing companies between countries in different levels of competitiveness differ. (see publication 5). The firms in less competitive countries are actively reaching beyond the company borders and using open approaches to improve their innovation processes and catch up in competitiveness.

5.4 Limitations and suggestions for future research

This thesis has some limitations which should be discussed and taken into account in future research. The current research has also raised questions that can be tackled in future research.

The first notable limitation is the geographical perspective. Most of the empirical evidence came from Russia. The thesis largely discusses emerging markets; however, this generalisation might not apply to all emerging countries. Even though many emerging countries experience similar market growth and challenges, and that the broad ideas and conclusions might apply, market environments, industry structures, and cultures differ significantly. The vast emerging countries, like Russia, are diversified and have large regional and industry variation within the country (EBRD, 2012).

The second limitation relates to the data. This study mainly utilised cross-sectional primary and secondary data. The secondary data sources allowed the use of one longitudinal industry-level dataset and one very large firm-level dataset, which enabled

more general analysis of the research topic but lacked the closer firm-level analysis. In the future, primary longitudinal data (panel data) would allow one to make further conclusions about the development of firm strategies.

The third limitation concerns the data analysis of the studies, which was mainly quantitative but remained largely descriptive due to the small sample of companies exploiting strategies studied in this thesis, which limited the use of further quantitative data analysis methods. Descriptive data analysis was supported by one brief case study in publication 4 to add to the reliability of the study. Further qualitative research would allow more detailed studies about firms' management and strategies and the reasons behind strategic choices concerning operations beyond firm boundaries.

In addition, previous emerging markets research have called for further longitudinal and mixed-methods studies with a widened geographic focus. Current research is noted to be biased towards studies focusing only in China. There is also bias regarding the industrial sectors studied, and little distinction has been made between the manufacturing and service sectors (Hoskisson et al., 2000; Jormanainen and Koveshnikov, 2012; Wright, et al., 2005). This thesis partly answers to this call by expanding the literature on Russian markets and utilises expansive data to focus on the manufacturing industry.

The entire research process has also raised new questions and directions for future research. As industrial development is constantly challenging and changing market environments, it has become a great personal interest through my studies. To continue with this research interest, it would be most valuable for future studies to gather some new survey data, especially concerning the benefits of close inter-firm collaboration and technology exchange. It would also be interesting to gather some qualitative data to examine this issue further, especially studying the catching-up process and the challenges of emerging market firms to become more involved with firms and networks mainly operating in developed countries.

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Part II: Publications

Publication I

Torvinen, P. and Väättänen, J.

Review of the competitiveness of Russian manufacturing industry

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Review of the competitiveness of Russian manufacturing industry

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Abstract: This article examines the competitiveness of the Russian manufacturing industry. The study uses secondary data and follows the development of selected indicators in the Russian manufacturing industry. The selection of indicators is based on a literature review of measuring competitiveness. The main indicators are production, productivity, unit labour costs, and exports to European Union markets. The main data source is the industrial database of The Vienna Institute for International Economic Studies (WIIW). This data has been used to make calculations to identify the effects of selected indicators on the competitiveness of the manufacturing industry. The results of the study show that the Russian manufacturing industry is in a difficult situation. Most Russian industries face problems in improving their competitiveness and competing in domestic and international markets.

Keywords: Russia; competitiveness; industry; manufacturing.

Reference to this paper should be made as follows: Torvinen, P. and Väättänen, J. (2013) 'Review of the competitiveness of Russian manufacturing industry', *Int. J. Business Excellence*, Vol. 6, No. 3, pp.293–309.

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1 Introduction

The last 20 years, since the collapse of the Soviet Union, has been a time of economic development and learning to meet the demands of market economy in Russia. Since then the borders have opened to global trade, and Russian industries have faced the competition in the markets. Manufacturing is one of the key industries in increasing national competitiveness. The manufacturing industry competes against global markets both locally and globally. This makes it possible to draw conclusions about the international competitiveness of the manufacturing industry from the changes in economical and industrial data.

Competitiveness has been one of the most commonly discussed topics in economics in the last 20 years after Porter (1990) introduced his competitiveness framework. The discussion is still current today (Rugman et al., 2011; Carayannis and Wang, 2011). The general aim of any nation today is to upgrade national and industrial competitiveness and productivity to increase prosperity and the standard of living (Porter, 1990; Schwab, 2010). Developed nations, and especially developing economies, have considered this to be one of the main goals of economical development for the future. Russia has relied much on inherited endowments, such as extraction of natural resources. It has been noted on national level that the policies have to be developed and there has to be also other competitive industries in Russia in order to sustain the position in global competitiveness in the long run (Porter and Ketels, 2008).

National competitiveness is derived from industries and companies (Porter, 1990). Russian industries have acknowledged that they lag behind in competitiveness in the global scale (Yasin, 2010). Russian national competitiveness has stayed at the same level in global comparisons in recent years (Schwab, 2010). Despite the strong economical growth, the national competitiveness has not increased significantly. Nevertheless, Russia has a strong ambition to become an internationally competitive and innovation-driven economy.

The competitiveness of the Russian economy has been discussed in the literature. There is still room for further analysis and especially research from the Russian manufacturing industry which is clearly less explored. There are few recent articles which tackle the topics of this research. Waheeduzzaman (2011) has studied the G7 countries against big emerging markets and pointed out that the role of emerging markets in world economy is growing fast which should be recognised. Connolly (2008) has discussed about the structure of Russian exports and the balance between primary products and high-technology and how the nation could diversify the export base. Garanina (2009) has pointed out the rapid deterioration of trade balance in Russian manufactures. Porter and Ketels (2008) suggest that Russia is at crossroads. They perceive that Russia can continue on the same path where companies would remain generally domestically focused or choose the competitiveness approach as the driving principle for economic policies which would tackle the weaknesses of the Russian business environment. The study points out the strengths and weaknesses of the Russian economy and the areas of economy at micro and macro level that should be focused on to develop the nation's competitiveness in the future. Desai and Goldberg (2007, 2008) discuss Russia's competitiveness in general. They have focused their research on the developments and characteristics of the Russian economy and policies which affect the competitiveness of the nation and the innovation environment in Russia. Yasin et al. (2010) examined the state of Russian manufacturing in the beginning of the financial

crisis in 2008. A study by Avdasheva et al. (2010) also discusses the competitiveness and the state of the Russian manufacturing industry in the 21st century based on a survey made in Russian enterprises.

The objective of this article is to examine how the competitiveness of Russian manufacturing industry has developed and which are the most competitive industries. The study has been done by using statistical data from secondary sources. The evaluation of the competitiveness of the Russian manufacturing industry is based on data from the industrial database of The Vienna Institute for International Economic Studies (WIIW). The development in production, labour productivity, unit labour costs (ULCs), and Russian trade with the European Union (EU) are the main factors used to evaluate the industrial competitiveness. In the results, the most competitive and potential industries are also named.

The article is structured as follows: the first section introduces the competitiveness framework and literature base of the study. Next, the research data and methodology are described more closely. The following section evaluates the national competitiveness of Russia and compares it globally. This section is followed by the main findings and results of the research. The final section concludes the results and discusses the limitations of the study and addresses some future research directions.

2 A framework to measure industrial competitiveness

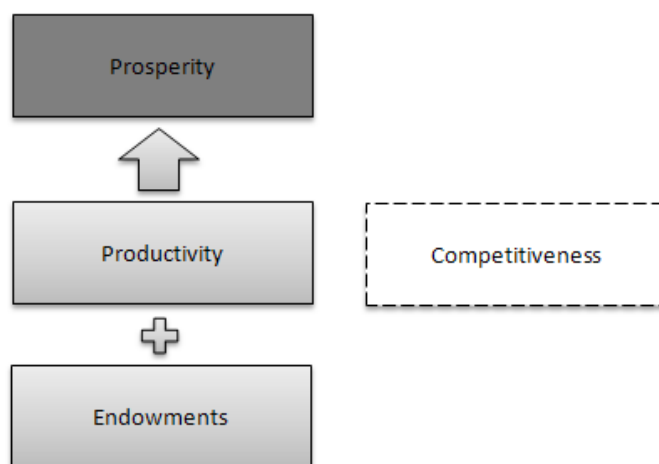
National and industrial competitiveness has been discussed and studied in literature extensively. There are different frameworks and indicators which are used to measure competitiveness in different levels (Chikán, 2008; Fagerberg et al., 2007). Research has been made on competitiveness in different nations and especially emerging markets has received a lot of attention lately (Pillania, 2009; Waheeduzzaman, 2011). Competitiveness of manufacturing industries has also been noticed to have strong effect and it has been examined in many cases (Brunner and Calí, 2006; Trasca, 2011; Saboniené, 2011).

The term competitiveness has varying definitions in the literature. Competitiveness can be defined as benchmarking the economic performance of nations or companies against their major competitors. Performance can be measured from the perspective of an enterprise benchmarking productivity, profitability, market share, or growth rate of sales (Dunning, 1995). OECD (2011) defines competitiveness as follows: “competitiveness is a measure of a country's advantage or disadvantage in selling its products in international markets”. OECD takes the ULCs in manufacturing and consumer prices into account in the countries compared. Porter's (1990) definition of competitiveness concentrates much on the productivity of the companies in a certain location and what kind of macroeconomic environment the location offers for the companies. Porter's view is shared in the definition of Harvard Business School's Institute for Strategy and Competitiveness and in the Global Competitiveness Report (GCR) (Schwab, 2010; HBS Institute for Strategy and Competitiveness, 2011).

Porter (1990) has created a competitiveness framework which is the most widely used concept to evaluate competitiveness on macro and micro economical levels. This approach is also the base for the annually published GCR, which evaluates the competitiveness of nations. Porter's diamond model, used on the microeconomic level,

has also been criticised and further developed by others. The criticism has created different approaches, especially to measuring the competitiveness of nations. Since the introduction of the framework, over 20 years ago, the concept has gained strong support but also some debate which has ultimately developed the model further (Rugman, 1991; Dunning, 1992, 1993; Cartwright, 1993; Bellak and Weiss, 1993; Rugman and D’Cruz, 1993; Krugman, 1994; Waverman, 1995; Jegers, 1995; Davies and Ellis, 2000; Boltho, 1996; Moon et al., 1998). The model has been, for example, criticised to focus too much on the home nation when the companies compete in the international markets but there is also evidence that the competitiveness is still most dependent on the home nation (Rugman et al., 2011). Ketels (2006) has also discussed and explained Porter’s framework further for practitioners and researchers. The acceptance of Porter’s base theories is still strong.

Figure 1 Defining competitiveness



Source: Porter et al. (2008, p.45)

Porter (1998) has stated that, ultimately, it is companies that compete, not nations. Firm-level competitiveness is linked to the competitiveness of industries, which, at the end, leads to national competitiveness. National and firm-level competitiveness are the most commonly discussed topics in the literature, but there is less research on industry-level competitiveness. In addition to Porter’s productivity-based view, there are indicators which have been acknowledged to measure competitiveness on the micro level. Competitiveness is not measured only by productivity, but also by the cost of inputs in the process. ULC is one of the indicators which can be used to measure competitiveness. It combines labour cost and productivity into a single measure of labour cost per unit output (Van Ark, 2005). Mitschke (2008) has recognised indicators which indicate the international competitiveness of companies and industries. Productivity, ULCs in labour intensive industries (such as manufacturing industries), exports and export market shares, foreign direct investments (FDIs), innovations, (through patents and R&D expenditure), and sustainable growth are indicators which can be used to measure microeconomic competitiveness. Market demand and innovation are in important role to develop productivity and competitiveness of industries (Crespi and Pianta, 2008). Figure 1 presents the competitiveness framework by Porter, where increase in productivity and

competitiveness leads ultimately to prosperity. This framework and the studies reviewed form the base for the methodology used to measure competitiveness in this study.

3 Data and methodology

The present study is quantitative and it is based on statistical data from secondary sources. The following two sections examine the development of Russia's economy and the competitiveness of the Russian manufacturing industry. The main statistics used to present the state of the Russian economy are from the World Bank, the World Economic Forum (WEF), UNCTAD, and Eurostat.

The main data source for evaluating the competitiveness of the Russian manufacturing industry is the WIIW industrial data from the years 2000 to 2008 (WIIW, 2010). The WIIW data relies on the Russian Federal State Statistic Service and Eurostat statistics. The data has been used in calculations which reflect the development in competitiveness. The data describes the development of the Russian manufacturing industry in industrial production, employees, labour productivity, wages, ULCs, and trade between Russia and the EU. The data is based on two-digit level of NACE 1 classification. Table 1 demonstrates the contents of data used in this study.

Table 1 Contents of the data

INDUSTRY	INDICATORS
NACE Rev. 1	2000–2008
CDE Total industry	Industrial production
C Mining and quarrying	Employees in industry
D Manufacturing	Average monthly wages
DA Food products, beverages and tobacco	Labor productivity in industry
DB Textiles and textile products	Unit labor costs in industry
DC Leather and leather products	Exports from Russia to EU
DD Wood and wood products	Imports from EU to Russia
DE Pulp, paper and paper products; publishing and printing	Trade balance (EU-Russia trade)
DF Coke, refined petroleum products and nuclear fuel	
DG Chemicals, chemical products and man-made fibres	
DH Rubber and plastic products	
DI Other non-metallic mineral products	
DJ Basic metals and fabricated metal products	
DK Machinery and equipment n.e.c.	
DL Electrical and optical equipment	
DM Transport equipment	
DN Manufacturing n.e.c.	
E Electricity, gas and water supply	

The developments of industries in Russian manufacturing are examined especially in production, labour productivity and ULC to expose the development in competitiveness. The trade with EU is also examined as a factor indicating the international

competitiveness of the Russian manufacturing industry. Figure 2 shows the indicators used to measure competitiveness in this study. These selected indicators reflect to the framework to measure competitiveness based on Porter's competitiveness theories and other studies measuring competitiveness.

Figure 2 The main indicators of industrial competitiveness used in the study



4 Russian competitiveness

Russia has faced a strong economic growth in recent years, but the competitiveness has not increased essentially. In 2009, the Russian GDP per capita was \$18,962 (adjusted with PPP). The Russian GDP has grown annually approximately by 5.5% in the 21st century and it is now higher than ever before. Compared to the other BRIC countries (Brazil, Russia, India, and China), Russia has clearly the highest living standard, which has, however, decreased due to the global economic downturn. The expenditure to R&D in Russia was 1.1% of the GDP in 2007. In the Russian case, this is a relatively small figure but it is in the line with the other BRIC countries. The GDP per person employed, indicating the labour productivity, has increased also by approximately 6% annually (The World Bank, 2011). The level of productivity is still far from the western standards, but the development has been positive. Among the BRIC countries, Russia ranks clearly number one also in this comparison.

The GCR is one of the most acknowledged publications to evaluate national competitiveness. Its foundation is in Porter's competitiveness framework, and it is based on hard data and executive surveys. According to the GCR, Russia's competitiveness ranking has stayed at the same level in recent years. Russia ranks 63rd of 139 countries in the GCR 2010–2011 comparison (Schwab, 2010). Russia is in an efficiency-driven stage of economic development. Table 2 shows a comparison of the BRIC countries and how they are positioned in the GCR 2010.

FDIs in Russia had good growth from the year 2000 till 2007. In 2007 the FDI inward stock decreased dramatically, but since then the FDIs have been increasing steadily (UNCTAD, 2010). Of the BRIC countries, China and Brazil have bypassed Russia in the FDI stock. Approximately 60% of the FDIs to Russia go to services, 25% to manufacturing, and 17% to mining and quarrying (Vinhas de Souza, 2008). The recent financial crisis has affected the level of Russian outward investments dramatically, but the investments started to increase already in 2009 (UNCTAD, 2010). Among the BRIC countries, Russia is the number one investor in global markets.

Russian trade, in general, is quite one-sided. In 2010, total 68.8% of total exports were oil and gas and 10.6% metals. 45.2% of imports were machinery and equipments.

(Economist Intelligent Unit, 2011). The EU is clearly the biggest and most important trade partner of Russia with the share of 45.8% of the trade. 74% of the EU imports from Russia are mineral fuels, lubricants and related materials, which is 30.8% of the total EU imports of these materials. 44% of the EU exports to Russia come from machinery and transport equipment and 20% from different manufactured articles and goods (European Commission Directorate-General for Trade, 2010).

Table 2 BRIC-countries in the GCR 2010

<i>Key indicators 2009</i>	<i>Russia</i>		<i>Brazil</i>		<i>China</i>		<i>India</i>	
Population (millions)	140.9		193.7		1,345.8		1,198.0	
GDP (US\$ billions)	1,229.2		1,574.0		4,909.0		1,236.0	
GDP per capita (US\$)	8,694		8,220		3,678		1,031	
GDP (PPP) as share (%) of world total	3.05		2.87		12.52		5.06	
<i>Stage of development</i>	2		2		2		1	
<i>Global Competitiveness Index</i>	<i>Rank</i>		<i>Score</i>		<i>Rank</i>		<i>Score</i>	
GCI 2010–2011 (out of 139)	63	4.2	58	4.3	27	4.8	51	4.3
GCI 2009–2010 (out of 133)	63	4.2	56	4.2	29	4.7	49	4.3
GCI 2008–2009 (out of 134)	51	4.3	64	4.1	30	4.7	50	4.3
Basic requirements	65	4.5	86	4.3	30	5.3	81	4.3
1st pillar: institutions	118	3.2	93	3.6	49	4.4	58	4.0
2nd pillar: infrastructure	47	4.5	62	4.0	50	4.4	86	3.5
3rd pillar: macroeconomic environment	79	4.5	111	4.0	4	6.1	73	4.5
4th pillar: health and primary education	53	5.9	87	5.5	37	6.2	104	5.2
Efficiency enhancers	53	4.2	44	4.4	29	4.6	38	4.4
5th pillar: higher education and training	50	4.6	58	4.3	60	4.2	85	3.9
6th pillar: goods market efficiency	123	3.6	114	3.7	43	4.4	71	4.1
7th pillar: labor market efficiency	57	4.5	96	4.1	38	4.7	92	4.2
8th pillar: financial market development	125	3.2	50	4.4	57	4.3	17	4.9
9th pillar: technological readiness	69	3.6	54	3.9	78	3.4	86	3.3
10th pillar: market size	8	5.7	10	5.6	2	6.7	4	6.1
Innovation and sophistication factors	80	3.4	38	4.0	31	4.1	42	4.0
11th pillar: business sophistication	101	3.5	31	4.5	41	4.3	44	4.3
12th pillar: innovation	57	3.2	42	3.5	26	3.9	39	3.6

Source: Schwab (2010)

FDIs and trade have a strong effect on emerging economies and Russia. Russia has had problems in creating own science-based innovations recently. FDIs are one of the factors that affect significantly to the development of innovations (Torkkeli et al., 2009). The innovation activities are affected by organisational structures with culture and the way how innovation activities are managed and developed (Banerjee et al., 2011). These structures are not always supporting innovation activities in Russian enterprises.

Manufacturing in emerging economies has grown strongly, especially in China. These industries have to compare their performance in global context (Liu and Takala 2010; Lima et al., 2011). Retail markets in Russia have faced strong growth in all the sectors (Karhu and Yla-Kojola, 2010). The market development creates a strong support for the

manufacturing companies in Russia to succeed, but only the most competitive will survive from the global competition.

According to the statistics, there is no indication that the Russian competitiveness would have increased remarkably. The development has been moderate, and the national-level competitiveness has not been able to match the pace of the other BRIC countries. This study supports the previous research as it examines the competitiveness of the Russian manufacturing industry. It addresses the long-term development in Russian manufacturing in the 21st century, which, besides the industries, has an effect on the competitiveness of the whole nation. It also points out the best performed and most potential industries for the future development of the Russian economy.

5 Results of the study

The Russian industry produces 33% of the nation's GDP. The growing service sector has decreased the role of industry in the Russian economy in recent years (European Commission Directorate-General for Trade, 2010). The number of employees has generally decreased, which, together with growth in production, indicates a positive change in labour productivity. The labour productivity in manufacturing has grown strongly, approximately by 10% annually. Between the years 2000–2008, the wages rose by 12% annually (deflated with CPI). The ULCs are still far from the European standards, but have grown on average approximately by 15% annually. The manufacturing production increased only by 66% and the export to the most developed EU countries (EU-15) increased by over 200% between the years 2000–2008; the imports, however, increased by over 300%. The labour productivity in Russian manufacturing has increased approximately by 100% but the ULCs have at the same time increased by over 200%, which has had a negative effect on the competitiveness of industries (WIIW, 2010). In this perspective, Russian industries have competitive advantage in ULCs compared to the EU, which could make Russia an attractive target country for European FDIs in high labour cost industries. The rapidly rising costs, however, increase the risk in Russia. In some industries, for example coke, refined petroleum products and nuclear fuel, work seems to be well compensated for, but the general level in ULCs is still low, which supports the industry's competitiveness. The overall development puts the Russian manufacturing industry in a difficult situation in maintaining the level of competitiveness. Table 3 describes the general development in Russian manufacturing between the years 2000 and 2008.

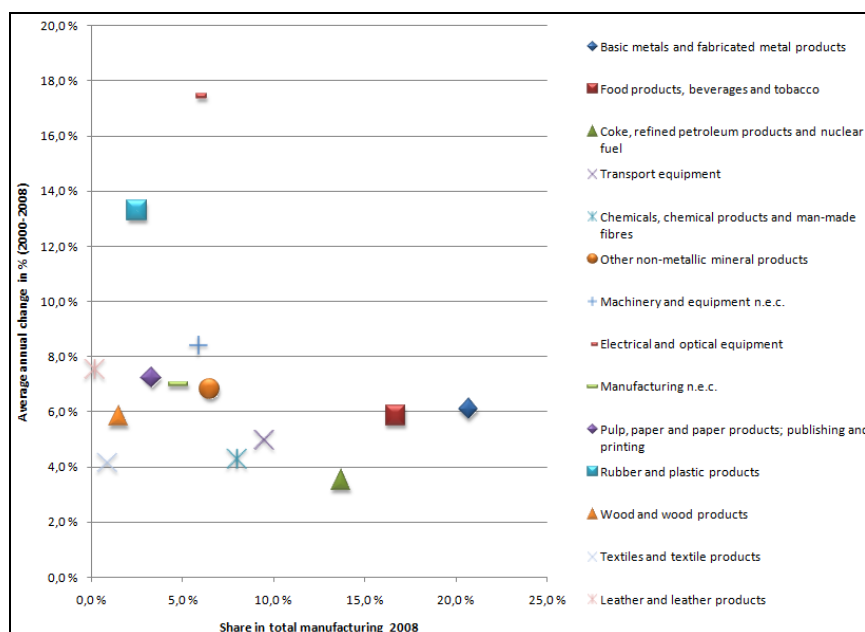
Table 3 Development of Russian manufacturing in 2000–2008

<i>Indicator</i>	<i>Change 2000–2008</i>
Production (reference prices 2002)	66%
Employees	–19%
Productivity	103%
Wages (deflated with CPI)	145%
ULC (national currency)	230%
Exports to EU-15 (EUR-based)	221%
Imports from EU-15 (EUR-based)	334%

Source: Adapted from WIIW (2010)

The Russian manufacturing industry has grown approximately by 7% annually in the 21st century. There are notable differences between some of the industries. The chemical and textile industries have, for example, had minor growth compared to the electrical and optical equipment industry, where the production grew by more than 200% between the years 2000–2008 (see Appendix). The industries with the most growth are, however, relatively small in size. The major industries – coke, refined petroleum products and nuclear fuel, food products, beverages and tobacco, and basic metals and fabricated metal product industries, have had relatively small growth. Figure 3 presents the share of the Russian manufacturing industries and their annual average growth between the years 2000 and 2008.

Figure 3 The share and growth of industries in manufacturing (see online version for colours)

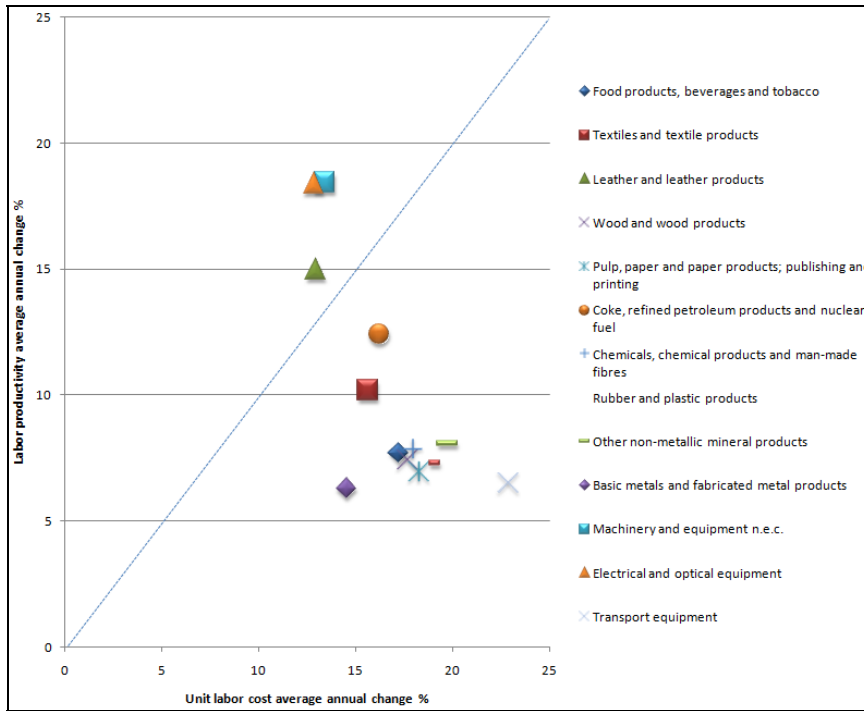


Source: Adapted from WIIW (2010)

The productivity of manufacturing has increased, but the increase in wages and ULCs has been stronger. In general, this is an indication of weakening competitiveness. The basic industries have the best productivity and they have the competitive edge. The ULCs have increased down the line and there have been only a few industries that have been able to increase their productivity more than the ULCs have increased. Machinery and equipment, electrical and optical equipment, and leather and leather products have been able to have such development between the years 2000 to 2008. This development has been important for these industries. The machinery and equipment and electrical and optical equipment industries also produce high technology products. These new industries are still small in size, but they have clearly potential and strength to develop in the difficult situation. The Russian industrial competitiveness is still in basic industries and based on natural resources. The smaller industries have potential, but they are still very small industries which have also a small share in exports. The change will definitely

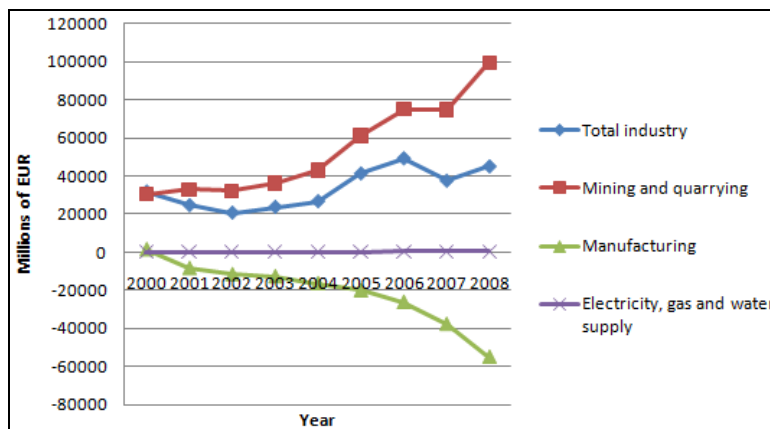
take quite a long time still for the developing Russian industries to become competitive in a scale which would affect substantially on the national and global level. Figure 4 presents the annual average development of labour productivity and ULCs in Russian manufacturing between the years 2000 and 2008.

Figure 4 Labour productivity and ULC average annual change % (see online version for colours)



Source: Adapted from WIIW (2010)

Figure 5 Russian trade balance with EU-27 (see online version for colours)



Source: WIIW (2010)

Russia is a very important trade partner to the EU, especially in primary products. Russia depends on the EU in import of machinery and high technology goods. The EU markets demand competitive products in exports from Russia and offer competitive products in imports to Russia, which measures competitiveness well. Russia's imports from the EU have increased dramatically in the last decade. The increased competition and imports have made the situation in Russian domestic manufacturing also difficult. Manufactures are increasingly imported from the EU. The demand of manufactures has increased significantly in recent years. This places the domestic industry in a position where it can grow or diminish depending on how competitive it can be compared to others. Figure 5 presents the trade balance of Russian industry with the EU-27 countries.

The Russian manufacturing industry relies still heavily on basic industries, which to great extent rely on natural resources. These industries are low value-adding industries that, however, provide a strong positive cash flow in trade through exports. The share of high technology export of manufactured exports has decreased quite dramatically. In 2008, only 6.5% of the manufactured exports were high technology, when the figure five years before was 20% (The World Bank, 2011). In general, Russia imports manufactures almost twice the worth of its exporting. The mining and quarrying industry provides Russia a strong positive trade balance (includes, e.g., the extraction of raw materials such as metals, crude oil, and natural gas). This leads to the positive trade balance in the total industry. The role of electricity, gas and water supply in trade is minimal compared to the other two industries. The manufacturing industry exports to competitive EU markets have increased, but the imports from these markets have increased even more. The increase in domestic production has been very moderate compared to the increase in imports. This indicates that the domestic industries are not able to meet the demands of the domestic markets. This is probably also the case in Russian manufacturing meeting the demands of international markets in general. Coke, refined petroleum products and nuclear fuel, basic metals and fabricated metal products, and wood and wood products are the only industries that produce a positive trade balance in manufacturing with the EU-15 countries. The Russian exports with the EU-27 in manufacturing increased by 97% between the years 2000–2008. At the same time the imports from the EU to Russia increased by 370%. The huge growth in imports indicates a significant growth in demand in Russian markets. The production in Russian manufacturing increased only by 66% at the same time, which proves that the domestic demand in Russia is increasingly met by foreign imports.

In manufacturing, the basic industries take the biggest share of exports. Coke, refined petroleum products and nuclear fuel have the largest share and they have been also one of the biggest growers. There are some big growers also among the other industries; these industries are still small, however, which makes the growth figures look good. Electrical and optical equipment is basically the only industry worth mentioning which has had good growth in exports to the EU-15 countries. Most of the industries have had just a minor growth in exports. There are only four industries which have more than a 10% share from production going to exports to the EU-15. These industries are coke, refined petroleum products and nuclear fuel, basic metals and fabricated metal products, wood and wood products, and leather and leather products. This indicates the competitiveness of these basic industries. These basic industries have also been able to increase their exports more than production in 2000–2008. In addition, the electrical and optical

equipment industry is the only one which has been able to increase its share in exports, but the size of the industry in exports is still quite small.

In general, all the industries have had a strong growth in imports in recent years. The most commonly imported products come from the machinery and equipment, transport equipment, electrical and optical equipment, and chemical industries. These industries are generally high technology industries. The transport equipment industry has had the most growth of all the industries. There are only three industries that were able to have a positive trade balance with the EU-15 countries in manufacturing in 2008, so that the worth of the exports were more than that of the imports. These industries are coke, refined petroleum products and nuclear fuel, basic metals and fabricated metal products, and wood and wood products. The huge increase in manufactured imports proves that the Russian markets have huge potential and they have strong demand for competitive products. This forms a very suitable platform for domestic production. Today's situation is, however, that the increasing imports are replacing the domestic production and the exports to developed markets have not increased substantially.

Most of the industries in Russian manufacturing seem to be in a difficult position. The industries have been able to increase their productivity, but the increase in labour costs has been overwhelming. The increase in exports has been generally relatively small, which indicates low competitiveness of Russian manufactures in the global markets. This is the case especially in technologically advanced fields of manufacturing industry. The overall increase in the production of Russian manufactures has been moderate. The huge increase in Russian consumption has increased the importing of manufactures from abroad, and the domestic industries seem to have difficulties to meet the increasing standards and demand.

This paper contributes to managerial issues and gives perspective what is happening in Russian manufacturing. The results can have implications also to policy-making which has agenda to influence the future of Russian manufacturing. The previous development of Russia's competitiveness does not indicate that there would be a notable change happening. Overall, the general development in competitiveness has been negative. Rising labour costs hinder the competitiveness because the industries are not able to increase their competitiveness at the same pace. There are some industries which do better than the others but still the overall development looks gloomy. Supporting the small and growing industries is important, but also the big traditional industries need attention. Attracting FDIs would help the situation in the long run. The general development suggests that there is definitely room for western FDIs with competitive production. The local markets are growing, and presence in Russia could work as an advantage. This would also put pressure for local companies to develop production, productivity, manufacturing technologies, and ultimately develop more competitive and innovative products.

6 Conclusions

The Russian GDP has developed significantly in recent years. The living standard in Russia is higher than it has ever been before, and productivity has increased; however, the Russian national competitiveness and the competitiveness of the manufacturing industry show few signals of increased competitiveness. The target of this study was to find out whether the main industries in Russian manufacturing have been able to increase

their competitiveness. The paper has discussed the general development in industries (production, labour productivity, ULCs) and taken the development and effects of foreign trade (exports and imports) into account.

The competitiveness of the Russian manufacturing industry has not been discussed extensively in the literature, and there has been room for further research. As a nation, Russia has a strong strive to change and become a more competitive knowledge-based economy. The manufacturing industry is in a vital role in developing the nation's competitiveness. This study has given a good overall view to the recent developments in the competitiveness of Russian manufacturing.

Russia has not been able to increase its national competitiveness in recent years, but it has not decreased either. There are issues that have not improved, which affects the nation's competitiveness. Russia is increasingly investing abroad and the companies are becoming more international. Russia is still an attractive market for foreign investors, which has positive effects on competitiveness as well. As a nation, Russia seems to have potential, but the development in increasing competitiveness has been poor.

The share of high-technology exports of manufactures from Russia has decreased substantially in the last five years, which indicates very poor development in producing competitive high value added products to the global markets. The wages and ULCs have increased more than productivity, which has had a negative effect on the competitiveness of Russian manufacturing industry. There are only a few industries which been able to increase their productivity and competitiveness. The general decline in competitiveness and the huge increase in manufactured imports prove that the situation in the whole manufacturing in Russia is not easy. The domestic production is outperformed by more competitive foreign production. The production and productivity in Russian manufacturing has increased in all the industries. Exports to developed economies have also increased substantially. The fast increasing labour costs have had a negative effect on competitiveness in all sectors. This has been the main source of negative development. The imports from developed European economies have increased, which indicates, to some extent, the inability of domestic production to match the demands, but even more it indicates the huge market potential that the Russian markets have for competitive products.

The basic, natural resource-based industries are generally the best performing industries. They control the exports and create surplus in trade. A majority of manufactures are imported from abroad, which indicates an inability of the industry to meet the market demands. There are a few notable industries that have shown good development in trade and other fields. The machinery and equipment and electrical and optical equipment industries have been able to raise their level of productivity more than the ULCs have risen. This is a clear indication of increased competitiveness. These industries are also among the few that have been able to increase their exports to the competitive EU markets considerably. The imports in the whole manufacturing have increased substantially, indicating increased demand but also toughening competition in the domestic markets.

The best performing industries have potential and they may turn up to be important for Russian competitiveness in the future if they are able to increase their competitiveness in international markets. As a nation, Russia has potential for becoming more competitive if it is able to create an attractive and supporting environment for creating new businesses and innovations. At the moment, the Russian manufacturing is in a difficult position. The

domestic production is growing slowly and foreign imports fill the Russian demand. The consumption in Russian markets has increased substantially, which offers great opportunities for industries. Meeting the demands of global markets is hard, but some Russian industries seem to be ready for the challenge.

This study has been done by using secondary sources of data. The study stayed only in the industrial level and covered the Russian manufacturing industry. It has tackled the general development and trends in the Russian manufacturing during the years 2000–2008. There is room for more in-depth data collection and analysis of Russian companies. This study presented a few industries which have had positive development regarding their competitiveness, but is this really the case? The large companies easily take a decisive role in statistics, especially in the case of Russia. How the Russian SMEs will handle the global competition and how strong they will be in the future are questions that are worth a further study.

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Appendix

Development of Russian manufacturing industry

	Total changes 2000–2008											
	Production 2008 (current prices MEUR)	Share of total industrial production 2008 (current prices)	Share of manufacturing production 2008 (current prices)	Production (reference prices 2002)	Employees	Productivity	Wages (deflated with CPI)	ULC (national currency)	Exports to EU-15 (EUR-based)	Imports from EU-15 (EUR-based)	Exports to EU-15 (absolute change MEUR)	Imports from EU-15 (absolute change MEUR)
<i>Total industry</i>	646857	100%	100%	47%	-16%	74%	137%	272%	383%	333%	65,678	66,242
<i>Mining and quarrying</i>	142199	22.0%	22.0%	39%	-38%	55%	104%	260%	581%	18%	47,084	54
<i>Electricity, gas and water supply</i>	70619	10.9%	10.9%	19%	-3%	23%	121%	390%	296%	-100%	323	0
<i>Manufacturing</i>	434039	67.1%	100%	66%	-19%	103%	145%	230%	221%	334%	18,271	66,188
Basic metals and fabricated metal products	89894	13.9%	20.7%	47%	-9%	62%	71%	188%	140%	310%	3,292	3,438
Food products, beverages and tobacco	72514	11.2%	16.7%	58%	-12%	80%	131%	251%	26%	127%	-35	2,563
Coke, refined petroleum products and nuclear fuel	59334	9.2%	13.7%	33%	-44%	140%	159%	197%	452%	497%	13,308	598
Transport equipment	41185	6.4%	9.5%	30%	-17%	57%	157%	347%	29%	983%	-24	13,551
Chemicals, chemical products and man-made fibres	34760	5.4%	8.0%	25%	-31%	80%	140%	264%	200%	311%	1,417	8,697
Other non-metallic mineral products	28418	4.4%	6.5%	62%	-12%	83%	174%	309%	25%	283%	3	1,194
Machinery and equipment n.e.c.	25782	4.0%	5.9%	89%	-46%	252%	209%	140%	84%	455%	143	16,061
Electrical and optical equipment	25233	3.9%	5.8%	207%	-12%	248%	200%	136%	175%	258%	171	10,088
Manufacturing n.e.c.	20738	3.2%	4.8%	64%	143%	-33%	121%	798%	19%	219%	-56	1,729
Pulp, paper and paper products; publishing and printing	14113	2.2%	3.3%	58%	-5%	65%	128%	277%	32%	153%	-79	1,562
Rubber and plastic products	10873	1.7%	2.5%	137%	38%	71%	134%	273%	899%	246%	100	1,861
Wood and wood products	6397	1.0%	1.5%	45%	-17%	75%	128%	257%	66%	289%	184	515
Textiles and textile products	3981	0.6%	0.9%	12%	-48%	114%	143%	210%	-67%	234%	-220	3,323
Leather and leather products	815	0.1%	0.2%	75%	-40%	190%	156%	142%	364%	201%	68	1,008

Source: Adapted from WIW (2010)

Publication II

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**Building competitiveness of emerging market firms: The role of interfirm
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BUILDING COMPETITIVENESS OF EMERGING MARKET FIRMS: ROLE OF INTERFIRM TECHNOLOGY TRANSFER

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BUILDING COMPETITIVENESS OF EMERGING MARKET FIRMS: THE ROLE OF INTERFIRM TECHNOLOGY TRANSFER

Abstract: Firms in emerging markets need to develop their innovation capabilities to become more competitive. In addition to finding, exploiting, and commercializing external technologies, firms need to commercialize their own technologies for external use. Access to interorganizational networks is a prerequisite for successful technology transfer. It is beneficial for emerging market firms to move from less competitive domestic networks to more competitive global networks. This requires firms to overcome their boundaries by developing internal capabilities to connect to other firms and inwardly and outwardly transfer technologies. A conceptual model concerning critical factors for emerging market firms to improve competitiveness is built in this paper. Technology transfer, intrafirm capabilities, and network connections are important factors for firms to overcome challenges set by the domestic business environment. However, emerging market firms have a lower level of competitiveness compared to firms in more developed markets and lack internal capabilities for technology transfer. Such firms are connected to less competitive, most probably domestic, networks and face difficulties in competing against global rivals, even in domestic markets. If firms in emerging markets cannot improve their internal capabilities and join competitive intrafirm networks, both horizontally and vertically, they will become less competitive.

Keywords: emerging markets, networks, knowledge transfer, technology transfer, competitiveness, performance

**BUILDING COMPETITIVENESS OF EMERGING MARKET FIRMS:
THE ROLE OF INTERFIRM TECHNOLOGY TRANSFER**

INTRODUCTION

International markets have become increasingly competitive and few companies can succeed without access to international networks and external knowledge and technologies. Firms in emerging markets face challenges to achieve competitive parity and develop their strategies. In the case of Russia, for example, there are only a few industries that have been able to improve their productivity in relation to rising unit labor costs. High technology exports have decreased dramatically and manufacturing industry's trade deficit has also grown substantially (Torvinen & Väättänen, 2013). Companies are facing major challenges to be internationally competitive. Access to international networks and competitive technologies is one of the most efficient ways to close the innovation gap with developed economies and enhance emerging economies' competitiveness. To improve their performance, companies need to develop their capabilities to enable effective acquisition and exploitation of external knowledge.

Internationally competitive companies and industries are the source of a national economy's competitiveness (Porter, 1990). The competitiveness of companies is strongly influenced by their ability to innovate and commercialize their innovations. Without commercialization and access to the markets, companies are unable to utilize the value they have created through developing new technologies and innovations (Chesbrough, 2003; Debackere & Veugelers, 2005; Zahra & Nielsen, 2002). However, successful innovation involves more than being first to market by commercializing developed technologies. It requires the handling of a spectrum

of technology management strategies (Trott & Hartmann, 2009). Companies have had to change radically their technology management and research and development (R&D) because the world has changed; technology development is extremely rapid and R&D costs are increasing. Tapping into external technologies and interorganizational networks have enabled companies to increase their innovation performance.

Internal R&D, technology transfer, and networking are substitutes when companies innovate. Technology transfer and interorganizational networks especially enable companies to increase the extent of their innovation (Love & Roper, 1999). It is not sufficient for companies only to manage internal R&D processes, they need to take new strategies for exploiting external sources for technology into account (Granstrand et al., 1992). Firms must also develop internal processes to identify and manage these technologies. Interorganizational technology transfer offers companies a way to acquire new technologies without heavy R&D investments and commercialize their technologies to gain financial benefits from their R&D outcomes.

Technology intensive industries face increasingly strong competition in the markets, and their attempts to aim at the frontier of development require heavy investments in R&D and innovation. If companies lack the resources to maintain parity in technology development, they have, in most cases, to rely on external sources to access the required technologies. A closed approach to innovation, relying strongly on internal R&D, does not fit with today's rapidly changing competitive environment (Chesbrough, 2003). Open business models, networking, and technology and knowledge transfer have become everyday activities for many companies. There are companies and economies that have been extremely agile in acquiring and incorporating external technologies to develop new products. However, this is still a new development for the majority of companies in many emerging economies.

Nowadays, more than ever, networks are necessary for companies and their competitiveness. Networks enable companies to learn and access knowledge, technologies, and resources they need without making high internal investments. Networks span across borders, connecting firms and markets. Companies' networks and their network position are also important for company internationalization (Johanson & Mattsson, 1988). In addition to good network position, companies need to develop their absorptive capacity to be able to assimilate and utilize new knowledge from different sources. When these issues are organized, companies can gain significant positive effects on business unit innovation and performance (Tsai, 2001).

In international business research, emerging markets have been of focal interest over recent decades, and research on emerging markets is still expanding (Xu & Meyer, 2013). Hoskisson et al. (2000) have identified four major theoretical perspectives in emerging market research: transaction cost theory, agency theory, resource-based theory, and institutional theory. Due to the vast challenges and instability arising from the institutional weaknesses in most emerging markets, institutional theory has been the most dominant field of emerging market research. However, different research strategies are also needed because of the significant variation in countries' economic and institutional development (Wright et al., 2005).

This study focuses mainly on firm-specific resources and capabilities. More specifically, how companies in emerging markets can increase their competitiveness for better performance through interorganizational technology transfer is examined. The focus is on two specific elements when discussing competitiveness: the firm's internal capabilities for successful technology transfer and its ability to be involved in developed (international) networks. The aim is to address this research gap and review the most relevant literature on the issues addressed, and build a conceptual model that illustrates the role of emerging market firms

between developing and developed business networks. The study highlights the role of firms' capabilities and technology transfer as a tool with which to join more competitive networks and improve firms' performance and competitiveness. Especially, technology transfer that occurs between industrial firms and networks is discussed.

The theoretical background and various streams of the literature are discussed in the following section; based on which, concepts necessary for successful technology transfer and development of competitiveness are constructed. The final section discusses and conceptualizes the findings, and presents avenues for future research.

BUILDING COMPETITIVENESS THROUGH TECHNOLOGY TRANSFER

According to the Resource-Based View (RBV) (Barney, 1986, 1991; Grant, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984; Conner, 1991), firms' internal resources and capabilities are the basis of their competitive advantage and success. The home market environment and its opportunities are extremely important for emerging market companies. However, firms also need resources and capabilities to be competitive and perform in the global environment. The business environment is constantly changing, and firms need to react to the changes; they need dynamic capabilities to change their ordinary assets, capabilities, and positioning (Teece et al., 1997; Eisenhardt & Martin, 2000; Winter, 2003).

Technology transfer links closely to knowledge-based theory (KBV) that builds on RBV, and focuses on knowledge as a firm's most critical resource (Grant, 1996; Kogut & Zander, 1992; Spender, 1996). Knowledge and also technologies can be transferred between companies, which can result in increased competitiveness of different actors. Radosevic (1999), however, highlights the clear distinction between technology as information and technology as

knowledge. In this case, knowledge is regarded as a firm-specific asset rooted in the specific organizational context, and is more difficult to transfer than information and techniques that can be easily accessed and taken to other firms. Firms need to develop internal capabilities to be able to succeed in technology transfer (Cohen & Levinthal, 1990; Zahra & George, 2002).

The relational perspective (Dyer & Singh, 1998) focuses even more on interfirm relationships as a competitive advantage for companies. The network literature emphasizes the importance of international opportunities in company success (Oviatt & McDougal, 1994); interorganizational connections foster knowledge and technology transactions. Networks have become vital for all companies, and are extremely important for emerging market companies.

Firms' competitiveness in emerging markets

A weak institutional environment has been recognized in previous studies as a challenge in emerging markets. This has also been a major area of later research on emerging markets (e.g., Peng et al., 2008; Hoskisson et al., 2013). The global economy increasingly offers new opportunities, but also new challenges for emerging market companies. Emerging markets have recently faced strong growth while simultaneously facing major societal changes. Companies have also become increasingly international while facing global competition in their domestic and international markets. The growth and industrial competitiveness in emerging markets is driven by technological change and development that requires companies to improve their innovation performance and productivity. For example, in the case of Russian firms, interfirm coordination is regarded as the most difficult part of the innovation process, which is mostly due to the underdeveloped business environment. However, increasing competition is forcing firms to innovate (Gurkov, 2004).

A successful and efficient innovation process requires the development of internal capabilities. To enhance innovation and access to competitive technologies and knowledge that contributes to increasing the competitiveness of firms in emerging markets, it is also extremely important for them to be involved with firms in global networks. Firms need to be competitive and well managed to be able to access these networks. They also need the capabilities to utilize the opportunities offered by interfirm connections and access to new knowledge and technologies (Fu et al., 2011). Technology transfer is a tool that can offer firms the opportunity to save R&D costs, modernize their production, and access world-class technologies and global networks.

The market situation in emerging markets is clearly different to that in developed markets. Firms have less experience in collaboration and face challenges in improving their overall competitiveness. In the case of Russia, for example, manufacturing firms face major challenges in increasing productivity and exporting their products to competitive markets (Torvinen & Väättä, 2013). In addition, these firms do not seek international R&D cooperation before they have experienced increasing international competition in their home markets (Hinkkanen et al., 2013). Most successful new product development oriented firms seem to employ in-house R&D and collaboration in their strategies. These firms also possess the competences and readiness for international cooperation that, in turn, improves their competitiveness and success in both domestic and foreign markets (Smirnova et al., 2012). The business environment also plays a decisive role for firms and how they can exploit open business models in innovation. In particular, the market dynamics and protection of intellectual property (IP) strongly influences firms to be active in technology transfer activities (Savitskaya & Podmetina, 2013).

Outward investments from emerging economies have increased in recent years. Nowadays, emerging market companies have good opportunities to utilize foreign direct investment (FDI) to acquire strategic resources abroad, which reduces institutional and market constraints set by their home markets, and also to develop and achieve competitive parity (Luo & Tung, 2007; Gammeltoft et al., 2012). However, FDIs from emerging markets are generally made by big multinational enterprises (MNEs). Small firms and firms operating in traditional industries face more problems and generally lack the capabilities to exploit external knowledge and follow open business strategies (Spithoven et al., 2010).

Technology transfer

Technology transfer can improve companies' economic and innovation performance. External technology acquisition (ETA) can help companies to access competitive technologies without vast internal R&D investments. However, through internal R&D, firms are able to develop internal capabilities to find, exploit, and apply external technologies for commercial use. This capability is termed *absorptive capacity* (Cohen & Levinthal, 1990; Zahra & George, 2002). Studies have shown that acquired technological knowledge increases companies' economic outputs (Cohen & Levinthal, 1989; Chatterji, 1996; Henderson & Cockburn, 1996) and innovation outputs (Roberts, 1995; Chatterji, 1996; Lambe & Spekman, 1997; Hagedoorn & Duysters, 2002). Internal R&D and ETA complement each other, and firms succeed better when they combine these two strategies of technology development (Cassiman & Veugelers, 2006; Granstrand et al., 1992; Pavitt, 1990). Thus, technology and innovation management plays a substantial role in the success of firms that need to develop their capabilities (i.e., absorptive, desorptive, and connective) for successful inward and outward technology transfer (Lichtenthaler & Lichtenthaler, 2009). These capabilities create a strong competitive advantage for emerging market firms that aim to improve their competitiveness.

Technology can take different forms, which are difficult to define precisely. Technology can be IP or intangibles, such as software or a design, or embodied in existing products or technical services. It is also difficult to define the distinction between physical products and technology in relation to technical knowledge. Earlier studies refer to markets in a broad sense as, in addition to the typical exchange of money for a good, technology transactions might involve very detailed contracts and different technological alliances. Arora et al. (2004) exclude corporate mergers and acquisitions from their analysis because, in these cases, transactions include existing technologies and also the capabilities and competences to develop new technologies. This research has also followed the above-mentioned limitations and employs these terms in a broad sense.

Turnbull et al. (1996) elaborate that successful companies know their technology portfolio well and understand how their technologies relate to others' requirements. They also highlight that technologies are often the basis of companies' existence although, in themselves, they have no value until they are worth something to another company and are transmitted over a process of interaction between companies. Companies can commercialize their developed technologies. Many companies, especially large firms, even have surplus technologies as a result of R&D that they neither utilize internally nor commercialize. However, technology commercialization faces many challenges. Companies have strategic reasons such as creating competitors and cannibalizing markets, or they see that costs are higher than returns and, thus, it is not efficient for them to commercialize (Arora et al., 2004).

Companies also have to identify the opportunities for external knowledge exploitation that can be challenging and requires prior knowledge. The firm's ability to externally exploit knowledge can be termed *desorptive capacity*. Successful external technology

commercialization (ETC) can offer companies additional revenues from technologies from which they do not otherwise profit (Lichtenthaler & Lichtenthaler, 2009, 2010). In addition to only gaining monetary profits from licensing, companies can operate both ways and also get benefits, for example, from cross-licensing, whereby companies operate in both directions by transferring technologies to gain access to others' external knowledge (Grindley & Teece, 1997).

Companies also need to be able to retain and maintain knowledge from interfirm relationships. This does not necessarily require inward knowledge transfer as, without it, firms can gain access to knowledge within their network. The ability of companies to retain knowledge outside their organizational boundaries can be termed *connective capacity*. This is also affected by prior knowledge that companies have gained through relationships and cooperation (Lichtenthaler & Lichtenthaler, 2009). When companies can attain a central network position and have access to the knowledge of other organizations, they can produce more innovations and improve their performance (Tsai, 2001).

Figure 1 illustrates the factors associated with companies' technology management decisions, including interorganizational cooperation and the moderating role of outward and inward technology transfer, which altogether contribute to the firms' performance and competitiveness via markets for technology. It also connects the elements that Lichtenthaler and Lichtenthaler (2009) have identified to describe external and interfirm capacities required by companies when transferring technologies and connecting to interorganizational networks.

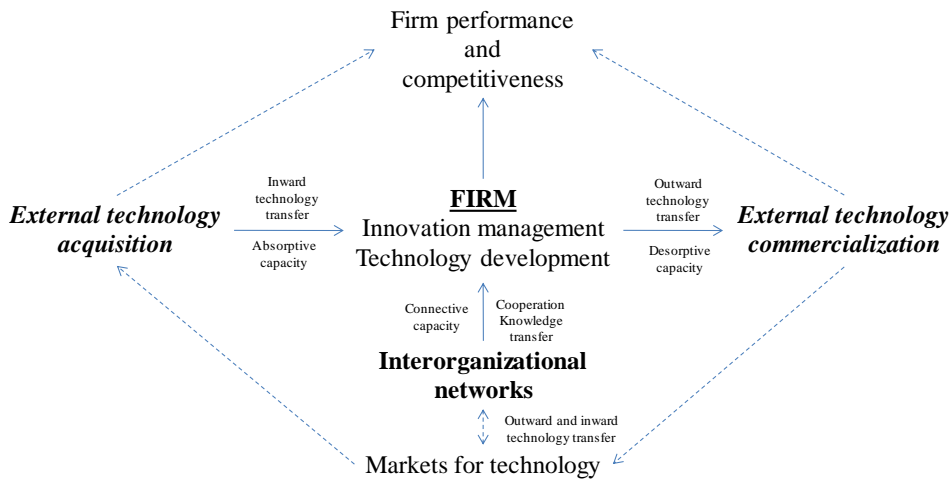


Figure 1. Concepts of technology transfer

Competitiveness can be measured at different levels by different indicators. Buckley et al. (1988), for example, have pointed out several indicators for measuring competitiveness from national to product levels. At the firm level, profitability and the ability to export can be regarded as performance indicators. Cost and price competitiveness, and productivity and technology indicators, measure the potential for competitiveness. Management process indicators, such as ownership advantage, economies of scale and scope, and the level of international business, measure the level of firms' competitiveness (Buckley et al., 1988). A firm's competitiveness is also affected by various factors; especially, its home country network connections and internal capabilities being two of the most important (Yiu et al., 2007). Network connections of firms is an issue that has recently received much research attention. Networking and cooperation vertically and horizontally have positive effects on a firm's performance (Alvarez et al., 2009; Lechner & Dowling, 2003). A suitable network structure and the firm's capabilities enhance its performance (Zaheer & Bell, 2005). Network connections and involvement are critical for learning and building the firm's capabilities.

Domestic rivalry, networks, and the business environment in emerging markets play an important and facilitating role in the international expansion and development of firms (Yiu et al., 2007). International expansion can be also critical for companies to reduce home market constraints (Luo & Tung, 2007). The extent of cooperation and a firm's network position in domestic and international networks affects its performance, capabilities, and future development. Building the firm's capabilities are vital and, to some extent, prerequisites for accessing competitive international networks (Lee et al., 2001; Zaheer & Bell, 2005; Zahra & George, 2002). When discussing competitiveness in this paper, the focus is on the development of a firm's internal capabilities for successful technology transfer and the capability to be involved in developed business networks.

A key factor in building firm competitiveness is the development of production and technology by looking outside the company and national borders; that is, companies need more open business and technology strategies. Emerging market firms can have different ways to advance their technology base: internal R&D, technology transfer, and FDIs. The role of internal R&D is important for companies in emerging markets; it complements technology transfer, from domestic and foreign sources, and helps firms to build their knowledge base and increase productivity. FDIs seem to play a lesser role in facilitating technology transfer (Hu et al., 2005).

For functional interorganizational technology transfer, both commercialization and acquisition is needed to provide effective supply and demand to the markets. These transactions play an important role in fostering innovation. Without the opportunity to benefit from trading developed technologies, many firms would not invest in R&D and create new technologies. Also, many firms might lack the resources to commercialize all of their

developed technologies (Arora et al., 2004). Technology markets have made knowledge and technology more accessible. Many companies can benefit from this, and it can especially help new ventures to launch products more easily into the markets (Arora et al., 2001)

Market intermediaries and public intervention play a large role, and they can support companies ultimately to transfer their technologies (Howells, 2006). However, external intermediaries are a complement rather than a substitute for firms' internal activities. Internal capabilities and competences play a substantial role in the operation of technology markets (Lichtenthaler & Ernst, 2008).

Chesbrough's (2003) Open Innovation concept, also addressing technology transfer, has become widely recognized in recent years. It focuses on a firm acquiring and selling technologies instead of only relying on its own R&D and keeping the technologies in-house. In open innovation, companies seek external sources for technologies when developing and commercializing them. In inbound open innovation, companies monitor the environment for new technologies and knowledge to support their internal R&D. In outbound open innovation, companies also seek external organizations that might be better at commercializing their technologies instead of only commercializing the technologies themselves (Chesbrough, 2003).

Technology transactions have increased, although many industrial companies still face challenges, especially in outward technology transfer due to imperfections in the markets for technology (Lichtenthaler & Ernst, 2008). Transfer and commercialization of technology has proved to be much more complex than the commercialization of products (Arora et al., 2001). Functioning markets for technology and networks are essential for supporting technology transfer. However, ETC is not a default option for companies, especially in emerging markets,

and the demanding business environment with difficult IP protection challenges the market supply for technologies.

Improving firms' performance through interorganizational networks and technology transfer

In addition to technological competitive advantages, many researchers have also perceived a company's ability to develop and manage its networks and relationships as an important source of the firm's competitiveness (Turnbull et al., 1996). The traditional Resource-Based View can also be extended to the competitive advantage gained by networks of interconnected firms (Lavie, 2006). Strategic alliances, cooperation, and partner selection have become increasingly important for emerging market firms. The extant literature suggests that not only a partner's characteristics but also its access to resources and organizational learning opportunities affect partner selection, which help firms to build their capabilities (Hitt et al., 2000). However, the different institutional environment in the case of emerging markets affects the behavior of firms concerning their partner selection (Hitt et al., 2004).

To become more effective, companies need to concentrate on transactions other than their own production, and move their focus from control of resources towards integration of resources. They should also be reactive in their management. However, in networks, an organization's performance becomes dependent on those with which it interacts (Håkansson & Snehota, 1989). Organizations are proven to rely on interdependencies, information from their network, and prior alliances when choosing network partners (Gulati & Gargiulo, 1999). Network advantages are also linked to network partners' resource profiles. Large and innovative high-technology firms, in particular, are by far the most valuable associates in networks (Stuart, 2000).

The importance of network types of organizational form, for example, subcontracting and alliances whereby technology is embedded in interfirm relationships, has been increasing. However, other modes such as FDI and licensing also have not lost their value. Effective technology transfer is not a matter of identifying the best channels, it is the result of a combination of appropriate modes that are highly dependent on the industry, technology, and level of a country's development (Radosevic, 1999). Different organizational arrangements have different requirements, and they also impact performance and interfirm relationships (Hagedoorn, 1990).

Technology transfer can be discussed at different levels; however, ultimately, transactions happen between firms. Companies have to identify and be able to acquire external technologies to complement their own technology efforts (Radosevic, 1999). Knowledge and technology transfer usually refers to a dyadic relationship and exchange of technology between a technology source firm and the technology recipient firm. Prior studies have indicated that the research focus should move from dyadic stakeholder research to studying multiple stakeholders, business networks, and wider structures (Rowley, 1997; Turnbull, et al., 1996; Ritter & Gemünden, 2003).

Figure 2 illustrates how an emerging market firm can move between two different types of market, market environments, and networks. Firms can connect to domestic (i.e., emerging market) networks and international (i.e., developed market) networks where the developed market conducts its networking activities. The connections to developed market networks have proved to be more beneficial for emerging market companies. Technology transfer is regarded as a means to improve a firm's competitiveness and a tool with which to move between these two types of network. As such, both networks also offer vertical and horizontal

connections for the firm. It is beneficial for a company also to collaborate with companies outside its own industry. A prerequisite for network connections are the firm's interfirm capabilities for exploiting external technologies. The improved capabilities can also be regarded as a result of increased cooperation with developed market firms. Successful technology transfer, and access to developed market networks and the value chain's vertical and horizontal connections, increases firms' competitiveness. Figure 2 highlights interfirm connections, but there are also institutions such as universities and research organizations that can also connect to firms. In addition, the market environment and national innovation system play a supporting role for technology transfer.

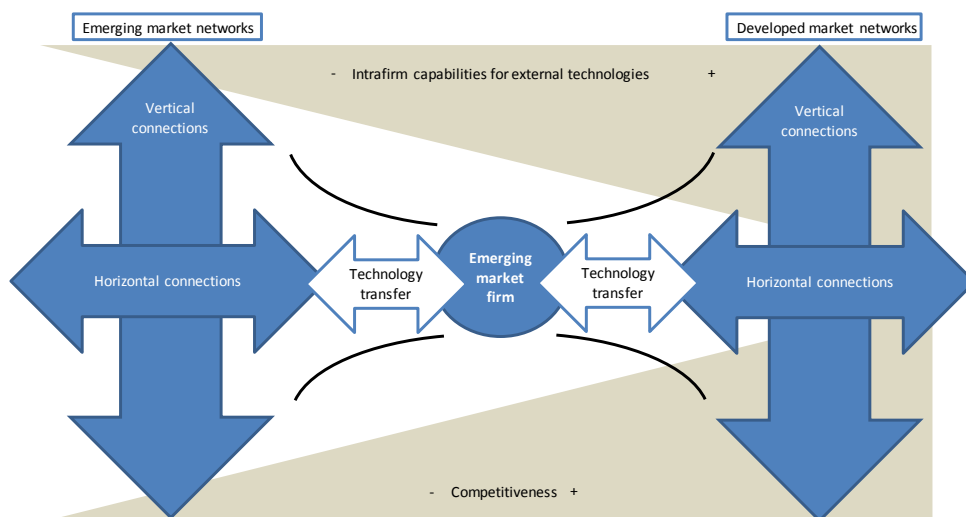


Figure 2. Technology transfer through network connections

The economic growth of nations is linked to successful international transfer of technology (Tece, 1977). There are a small number of industrialized countries that account for most of the creation of new technologies. However, for the majority of countries, foreign technologies account for most of their domestic productivity growth. Technology diffusion is vital for

emerging markets to achieve parity with more developed countries. Receiving technology abroad has a positive effect on a country's total factor productivity. For a country to achieve great growth, it already needs to have a good share of the world's research labor and technologies, and also a high rate of technology diffusion with other countries (Keller, 2004). International trade, joint ventures, and FDIs are considered the major channels for technology diffusion and knowledge spillovers (Keller, 2004; Xu, 2000). It seems that technology transfer contributes to productivity growth in developed countries, but not in the least developed countries. Countries need to have a particular minimum human capital threshold to succeed in technology transfer (Xu, 2000).

Figure 3 illustrates four types of emerging market firm, starting from "low competitiveness" whereby they have not developed internal capabilities for technology transfer. These companies are also involved in less competitive networks and will struggle to compete even in domestic markets. Companies with "medium competitiveness" might have high internal capabilities that make technology transfer possible but lack good and competitive network connections. Alternatively, these companies can also be in the opposite situation whereby they have relatively good international network connections but lack the capabilities to exploit the opportunities offered by technology transfer. Most firms that have progressed to "high competitiveness" are involved in competitive global networks and are able to exploit technology transfer opportunities to increase their competitiveness.

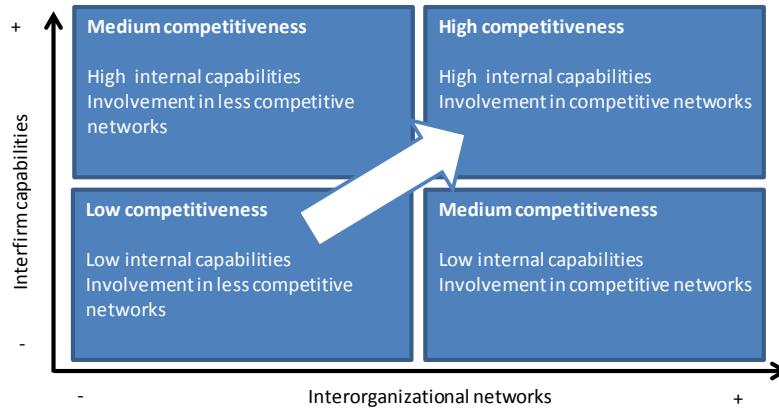


Figure 3. Firms' involvement in networks and internal capabilities for interorganizational technology transfer

DISCUSSION AND AVENUES FOR FUTURE RESEARCH

A country's development and competitiveness very much relates to the success of its manufacturing industries (Porter, 1990). This is important for developed nations, but it is even more important for emerging market firms that try to survive and achieve parity in global markets when global competition is increasing. Firms in emerging markets face great challenges when endeavoring to achieve parity, be more competitive, and reach out from their domestic markets (Torvinen & Väättänen, 2013). The local business environment also challenges companies, especially in the field of innovation when protecting IP (Savitskaya & Podmetina, 2013). Despite the high potential of emerging market firms, for example in Russia, they have generally realized poor innovation outcomes (Hanouz & Prazdnichnykh, 2011). For innovation, access to competitive networks and interfirm technology transfer are efficient ways to modernize production for industries lacking competitiveness. Combined

networking and technology transfer is one of the best ways to improve innovation performance in emerging market firms.

The extant literature supports the present authors' notion that domestic markets and networks have a strong impact on the success and competitiveness of emerging market firms (Yiu et al., 2007). First, emerging market firms have to develop their internal capabilities to learn and exploit opportunities offered by external interfirm connections and technology transfer. This development is challenged by the domestic business environment and institutions (Luo & Tung, 2007; Savitskaya & Podmetina, 2013). By connecting to networks that are more developed, emerging market firms are able to expedite the process of pursuing parity, and further develop their competitiveness and internal capabilities. They also learn by transferring technologies and knowledge from more developed network partners. However, the firms have to be managed well and need to have open business models to gain network position and intrafirm connections to more developed networks. If they succeed in this, they can improve their financial and innovation performance, and better their overall competitiveness (e.g., Zaheer & Bell, 2005).

Dyadic interfirm relations in technology transfer are important for the innovation activities, growth, and development of many companies. Today, companies are increasingly dependent on their network connections, which can also extend horizontally and vertically across multiple networks beyond national borders. However, there is a threshold for emerging market firms to be able to join these more competitive networks with firms from developed markets. Thus, firms need internal capabilities for technology transfer and open business strategies (e.g., Cohen & Levinthal, 1990; Chesbrough, 2003).

Although the emerging market context is still somewhat understudied, this study has discovered that the research on interfirm technology transfer is relatively extensive. The topic of has been widely studied in several research streams based on different approaches (e.g., knowledge-based view, resource-based view, and Open Innovation). However, the authors are confident that the market environment and the challenges and opportunities faced by firms in emerging markets make them behave and strategize differently. Studying these firms will offer new valuable perspectives and future research areas on the topic.

For practitioners, this paper offers valuable insights for technology and innovation management strategies. By examining the recent literature, it shows the benefits of interfirm technology transfer and networking that expands over national, value chain, and firms' borders. In addition, the paper highlights the need to develop internal capabilities for technology transfer. Capability development is also vital for gaining access to competitive networks and commencing collaboration with competitive companies in developed markets.

The conceptual nature of the paper sets some limitations, and further research is needed on the topic. The conceptual model presented in this paper needs to be further tested. Large surveys focusing on emerging market firms and their innovation and technology management offer a good base for quantitative studies, which will shed more light on the topic of technology transfer and its outcomes in emerging market firms. Future studies should especially measure firms' capabilities, domestic and international network connections, collaboration in innovation, the level of technology transfer (i.e. acquisition and commercialization), and the development of financial and innovation performance. Qualitative studies will also identify valuable cases concerning technology transfer capabilities, networking, and management decisions in emerging market firms.

Future research should go deeper into understanding the emerging market environment and whether domestic companies are able to access the most competitive global networks controlled by MNEs from developed markets. For example, while international networks have proved beneficial for participating companies, what are emerging market firms' disadvantages that restrict their access to these networks? Do emerging market firms continue to rely on domestic sources of technologies instead of international networks?

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Publication III

Torvinen, P., Podmetina, D., Hinkkanen, J.J. and Väättänen, J.

External technology acquisition in Russian firms

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External technology acquisition in Russian firms

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Abstract: Few companies today are able to be competitive and sustain their market position by relying solely on their internally developed technologies and R&D. In Russia, as in other emerging markets, companies have to compete not only with local firms, but also with foreign companies, who have more resources and experience. Thus, Russian companies aim to make their innovation processes more effective. External knowledge and technology acquisition has proven to affect positively companies' competitiveness, innovation and financial performance. This study analyses external technology acquisition in Russian firms based on the data from survey of 206 companies conducted in 2009–2010. The results show that companies sourcing, acquiring and implementing external technologies have been able to improve their performance by enhancing new product development and decreasing R&D costs. Furthermore, external technology acquisition helps companies to focus on their core competences, and has a positive effect on companies' competitiveness and market expansion.

Keywords: external technology acquisition; R&D; open innovation; emerging markets; innovation management; new product development; Russia.

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1 Introduction

Few companies today are able to be competitive and sustain their market position by relying solely on their internal resources and research and development (R&D). Thus, external technology acquisition (ETA) has become an important source of innovation for companies (Duysters and Hagedoorn, 2000). In Russia, as in other developing economies, companies have to compete not only with local firms, but also with foreign companies, who have more resources and experience. By studying innovative companies in Russia, we aim to understand whether these companies should produce R&D internally or would they do better by acquiring some knowledge and technologies from external sources and cooperating with external partners on R&D.

ETA and the commercialisation of surplus technologies are essential parts of the open innovation (OI) approach. This approach focuses on strong cooperation with external partners as an opportunity for companies to not be dependent on internal R&D only (Chesbrough, 2003). The theory provides evidence that OI and ETA create additional competitive advantage for the firm, and benefit innovation (Roberts, 1995; Chatterji, 1996; Lambe and Spekman, 1997; Hagedoorn and Duysters, 2002) and economic performance (Cohen and Levinthal, 1989; Chatterji, 1996; Henderson and Cockburn, 1996). At the same time, a company's internal R&D inputs improve the identification and exploitation of external technological knowledge (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Kim, 1999).

Therefore, the strategic choice between closed and open approaches to innovations or a combination of these modes is vital for companies' effective innovation management strategy and for gaining additional competitive advantage. Firms that have a higher level of diversification of innovation strategy are more likely to innovate through acquisition and invest in acquisitions than through internal R&D (Banker et al., 2011).

OI is a relatively young phenomenon and from the ETA perspective, researchers to date have studied acquisition and the exploitation of external technologies and its effects. This knowledge established a link between technology acquisition and the firm's performance but its role in developing economies has yet to be accurately studied. This study contributes to the knowledge of how companies from developing economies, such as Russia, would decide whether to concentrate on developing internal innovation capabilities or to acquire technology from the outside.

Russia has experienced tremendous economic progress over the last years, mainly due to rising energy prices rather than growing industrial output (Hanouz and Prazdnichnykh, 2011). The domestic market has become open and attractive to foreign imports and

foreign direct investments, which offer price and quality competitive products for the Russian markets (Hanouz and Prazdnichnykh, 2011; Trifilova, 2009; Valdaytsev and Sergeyev, 2011). Local companies need to meet these rising requirements by increasing their competitiveness, which can be achieved through innovation, R&D and improving the performance of internal R&D by acquiring technologies. Technology and innovation development are the key issues for competitiveness, market share increase, and productivity growth in Russian companies (Dirks and Keeling, 2009; Valdaytsev and Sergeyev, 2011). According to Lee et al. (2009), several factors (e.g., companies' capability, strategy, technology, market, and environment) affect the ETA strategy's selection, adoption and implementation. Based on this, we can assume that existing stronger market and environment turbulence in Russia will affect the companies' decision on acquiring external technologies.

The research aims to analyse the motives and capabilities affecting companies' choice of ETA against internal R&D in Russian companies, and the effect of this choice on the companies' innovation and economic output and competitiveness. We base our findings on a survey of 206 Russian firms conducted in 2009–2010.

The results show that companies acquiring external technologies increase their economic performance, new product development (NPD) and decrease R&D costs. Furthermore, our findings illustrate how technology acquisition further helps companies to focus on their core competences.

The paper is structured as follows: Section 2 studies the previous literature related to technology acquisitions and the current situation in Russia. Section 3 explains the research design and Section 4 presents the results and includes discussion. Section 5 concludes the study and discusses ideas for further research.

2 Literature review and research propositions

ETA is a method of innovation (Duysters and Hagedoorn, 2000) where external sources of knowledge can be implemented at each stage of the innovation process (Cohen and Levinthal, 1990): from the idea and product development stages to commercialisation.

Companies' strategic resources and capabilities determining the competitive advantage and success are studied within the resource-based view (RBV) framework (Barney, 1991; Penrose, 1959; Wernerfelt, 1984; Conner, 1991). The issue is discussed further in the knowledge-based view (KBV), which builds on the RBV and implies that the most significant, strategically important resource of a company is its organisational knowledge (Kogut and Zander, 1992; Grant, 1996; Spender, 1996). Developing an internationally comprehensive technology strategy and evaluating the performance of product and process technologies have become vital for companies (Hayes et al., 1988). Companies have limited resources, and not all technologies can be developed in-house (Chesbrough, 2003), therefore, in addition to traditional internal R&D investments, companies can source technologies elsewhere and thus expand their technological knowledge for innovation, and for developing new products and processes. The use of external knowledge has become a necessity to optimise internal R&D processes.

Sullivan and Marvel (2011) suggest that acquiring technology and knowledge is positively related to the innovativeness of products or services. Companies can develop their innovation capability by using external knowledge and technologies. When companies increasingly use the knowledge acquired from external sources to develop

their capabilities, their ability to adopt knowledge to capabilities becomes vital (Lane and Lubatkin, 1998). Consequently, realised capabilities are likely to have an effect on firm performance, especially through product and process innovation (Zahra and George, 2002; Tsai et al., 2011). In addition, Tsai et al. (2011) have also found that R&D inputs increase the effect of ETA on product innovativeness. A study carried out in Russian companies has shown that sufficient internal R&D is a pre-condition for ETA (Podmetina et al., 2011). Thus, even if we assume that internal R&D will affect company's decision on acquiring external technologies, we also suspect that the ETA will have an effect on increasing the internal R&D capability of the firm and formulate our first research proposition as follow:

Research Proposition 1 Technology acquisition has a positive effect on a firm's internal R&D and NPD.

Cassiman and Veugelers (2006) explain that internal R&D and ETA are complements, rather than supplements, and innovating firms perform better when they combine internal R&D and technology acquisition: this decision has considerable consequences for the future success of a company (Pavitt, 1990). The combination of internal R&D and technology acquired from outside is important for companies from developing economies, when they need to catch up with local and foreign competitors. Technology-oriented companies in Russia cannot succeed with internal R&D only (Filippov, 2010), which is why acquiring knowledge is essential, especially for high-technology companies (Yli-Renko et al., 2001). Thus, in previous research we have seen evidence that in Russia, high-technology companies are more active in ETA (Podmetina et al., 2011) and in this paper we aim to elaborate on the idea of different ETA intensities between high-technology and low-technology companies. The second research proposition is as follow:

Research Proposition 2 More high-technology-oriented companies will tend to acquire external technologies more often than low-technology companies.

Innovation management literature shows that the closed approach to innovation does not fit with today's fast changing competitive environment (Chesbrough, 2003; Gassmann et al., 2010) but knowledge-based activities are the basis of sustainable competitive advantage in today's economy (Van Gils and Zwart, 2004). Companies can achieve competitive advantage and cost savings by outsourcing technology development to external partners, if they have established trust in partnership (Fernandez and Kekale, 2007) and they possess the organisational capacity to manage relationships effectively (Lintukangas, 2011). Supplier management strategies and working relationships with suppliers may also provide a significant opportunity for companies to develop a strategic source of efficiency and to enhance global competitive advantages (Loppacher et al., 2011). Cooperation on innovation can improve the competitive position and minimise the risk (Kirchmann, 1994). In order to succeed and grow, an organisation has to maintain a technological edge in the competitive global business environment. This can be accomplished either through technological innovation or through technology acquisition and adaptation (Osman-Gani, 1999). We learned that competitive advantage of the firm can be increased by improving internal R&D, by acquiring external technology or by a combination of both strategies. Our next research proposition is presented below:

Research Proposition 3 Companies acquiring external technology have a relatively higher competitive advantage than companies concentrating only on internal R&D improvement.

Acquired technological knowledge increases the company's economic outputs (Cohen and Levinthal, 1989; Chatterji, 1996; Henderson and Cockburn, 1996) and innovation outputs (Roberts, 1995; Chatterji, 1996; Lambe and Spekman, 1997; Hagedoorn and Duysters, 2002). Furthermore, a company's internal R&D inputs improve the identification and use of external technological knowledge (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Kim, 1999). It has also been demonstrated that knowledge acquisition strategies showing high intensity and combining complementary and supplementary knowledge have been linked to higher company performance (Friesl, 2012).

The studies on technology acquisition and company performance vary, however, and they often use different and limited variables. Many studies focus on the relationship between company performance and external technologies, and they present contradicting associations between these factors (Zahra, 1996; Jones et al., 2001). Some studies show that an external reliance on product and process technologies has a negative effect on the company's success and performance (Lancot and Swan, 2000; Pavitt, 1990). Tsai and Wang (2008) imply that ETA does not provide a significant contribution to company performance; however, the positive impact of technology acquisition on company performance increases with the level of internal R&D inputs. This means that it is not advantageous to completely rely on ETA to substitute for internal R&D. Technology acquisition should be just a means to increase and support the internal development capability of the company. In spite of this, we formulate our next research proposition in a traditional way for this subject:

Research Proposition 4a ETA has a positive effect on the economic and innovation outputs of the firm.

Malecki (2011) has studied R&D strategies and networks and suggests that there is a clear simultaneous need for local and global, as well as internal and external, knowledge integration in companies. A recent study of Russian firms shows that there are differences in inter-firm local and international collaboration regarding the firm's NPD strategies, type of product innovations, and strategic aims (Smirnova et al., 2012). Trifilova (2009), and Trifilova et al. (2013) have also studied the collaboration of R&D organisations and the erosion of the 'closed innovation' paradigm in the Russian R&D system, but the study still proves that Russian innovative firms rarely consider internationally-oriented strategies. Instead of joining global R&D networks, the companies prefer to stay in the domestic markets, which are characterised by low investments and low demand.

Russian companies need to realise that they will lose their market position even in domestic markets if they do not introduce radical technological product and process innovations (Dirks and Keeling, 2009; Valdaytsev and Sergeev, 2011), which are more likely to be achieved in international cooperation (Smirnova et al., 2012).

Russian companies differ in many ways compared to the companies in other emerging markets due to the country's history and specific path of company formation after the breakdown of the Soviet Union (Väättänen, 2008). Access to foreign technology has

been found to be an important driver for the internationalisation of Russian multinational companies (Väättänen et al., 2009). It has also been noted that advanced technology is essential for profitability, especially when many state-owned and corporate R&D centres have lost their know-how (Väättänen, 2008). High-technology Russian companies with international experience more often acquire external technology (Podmetina et al., 2011). We consider that cooperation experience with external partners (local and foreign) when searching for and acquiring technology will positively affect a company's market expansion strategy (both local and international) and state our next research proposition as follow:

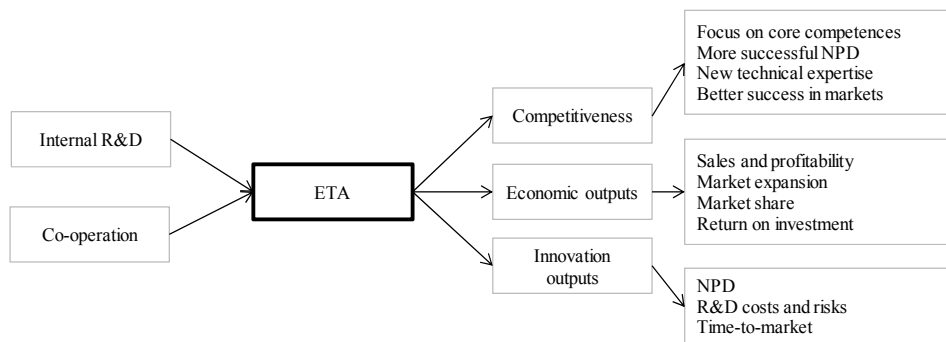
Research Proposition 4b ETA has a positive effect on the market expansion strategy of Russian companies.

Companies with an open approach to innovation aim to decrease fixed costs, share risks (Gassmann and Enkel, 2004), enhance their NPD, and minimise their time-to-market (Lambe and Spekman, 1997). Earlier research has shown contradicting results that cooperation on innovation can minimise the risks, but time used for development can increase it (Kirchmann, 1994). In spite of the fact that ETA may also have negative effect on companies' internal R&D investments and R&D intensity (Hitt et al., 1991), we assume that the overall effect will be positive. In our final research proposition, we aim to examine ETAs effect on the R&D risks and new product time-to-market:

Research Proposition 5 Technology acquisition is associated with a decrease in R&D risks, as well as in the product time-to-market.

In this study, we aim to identify how the use and acquisition of external technologies affects the competitiveness, economic outputs, and innovation outputs of Russian firms. Figure 1 shows the research design of the study. We study the relationship between internal R&D, R&D intensity and companies' decision to acquire external technologies (RP1 and RP2). We compare the effect of ETA on economic and innovation outputs for those companies cooperating on R&D with external partners and those that are not (RP3 and RP4). We also evaluate the effect of ETA on competitiveness (RP3), economic performance, and market expansion (RP4a and RP4b), and innovation output by decreasing R&D risks and product time-to-market (RP5).

Figure 1 Research design



3 Data and methodology

The data collection was conducted between November 2009 and February 2010. Two-hundred and six Russian companies from various industries participated in the structured interviews. The key respondents were representatives of the innovation department or top management of the firm. The sampling method was based on the stratified sample approach, which means not a representative, but a meaningful structure of the sample. A number of criteria (strata) were applied: the region, industry and annual revenue of the company. The initial sample was 1,000 companies, from which 206 interviews were granted.

The questionnaire consisted of 110 questions (some questions included two or more sub-questions). The questionnaire structure was developed according to the recommendations for conducting innovation surveys (Frascati Manual, 1993; Oslo Manual, 2007). The average age of the companies in the sample was 27 years, with the year of foundation varying from 1720 to 2009. There are mostly large companies in the sample: more than 44% of firms have more than 500 employees. The industrial distribution is as follows: electronics and optics equipment (18.5%), metallurgy (17.5%), machine building (13.6%), IT and telecommunications (10.2%), chemical industry (10.2%), electronic equipment (7.3%), oil industry (5.3%), rubber and plastic industry (3.9%), aircraft (3.9%), and other industries (9.6%). The study is descriptive by nature; as a primary method it applies the analysis of different indicators by cross-tabulation. As secondary method we apply the analysis of variance (ANOVA) model in order to explain the research propositions and to study differences between the analysed groups. The main indicators are presented in Appendix (dummy variables, Likert-scale variables and descriptive indicators).

We use descriptive analysis to capture the environment when and how companies use ETA. This method is also used to describe the benefits of ETA (supporting RP1, RP3, RP4a, RP5). We use the ANOVA to highlight the role of collaboration and ETA and how they result in increasing the company's economic performance and enhancing innovation processes (support for RP3, RP4a, RP4b, and RP5). We also use the cross-tabulation of companies' internal R&D or R&D intensity (technology orientation) to see which kind of technology strategies companies use and to which extent (supporting RP2).

4 Findings and discussion

The data sample mainly consists of innovative companies: 78.6% of firms develop R&D internally, more than half of them do it systematically. The self-assessed economic situation can be characterised as stable: only 1.9% assessed their economic situation as 'near bankruptcy', 10.7% as 'bad'. However, 53.4% assessed their situation as 'satisfactory', 28.6% as 'good', and 3.9% as 'excellent'. A significantly large part of sample (45.5%) conducts R&D internally in volumes enough for their own use. These firms can be characterised as self-sufficient in terms of innovation. However, a majority of the companies have a need for external technologies.

This research aims to analyse the motives and capabilities (Lee et al., 2009; Banker et al., 2011) affecting Russian companies' choice of ETA against internal R&D and its effect on the companies' innovation and economic outputs.

The intensity of ETA for the companies in the research sample varies from single cases (seldom ETA) to open business model (search, acquisition and use of external technologies as part of the business model) (see v2, Appendix). One third of firms (about 30%) reported acquiring technologies, innovations, intellectual property (IPR), and patents and 82.3% of them did it often, while the rest reported doing it seldom (see v1, Appendix).

4.1 Motives and constraints for ETA

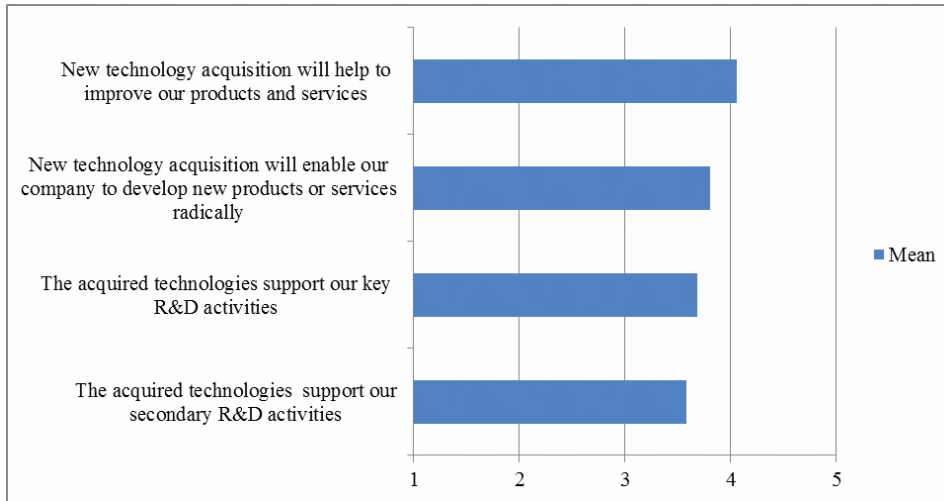
The surveyed companies which follow a closed approach to innovation indicated the following reasons not to outsource R&D and not to acquire technology externally (see v9, Appendix): fear of losing control over its innovation process (2.7%), risk of trusting partners and inter-firm negative perception towards technologies produced outside the firm (18.4%) – the so-called ‘Not invented here’ phenomena. Other reasons for not outsourcing are: the adaptation of external technologies consumes too many resources (28.6%); the search for new technologies consumes too much time (21.8%); and there was no supply for the needed technologies (28.6%). Companies need to overcome these constraints when implementing an OI approach (Chesbrough, 2003) and when deciding on external technology search and acquisition.

We found *three main motives* pushing companies towards the search and acquisition of external technology (see v4, Appendix). First is technology turbulence; when technologies and products are rapidly changing, companies try to diversify their technology portfolio in order to keep it relevant and current. When time is limited, companies prefer to acquire technology rather than to develop internally.

Second, *cooperation with external partners* motivates companies to externalise and acquire external technology. Thus, when firms have joint R&D projects with other companies, they more likely decide on using external technology, because in this case, the possible risks of the ‘not invented here’ syndrome are overcome and trust in technology developed together with the partner is higher.

The third motive is *market turbulence* – when the competitive environment is rapidly changing, companies have to react quickly to these changes and find the optimal way of acquiring new technology, which often means acquisition from the outside due to a lack of time and other resources.

ETA supports the companies’ NPD and R&D (Figure 2). These indicators were measured with a Likert attitude scale from 1 to 5 (1 = not agree, 5 = absolutely agree) (see v5, Appendix). The ETA supports incremental product innovations rather than the radical ones, but the difference between evaluations is not statistically significant. The expected effect of ETA on companies’ NPD is relatively higher than on R&D in general. These preliminary findings support RP 1, stating that “Technology acquisition has a positive effect on a firm’s internal R&D and new product development”.

Figure 2 Aims of ETA (see online version for colours)

Note: Likert scale 1 to 5, 1 = not agree, 5 = absolutely agree.

4.2 Intensity and channels of ETA

The intensity of ETA can be also weighed as a share of the company's need for technology, with the need itself being 100% (see v3, Appendix). The majority of the sample (over 50% of companies) follows a *low ETA intensity* strategy (less than 25% of total need in technology). Companies with a low ETA intensity also follow a low risk approach to diversifying their technology portfolio. R&D is an important strategic resource for the firms, especially in emerging economies, where competition is fierce, trust in partners low and turbulence high. It is natural that companies prefer not to outsource a significant part of their R&D process to potential competitors. In contrast, 12.7% of the firms follow a *medium ETA intensity* (25–50%) strategy and only 10.8% of firms pursue a *high ETA intensity strategy* (over 50 %).

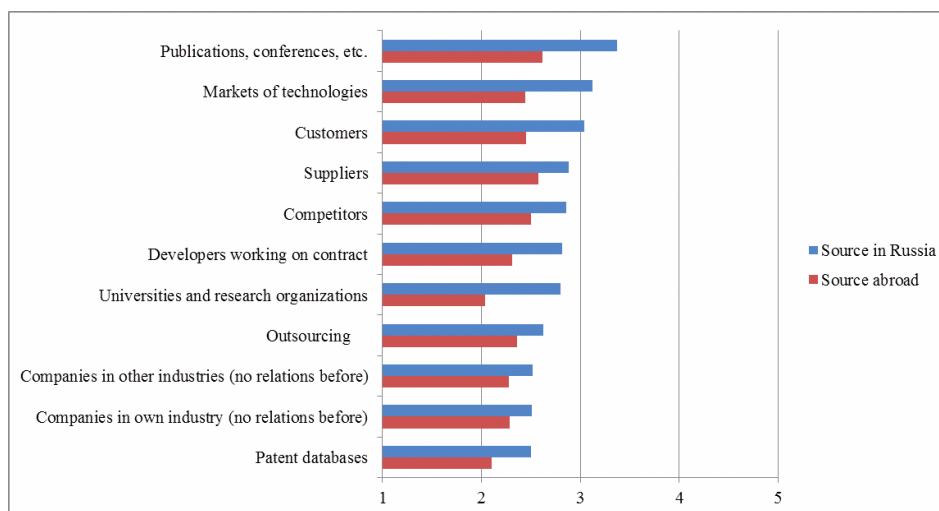
The most common channels for ETA (see v7, Appendix) are: direct technology acquisitions, including IPR (29.9%); licensing (27.4%) and, patents (14.6%). The external sources for ETA include (see v6, Appendix) domestic and international core stakeholders, markets and events, as well as research organisations and knowledge stores, such as patent databases (Figure 3). The indicators are measured with a Likert scale from 1 to 5. The statistical tests do not reveal the significant variance between the groups of sources of ETA, but at the same time, the difference in the intensity of involvement in Russia and abroad is significant.

Russian companies tend to source for external technologies on the domestic market and from domestic stakeholders. The most common domestic technologies (with a score over 3) are sourced from conferences, publications, technology markets and from customers. The latter represents user-driven innovation when the customer is often a first user who participates actively in the development of new technologies. The role of core domestic stakeholders is significant: suppliers, competitors, developers, universities and research organisations provide companies with new knowledge and technologies. Interestingly, the intensity of involvement companies, with whom the firm has never

cooperated before, is much lower. In addition, searching for new technology from patent databases is not very popular among high-technology-oriented Russian firms.

The lower involvement intensity of international knowledge sources is explained by the fact that companies do not have much international experience (the most experienced Russian players have been operating on the international market for only approximately 20 years), and tend to cooperate more with domestic partners due to high cultural and language barriers. The most common international sources of knowledge are suppliers, and customers, and, surprisingly, new partners. We encounter the pull effect here, when companies are 'invited' to cooperate by their foreign partners. Again, when firms cooperate with other companies, they more likely decide on using external technology, because, the possible risks of 'Not invented here' syndrome are overcome and their trust in technology developed together with their partner is higher.

Figure 3 Sources of external technologies in Russia and abroad (see online version for colours)



Note: Likert scale 1 to 5, 1 = the least important, 5 = the most important.

4.3 ETA and economic and innovation performance

Based on the theoretical findings, we expect a significant positive effect of ETA on companies' performance. In fact, 30% of the companies reported that their NPD had been enhanced through ETA (Figure 4) (see v8, Appendix). The positive effect is also observed through decreases in R&D costs and time-to-market, in the development of radical new products, and economic performance. These results support RP1: internal R&D and NPD improved; and RP4a: the effect on economic and innovation performance; and RP5: decrease risks and time-to-market.

To get a better understanding of the effect of ETA on a company's innovation output, we conducted an ANOVA between the levels of ETA in the groups collaborating with a different partner on R&D (ANOVA) (see v12, Appendix). Regardless of the type of partnership, we see the significance of ETA on innovation output measures (Table 1). ETA has the largest effects on core competences, NPD and decreasing R&D risks. In addition, the companies benefit from new knowledge and expertise through collaboration.

ETA also allows them to access new markets more successfully. These results provide the support for RP1 and RP3.

A comparison of firms with and without ETA cooperating with external partners on R&D reveals that firms with ETA have more successful new products, more new knowledge, and access to technical expertise, new markets and new clients. This supports also our proposition 4b: ETA has a positive effect on market expansion of the firm. The effect of lower R&D risks is also achieved as proposed in RP5.

Figure 4 The impact of technology acquisition on the company performance (% of answers) (see online version for colours)

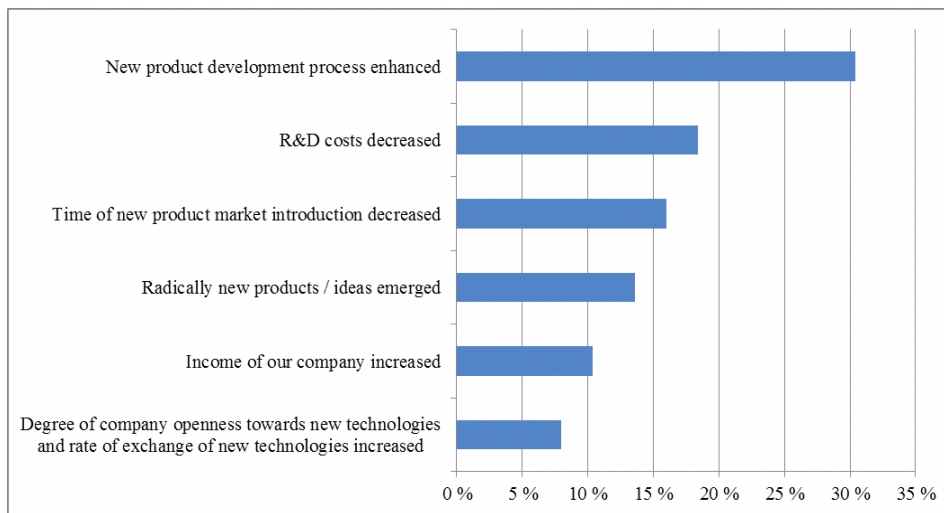


Table 1 Results of ANOVA between collaboration with R&D partners and ETA

	<i>Sig.</i>
Opportunity to concentrate on our core competences	0.000
More successful product development	0.001
Decreasing R&D risks	0.001
New knowledge	0.002
Access to new technical expertise	0.012
Access to new markets and clients	0.028
Higher guarantees for success on the market	0.272

The externalisation of the innovation process should positively affect the economic and innovative performance of the firm because firms tend to acquire external technologies when aiming to decrease costs, improve innovation, and achieve higher sales on wider markets in the long run (aims of ETA, Figure 2). Table 2 illustrates the results of the ANOVA analysis of differences in output indicators between firms with and without ETA (see v1 and v13, Appendix).

The results support RP3: ETA can increase the competitive advantage of companies. All output measures are significantly better for firms with ETA compared to their competitors. RP4a (ETA has a positive effect on the economic output of the firm) is also

supported (see Table 2). Companies with ETA show better sales growth and profitability, return-on-investment, and market share increase. The number of successful new products taken to the market is also improved and product time-to-market decreased.

Table 2 The economic and innovation output and ETA

<i>Changes in the company for the last three years</i>	<i>ETA in comparison with the objectives set</i>	<i>ETA in comparison with the main competitors</i>
	<i>Sig.</i>	<i>Sig.</i>
Sales growth	0.001	0.004
Sales profitability	0.003	0.006
Business profitability	0.012	0.001
Relative market share increase in comparison with the competitors	0.035	0.029
Return on investment (ROI)	0.062	0
Market share increase	0.074	0.105
Time needed for launching new products	0.085	0.009
Launching new products to the market	0.117	0.003
The number of successful new products	0.254	0.039

4.4 ETA strategies for high-technology and low-technology firms

The role of internal R&D experience is assumed to be significant for ETA (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Kim, 1999), hence its effect is unclear. We classify companies to clusters specified by internal R&D and ETA indicators (Table 3) (see v10 and v1, Appendix). Companies are divided into the following four clusters: concentration on internal R&D (closed innovation approach) (54%); combination of internal R&D and ETA (26.7%); no internal R&D, but ETA (4.5%); and no internal R&D, no ETA (14.8%).

Table 3 Clusters of companies

<i>Internal R&D</i>		<i>External technology acquisition</i>		<i>Total</i>
		<i>Yes</i>	<i>No</i>	
Yes	Count	47	95	142
	% of total	26.7%	54.0%	80.7%
No	Count	8	26	34
	% of total	4.5%	14.8%	19.3%
Total	Count	55	121	
	% of total	31.2%	68.8%	

For our research objectives, we analyse only the first three strategies (Table 3). We can thus claim some initial support for RP2: companies with higher R&D intensity will more often acquire external technologies than those with low R&D intensity.

We apply OECD taxonomy to technology orientation (2012) which defines the high-technology industry in terms of their R&D intensity (R&D / Turnover) > 5%;

medium high-technology industries – R&D intensity < 5% but > 3%; medium low-technology industries – R&D intensity < 3% but > 0.9%; low-technology industries – R&D intensity < 0.9%. In our questionnaire, we have a lower limit for R&D intensity at the level of 1.5, thus, we modified the classification due to our data collection specifics (Table 4).

Table 4 Technology orientation of companies

<i>R&D intensity</i>	<i>Count</i>	<i>% of total</i>
Low-technology industries	38	21.6%
Medium low-technology industries	68	38.6%
Medium high-technology industries	27	15.3%
High-technology industries	43	24.4%
Total	176	100%

High-technology-oriented companies generally invest more on internal R&D activities compared to medium and low-technology firms. Previous studies have proved that these companies have a higher readiness to exploit external technologies more effectively (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Kim, 1999). To understand the nature of the relationship between technology orientation and technology acquisition, we apply the selected clusters (Table 3) and classification (Table 4), so we add the layer to our strategy matrix, which shows us the distribution of companies with different R&D/ETA strategies based on their R&D intensity (Table 5) (see v11, Appendix).

The analysed companies with a low-technology orientation mostly follow a closed approach to innovations; they rely on internal R&D (over 60%). Considering ETA, these firms can equally pursue two strategies: diversification of innovations – OI (internal R&D and ETA) and outsourcing (only ETA). Most of the medium low-technology companies have a closed innovation approach (only internal R&D – 68.4%), but at the same time, the share of companies with an OI strategy has increased to 28.1%. Medium high-technology firms equally often apply a closed or OI approach – 52.2% and 47.7% respectively. However, the most interesting result we observe for high-technology companies, which again turn towards a more closed innovation approach.

Table 5 Technology orientation, R&D intensity and ETA strategies

<i>R&D intensity</i>		<i>Open innovation internal R&D and ETA</i>	<i>Closed innovation only internal R&D</i>	<i>Outsourcing only ETA</i>	<i>Total</i>
Low technology	Count	6	18	5	29
	% of total	20.7%	62.1%	17.2%	100%
Medium low technology	Count	16	39	2	57
	% of total	28.1%	68.4%	3.5%	100%
Medium high technology	Count	11	12	0	23
	% of total	47.8%	52.2%	0.0%	100%
High technology	Count	14	26	1	41
	% of total	34.1%	63.4%	2.4%	100%

Companies balance the spending on R&D between internal and external activities in order to minimise risks. When the R&D intensity exceeds 5% in the case of high-technology companies, the share of companies with ETA starts decreasing. The phenomenon is explained by the stronger company policies on IPR rights (IPR) when companies are developers of unique technologies and management has concerns about losing control over the innovation process. These companies tend to decrease the risks of managerial control loss, and balance spending on R&D.

These results provide partial support for RP2: companies with higher R&D intensity will more often acquire external technologies than those with low R&D intensity, until their R&D intensity achieves the minimum of 5% (high technology). Then, the share ETA starts to decrease. Table 6 summarises our findings and support related to our research propositions.

Table 6 Summary of the findings

<i>Research proposition</i>	<i>Support</i>
<i>Research Proposition 1: Technology acquisition has a positive effect on a firm's internal R&D and new product development</i>	<ul style="list-style-type: none"> • NPD process enched • R&D costs and risks decreased • Openness towards new technologies and exchange of technologies increased
<i>Research Proposition 2: More high-technology-oriented companies will tend to acquire external technologies more often, than low-technology companies</i>	<ul style="list-style-type: none"> • Companies with higher R&D intensity will more often acquire external technologies than those with low R&D intensity, however; when their R&D intensity achieves the 5% (high technology), then, the share ETA starts to decrease and companies again use more internal R&D and own technologies
<i>Research Proposition 3: Companies, acquiring external technology have a relatively higher competitive advantage than companies concentrating only on internal R&D improvement</i>	<ul style="list-style-type: none"> • Better economic and innovation output compared to competitors • Better access to technical expertise • Higher guarantees for markets success
<i>Research Proposition 4a: External technology acquisition has a positive effect on the economic and innovation outputs of the firm</i>	<ul style="list-style-type: none"> • Better economic and innovation output compared to competitors • Radically new products/ideas emerged • Economic output increased
<i>Research Proposition 4b: External technology acquisition has a positive effect on the market expansion strategy of Russian companies</i>	<ul style="list-style-type: none"> • Better access to new markets and clients • Market share increased • Launching successful new products to the markets
<i>Research Proposition 5: Technology acquisition is associated with a decrease in R&D risks, as well as in the product time-to-market</i>	<ul style="list-style-type: none"> • R&D costs and risks decreased • Product time-to-market decreased

5 Conclusions

This paper analysed the motives and capabilities affecting Russian companies' choice to search for and acquire external technology, and the ETA effect on the companies' innovation and economic outputs. This issue has not yet been sufficiently studied in the Russian context, where the innovation environment has proven to be very challenging (Chadee and Roxas, 2013; Trifilova et al., 2013). Russian companies need to increase their innovativeness when targeting growth and competitiveness on both domestic and international markets. In contrast, Russian companies will increasingly face tougher competition in the future from foreign imports and foreign direct investments (Dirks and Keeling, 2009; Valdaytsev and Sergeyev, 2011), even on the domestic market.

The outcome of this research illustrates Russian companies on their way to becoming more competitive by exploiting external technologies. We found *three main motives* pushing companies towards the search for and the acquisition of external technology: *technology turbulence, market turbulence* (Savitskaya and Podmetina, 2013), and *cooperation with external partners* (Smirnova et al., 2012). The intensity of ETA for companies in the research sample varies from single cases to the open business model. One third of Russian firms (about 30%) reported acquiring technologies, innovations, IPR, and patents, which supports the previous findings (Podmetina et al., 2011). The results of the previous studies have already indicated significant differences between industry clusters (high, medium, and low-technology companies) when discussing open business models. Sufficient internal R&D and technology acquisition is a precondition for implementing OI business models in Russian companies. There is also clear evidence that companies with international operations use OI business models more actively both for technology acquisition and technology commercialisation (Podmetina et al., 2011).

Our findings show that the companies which invested more in internal R&D are more active in acquiring external technologies. Our results provide partial support for our proposition *that companies with higher R&D intensity will more often acquire external technologies than those with low R&D intensity*. This is true until their R&D intensity achieves the minimum of 5% (high technology). Then, the share ETA starts to decrease because the risks also increase. These high-technology companies also have better readiness for internal R&D. The ETA strategies of Russian companies still seem to be more domestically oriented rather than international, and the companies rely more on domestic sources when searching for external technologies. Licenses and patents seem to be what Russian companies acquire the most.

External partners and collaboration play an important role in product innovation and NPD strategies. The Russian economy is also challenging for companies for building successful and mutually beneficial partnerships but still, companies have indicated to have a certain readiness and ambitions for building multi-stakeholder collaboration (Smirnova et al., 2012). Russian firms have well-educated employees and specialists in business and research, and potentially are an excellent source for innovation and R&D. However, the innovation output is still weak in Russia (e.g., Valdaytsev and Sergeyev, 2011). Therefore, acquired technological knowledge increases the company's economic (Cohen and Levinthal, 1989; Chatterji, 1996; Henderson and Cockburn, 1996) and innovation outputs (Roberts, 1995; Chatterji, 1996; Lambe and Spekman, 1997; Hagedoorn and Duysters, 2002). The externalisation of the innovation process affects the economic and innovative performance of the firm.

We found that the expected effect of ETA on companies' NPD is relatively higher than on R&D in general. Based on the theoretical findings mentioned above, we expect a significant positive effect of ETA on companies' performance. In fact, 30% of the companies reported that their NPD had been enhanced through ETA. Our research shows that technology acquisition has a positive effect on companies' NPD processes. The positive effect is observed through decreases in R&D costs and time-to-market, and in the development of radical new products and economic performance. Furthermore, ETA supports internal R&D and reduces its risks. Companies feel that they can get new knowledge and expertise through collaboration and ETA, which contributes to accessing new technologies and markets more successfully. The results also support our proposition that *ETA can increase the competitive advantage of companies*. All output measures are significantly better for firms with ETA compared to their competitors.

The results of this study offer insights for academics and business practitioners. These results support the view that companies, especially those from emerging markets, can improve their innovation processes by becoming more open to new technologies, business models which rely more on cooperation, and exchange technologies and knowledge. ETA supports companies' growth in many ways. It seems to enhance the market expansion, competitiveness, innovation, and economic performance of companies. It has a positive effect especially on companies' NPD processes.

However, this study has its limitations. It is descriptive by nature and it does not offer an in-depth analysis on the effects of ETA; in contrast, it describes well how Russian companies see ETA affecting their business generally. This study is also limited to study only Russian companies. The results and limitations of this study also raise questions for further research. Are Russian companies becoming more international and moving towards more open business models and strategies? How effective is technology acquisition as an innovation method for emerging market companies to narrow the innovation gap to that of more developed nations? Why do high-technology companies rely more on internal R&D than companies with lower R&D intensity? These questions require more detailed analyses on the behaviour of Russian companies and concern companies in all emerging markets. All in all, we are confident that our paper helps to understand the concept and role of technology acquisition in Russian firms, and ties it together with existing theoretical literature.

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Appendix

List of variables and measurement

Variable	Measurement
<i>External technology acquisition</i>	
v1. ETA	Does the company acquire technologies, innovations, intellectual property, and patents? <i>ETA dummy variable: yes/no</i>
v2. Intensity of ETA	To what extent do your company's innovation activities correspond to the following options? <ul style="list-style-type: none"> • Self-sufficient • External technologies needed sometimes • ETA is part of the business model
v3. Share of ETA	Estimate the approximate share of acquired technologies (company need in technology is 100%) <ul style="list-style-type: none"> • Less than 5% • Less than 10% • 10–25% • 25–50% • More than 50% • 100%
v4. Motives for ETA	In which case does the company seek/acquire external technologies <ul style="list-style-type: none"> • When competitive environment is rapidly changing • When technologies and products are rapidly changing • When price factor is decisive • In joint R&D projects with other companies • In joint R&D projects with research institutions
v5. Goals for ETA	What are the company's goals in searching for and acquiring technologies? (Likert scale 1 – not agree, 5 – absolutely agree) <ul style="list-style-type: none"> • New technologies acquisition will enable our company to develop radically new products or services • New technologies acquisition will help to improve our products and services • Acquired technologies support our key R&D activities • Acquired technologies support our secondary R&D activities
v6. Type of ETA	What types of external resources (either in Russia or abroad) does the company use to search for new technologies? (Likert scale 1 – least important, 5 – the most important, in Russia, abroad) <ul style="list-style-type: none"> • Competitors • Suppliers • Customers • Developers working on contract • Outsourcing • Companies in other industries • Universities and research organisations • Patent databases • Markets of technologies • Publications, conferences, etc. • Companies in same industry

Note: ¹OECD (2012) classification of technology orientation based on R&D intensity.

List of variables and measurement (continued)

<i>Variable</i>	<i>Measurement</i>
<i>External technology acquisition</i>	
v7. Methods of ETA	How does the company acquire third-party technologies? <ul style="list-style-type: none"> • Direct ETA • Patents • Licensing
v8. Impact of ETA	What has been the impact of technology acquisition on the performance of the company? <ul style="list-style-type: none"> • R&D costs decreased • NPD process enhanced • Openness towards new technologies and rate of exchange of new technologies increased • Time of new product market introduction decreased • Radically new products/idea emerged • Income of the company increased • Openness toward the collaborations with other technology developers increased
v9. Difficulties of ETA	What kind of difficulties has your company encountered when using external technologies? <ul style="list-style-type: none"> • Internal company distrust towards technologies produced by third-party companies • Search for new technologies consumes too much time • Market of technologies supply is still underdeveloped (the supply is limited) • Adaptation of third-party technologies consumes too much time/resources • Risk of losing your company's ability to develop innovations
<i>Other variables</i>	
v10. Internal R&D	Has your company implemented internal R&D in 2006–2008? <ul style="list-style-type: none"> • Yes • No
v11. R&D intensity	Ratio of R&D intensity = R&D spending / company's sales (%)
Technology orientation of companies	<ul style="list-style-type: none"> • <i>High-technology</i>¹ * industries (R&D investments/company sales > 5%) • <i>Medium high-technology industries</i> (R&D investments/company sales 3 to 5%) • <i>Medium low-technology industries</i> (R&D investments/company sales 1.5 to 3%) • <i>Low-technology industries</i> (R&D investments/company sales < 1.5 %)

Note: ¹OECD (2012) classification of technology orientation based on R&D intensity.

List of variables and measurement (continued)

<i>Variable</i>	<i>Measurement</i>
<i>Other variables</i>	
v12. Collaboration with external partners	How does your company assess the results of collaboration with external partners? (Likert scale 1 – no impact, 5 – strong positive impact) <ul style="list-style-type: none"> • More successful product development • Decreasing R&D risks • New knowledge • Opportunity to concentrate on core competences • Access to new technical expertise • Higher guarantees for success in the market • Access to new markets and clients
v13. Economic and innovation output indicators	Assess the changes of your company for the last three years in comparison with the goals set/in the comparison with the main competitors (scale –2 to +2) <ul style="list-style-type: none"> • Sales growth • Market share increase products • Sales profitability • New product introductions • Business profitability • The number of successful new products • Relative market share increase in comparison with the competitors • Return on investment (ROI)

Note: ¹OECD (2012) classification of technology orientation based on R&D intensity.

Publication IV

Torvinen, P., and Väättänen, J.

**External technology commercialisation and markets for technology in Russian
manufacturing industry**

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External technology commercialisation and markets for technology in Russian manufacturing industry

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Abstract: Functioning technology markets can offer valuable opportunities, such as increased revenues for new ventures and existing companies in the markets. External technology commercialisation (ETC) is a crucial part of this. However, many companies seem to be unable to identify or reluctant to commercialise surplus technologies they do not commercialise internally. This phenomenon also limits the supply in technology markets. ETC is proven to improve company performance and openness. This study examines the ETC of surplus technologies in Russian manufacturing companies. It combines two methodological approaches by using survey data and a case study. It shows that ETC is a minor business in Russian manufacturing; however, the companies doing it are recognising the benefits. If ETC is an essential part of their strategy, it can increase the company's returns and spread of technologies. Companies conducting ETC also seem to be forerunners in many fields, such as interfirm cooperation and technology development and acquisition.

Keywords: technology commercialisation; new product development; NPD; R&D; innovation; technology markets; technology acquisition; Russia; innovation management; technology transfer.

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1 Introduction

The competitiveness of a national economy draws from successful and internationally competitive companies and industries (Porter, 1990). This is also strongly influenced by its ability to exploit innovations commercially and develop them into products (Debackere and Veugelers, 2005; Zahra and Nielsen, 2002). The efficient exploitation of innovations requires functioning technology markets and companies which use open business models to commercialise their technologies. Companies can commercialise their technologies in three ways: they can use and implement the developed technologies as part of their products and current business; they can commercialise the technologies, for instance, in the form of licensing or patents as part of their business model. Finally, companies can also commercialise the technologies externally by offering them to external markets to create new ventures. To handle all three aspects of technology commercialisation, companies must have efficient technology management that is able to recognise even the surplus technologies that company cannot use internally. Well-organised technology management is an important competitive asset for companies (Chesbrough, 2003). External technology commercialisation (ETC) is an essential part of innovation and technology management, which can lead to the efficient use of a firm's innovation results, not only internally but also externally. In this study, we refer to ETC mainly as the commercialisation of surplus technologies not used or commercialised internally for external markets or companies.

Markets for technologies and technology market efficiency can support companies to buy and sell technologies (e.g., Roth, 2008; Arora and Gambardella, 2010). Markets for technology increase companies' strategy base. Companies can license out technologies instead of investing to downstream operations or license in technologies instead of investing heavily in internal R&D. This requires proactive technology and intellectual property (IP) management for internal technologies and the monitoring of external technologies. Organisations also have to support different operation modes, such as licensing and acquisition of external technologies (Arora et al., 2001). External technology acquisition (ETA) and acquisition of knowledge are already common phenomena, both in developed and developing countries, due to the fact that companies cannot rely entirely on internal R&D production when they aim to decrease costs and shorten the time to the market (Granstrand et al., 1992; Cassiman and Veuglers, 2006). Hence, technologies commercialisation, in the sense when it is not the business of the companies, is discussed more rarely (Chesbrough, 2003).

In this study, we focus on the companies that are able to recognise their surplus technologies and actively offer them to external use. ETC still seems to be rather unknown as part of technology management strategies when it undoubtedly could offer new possibilities to enhance firms' performance and the efficiency of technology markets (Koruna, 2004; Zahra and Nielsen, 2002). This holds especially when companies have surplus technologies that do not find their place in the firm's current business. In this

case, companies need to have managerial knowledge to commercialise technologies and yield value that could be not returned otherwise (Chesbrough, 2003). This also offers new possibilities for emerging market companies seeking new ways to enhance their competitiveness.

Russia has experienced tremendous economic progress over the last years, mainly due to rising energy prices rather than respectable industrial performance (Hanouz and Prazdnichnykh, 2011). Increased innovativeness, technology development, and opening up the business models are a necessity for Russian companies targeting growth and competitiveness, both in the domestic and in international markets (Dirks and Keeling, 2009; Valdaytsev and Sergeyev, 2011). Russian companies invest in R&D and they have wide research networks that offer an excellent base for the emergence of new technologies. However, Russian innovation outputs have been moderate despite their prominent potential (Hanouz and Prazdnichnykh, 2011; Smirnova et al., 2012; Torvinen and Väätänen, 2013). Companies rely on traditional innovation strategies, which are relatively closed, but the market situation is becoming increasingly tight and there is a clear need for more developed innovation management strategies which could help increase the competitiveness of Russian companies. Open innovation processes, especially outward technology transfer, are still quite untouched strategies in the case of emerging market companies' innovation management. ETC has become more used as a strategy for many companies (Chesbrough, 2007; Lichtenthaler and Ernst, 2007) but there is still room for further firm level research, particularly in the case of emerging market companies. One recognised fact is that markets for technologies and ETC processes inside companies are usually underdeveloped (e.g., Koruna, 2004). This is also visible in the case of Russian companies.

In this paper, we study Russian firms and to what extent they participate in technology exchange. We aim to determine the current thresholds in exploiting ETC and whether it can offer comprehensive competitive advantages for companies. We study the Russian technology markets and environment for ETC. We also look closer at those companies commercialising their surplus technologies, and examine one case company through which we show the characteristics and strategies of ETC companies and how they benefit from it. This illustrates how Russian companies are pursuing opportunities offered by technology commercialisation. The paper is combination of quantitative survey data and a case study. It aims to highlight the current state of Russian firms participating in technology exchange. Active technology exchange and ETC strategies are also two of the areas indicating the current state of innovation management in Russian companies.

We present two research propositions based on current literature and strive to contribute to Russian and emerging market perspectives for theory development. This paper is mainly descriptive and explanatory. This research offers managerial insights for technology management in companies in emerging markets contributing to the current understanding of ETC, especially in the case of Russian companies.

The paper is structured as follows: Section 2 reviews the literature concerning ETC and Section 3 describes the research methods used in this study. Section 4 explains the general aspects of and the environment for doing ETC in Russia. Section 5 focuses on the case of ETC in Russian manufacturing industry and Section 6 concludes the issues discussed in the paper and highlights its theoretical and managerial implications, and future research areas.

2 Literature review

2.1 External technology commercialisation

Knowledge has become a good that has substantial economic value (Granstrand, 2000). Companies can improve the rate of return on their technology investments by marketing their technologies (Ford and Ryan, 1981). This phenomenon is still underdeveloped and needs attention in business and industries. However, marketing and selling technologies and technological knowledge has proven to be essentially more difficult than selling industrial products for instance (Koruna, 2004).

There are many definitions for external knowledge commercialisation; for example, the following definition by Lichtenthaler (2005, p.233) defines that: “External knowledge commercialization (exploitation) describes an organization’s deliberate commercializing of knowledge assets to another independent organization involving a contractual obligation for compensation in monetary or non-monetary terms”. This definition derives from the Open Innovation concept by Chesbrough (2003) highlighting commercialising surplus technologies that are not used internally. Open innovation is, for example, defined “as systematically performing knowledge exploration, retention, and exploitation inside and outside an organization’s boundaries throughout the innovation process” [Lichtenthaler, (2011), p 77].

Technology itself has no value until it is commercialised some way. The same technology can also be commercialised in different ways to yield different returns, internally and externally. There are cases where technologies have no obvious business model in the company’s internal use. Then, managers must find an appropriate business model to capture the value from that technology. If they fail to do so, these surplus technologies will not yield any value to the firm. These technologies can find better business models outside the original firm when commercialised and ultimately can capture great value with the right company and the right business model (Chesbrough, 2003). Technologies not aligned with the company’s core business and business models can still create great value and even competitive advantages for companies through successful technology transfer and commercialisation. This, however, requires firms to develop their technology and R&D management (Anokhin et al., 2011; Zahra and Nielsen, 2002). For technology-based firms, their commercialisation orientation can offer clear competitive strengths and have a strong positive effect on firm performance. It should be an integral part of corporate strategy; however, managing the firm’s knowledge assets is extremely difficult and different types of technological assets require different commercialisation strategies (Lin et al., 2006a).

Current research has found that there is an important connection between technology opportunity identification and technology commercialisation performance. This also creates a link between inward and outward technology exploitation (Frishammar et al., 2012). Companies need to be able to create processes to identify opportunities for ETC. Successful outward technology transfer, by licensing, for example, requires companies to develop the management of IP, technology identification, commercialisation and exploitation processes. Pre-commercialisation activities (especially planning, intelligence and control over technologies) provide the critical support for successful management of external exploitation of non-core technologies (Kutvonen et al., 2010). A company’s internal R&D inputs improve the organisational learning and identification, and exploitation of external technological knowledge (Cohen and Levinthal, 1990; Lane and

Lubatkin, 1998; Gassmann and Enkel, 2004). Companies also need to monitor external technologies that could be used internally (Arora et al., 2001). Technology commercialisation has a facilitating role between R&D and the innovation performance of companies. By broadening the focus of internal R&D and investing into ETC capabilities, innovation performance can improve (Kim et al., 2011).

Technology commercialisation has increased because of an increase in interorganisational relations, networking, and cooperation (Hagedoorn, 2002). The increasing technology content of products and shorter product life cycles have impacted companies' innovation activities and these developments have a push effect towards outward technology transfer and ETC (Arora et al., 2001; Lichtenthaler, 2005). Companies can improve the returns on their R&D investments which are, in most cases, increasing at the same pace as market competition (Lichtenthaler and Ernst, 2007). They must exploit the technologies externally, if they do not apply it internally, to avoid losing its value to competitors (Chesbrough, 2003). Thus, ETC has led to more active technology management and emphasised the resource, knowledge, and technology-based perspectives in corporate strategies (Lichtenthaler, 2005; Lin et al., 2006b).

Research Proposition 1 An open business model and defined internal processes for technology identification positively affect a company's capabilities to commercialise and profit from developed surplus technologies.

2.2 Markets for technology in industrialised and emerging markets

Markets for technology and technology transactions can be difficult to define strictly. Technology exchange can take place in the form of contracts between companies but technologies are often exchanged through technology alliances, joint ventures, acquisitions, or the mobility of human capital. When talking about contracts, we can distinguish *ex-ante* contracts (i.e., R&D contracts) and *ex-post* contracts (i.e., contracts for existing technologies) (Arora and Gambardella, 2010). In this study, we will focus on technology markets mainly in the form of *ex-post* contracts such as licensing, selling patents or externalising surplus technologies.

Companies can profit from developed technologies by either using it in their final products, or by selling it (Teece, 1986). If companies decide to sell their technologies, it requires efficient markets for technologies. Roth (2008) has identified three basic factors that characterise efficient markets. The first is *market thickness*, which guarantees that a sufficient proportion of potential market participants will come together ready to transact with one another. The second factor is overcoming *congestion* so that market participants have the possibility to consider possible alternative transactions to arrive at satisfactory ones. The final factor is *market safety*. Gans and Stern (2010) note that most of the transactions in technology markets occur in 'bilateral monopoly' conditions where the buyer and seller engage in negotiations with limited outside options in terms of alternative exchange.

The supply for the technology market is dependent on companies' ability and willingness to commercialise their technologies. Arora and Gambardella (2010) indicate their studies have shown that firms with fewer downstream product market activities are more likely to license their technologies. These technology specialist firms are important for the supply to technology markets. Their studies also show that larger firms have lower

incentives to license their technologies compared to small firms. They have more resources to develop technologies internally and it seems that they mainly offer technologies that they themselves are not interested in licensing. However, in absolute terms, the share of large firms in licensing is substantial (Arora and Gambardella, 2010; Arora and Fosfuri, 2003; Gambardella et al., 2007).

Demand is usually limited by a number of factors. Previous literature has raised at least three major causes: 'Not Invented Here' syndrome (e.g., Katz and Allen, 1982), absorptive capacity (e.g., Cohen and Levinthal, 1990), and the relation between internal and external R&D. In addition, IP protection, estimating the value of technology and understanding the technology transactions cause further uncertainties for companies, which limit the demand and supply (Arora and Gambardella, 2010).

Companies in emerging markets need to recognise that their global competitiveness and market position is in danger in domestic as well as foreign markets if they do not improve their technology development and introduce radical technological product and process innovations. This is also evident with Russian companies (Dirks and Keeling, 2009; Valdaytsev and Sergeev, 2011).

Cooperation is noted as one of the key factors in increasing new product development (NPD) success (Smirnova et al., 2012). Innovative Russian firms still rarely consider internationally oriented strategies in collaboration. Instead of joining global R&D networks, the companies prefer to stay in domestic markets characterised by low investments and low demand (Trifilova, 2009; Trifilova et al., 2013). The Russian business environment is a crucial factor challenging companies to become more open in their activities (Podmetina et al., 2011; Savitskaya and Podmetina, 2013).

In the case of emerging markets, the opportunity from the commercialisation of surplus technologies and establishing new markets for technologies cannot be underestimated. Russia has well-educated technology and business specialists and researchers, and this potentially creates an excellent source for innovation and R&D. However, the innovation output is still weak in Russia. Russian companies are quite closed when it comes to business models and innovation, and they have relatively insufficient R&D (Hanouz and Prazdnichnykh, 2011; Dirks and Keeling, 2009). The empirical findings show that the number of companies acquiring external technologies exceeds many times the number of firms pursuing technology commercialisation (Podmetina et al., 2011). The link between research organisations and business is also weak in Russia; this creates extra constraint and challenges in companies in terms of commercialisation possibilities and new markets for technology.

Increasing the commercialisation of technologies can support building efficient technology markets. Functioning technology markets, however, need intermediaries to support diffusion and technology transfer. Intermediaries have a crucial role in identifying the partners, supporting the deal making, and packaging the technologies so that they can be transferred between companies (Howells, 2006). Studies show that industrial firms need to develop internal competencies for ETC. External service providers can support ETC rather than substitute their internal activities (Lichtenthaler and Ernst, 2008a). It also seems that the internet, despite its substantial potential, has not been that successful as a marketplace for technologies (Lichtenthaler and Ernst, 2008b).

The development of technology markets and growth of financing methods, such as venture capital (Chesbrough, 2003), can especially help small technology-based start-ups in using effective technology strategies with less investments and risk. Efficient markets for technology can attract start-ups with focused business models, increase competition,

and lower barriers to enter to markets. Markets for technology can also have major implications for a firm's corporate strategies when companies are able to increasingly buy or sell their technologies (Arora et al., 2001). Companies can buy technologies instead of internal development, and decrease their R&D risks and investments. For others, the commercialisation of surplus technologies can provide improved economic performance in the form of additional licensing revenues for example.

Research Proposition 2 Underdeveloped technology markets negatively affect the competitiveness of companies and limit the efficient exchange of technologies especially in emerging markets.

3 Research design

This study uses survey and case study approaches and with it combines quantitative data based on a survey of 206 Russian manufacturing firms. We also study ETC closer through a case company that has also participated in the same survey. For the case study, we have gathered further information from the company website and company reports.

We have selected a single case which represents a typical case among companies doing ETC; the criteria for case selection are explained further on in the paper. The case study itself is based on a constructivist paradigm where the truth is relative and dependent on one's perspective (Yin, 2003; Eisenhardt, 1989). By employing a case study method, the issue can be explored holistically and in detail. Our case study is based on both qualitative and quantitative data. Our study uses the survey data and in the case study we further examine the company's web pages and company reports. We endeavour to test and develop current ETC theory further, especially in the context of emerging economies and their industries.

The survey was conducted between November 2009 to February 2010 and was organised through structured face-to-face interviews with representatives from the top management of the companies. A number of criteria (strata) were applied: the region, industry and annual revenue of the company. The initial sample was 1,000 companies, from which 206 interviews were granted. The questionnaire consisted of 110 questions and was developed following the recommendations of the Oslo and Frascati Manuals. The sample includes mostly large companies: more than 44% of firms have more than 500 employees. Table 1 describes the sample in detail.

Table 1 Sample description

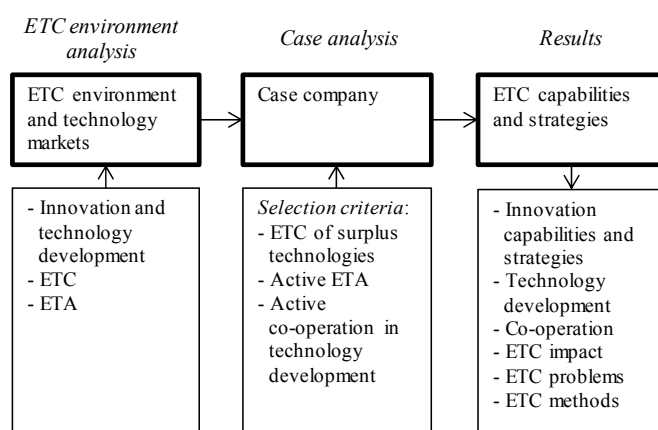
<i>Key industries</i>	<i>%</i>	<i>Number of employees</i>	<i>%</i>
Electronics and optics equipment	18.5	Less than 20	5.3
Metallurgy	17.5	From 20 to 50	5.8
Machine building	13.6	From 50 to 100	5.3
IT and telecommunications	10.2	100–250	27.2
Chemical industry	10.2	From 100 to 500	11.7
Electronic equipment	7.3	From 500 to 1,000	20.9
Oil industry	5.3	From 1,000 to 3,000	13.1
Rubber and plastic industry	3.9	More than 3,000	10.2

Table 1 Sample description (continued)

<i>Key regions</i>	<i>%</i>	<i>Ownership type</i>	<i>%</i>
Aircraft	3.9		
Other	9.6		
Saint-Petersburg and region	29.1	New companies	86.4
Yekaterinburg and region	14.6	(after 1991)	
Nizhny Novgorod and region	13.6	Privatised companies	12.6
Samara and region	11.2	State companies	1.0
Rostov-on-Don and region	9.7		
Krasnoyarsk and region	5.8		
Saratov and region	5.3		
Perm and region	3.9		
Novosibirsk and region	3.4		
Tatarstan and region	2.4		

In this study, we examine the whole sample to see the characteristics of Russian technology markets but we also focus more closely on the firms doing ETC (13 companies, 6% of surveyed firms, see Appendix for more details). These companies sell surplus technologies (innovations, objects of IP, patents) that they have created but do not commercialise or use internally.

Figure 1 Research design



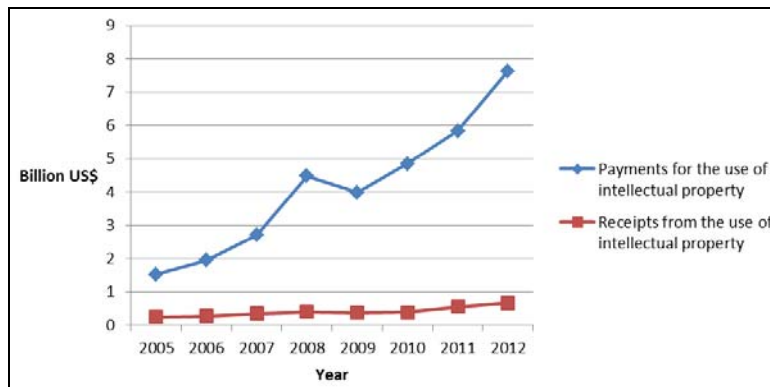
We have compared the sample of ETC companies to the whole sample of 206 companies to see if some factors are overrepresented among the ETC companies. This indicates the background factors and innovation strategies from the survey (such as company size, industry, R&D intensity, level of cooperation in technology development among others) which are common to ETC companies. We have used the factors that are clearly overrepresented among companies doing ETC as the selection criteria for the case company. These factors were the recognition and commercialisation of surplus technologies, active ETA and cooperation in technology development. The qualitative case study is used for a more in-depth analysis of the phenomenon. We study the case company, their websites and company reports closer to get a deeper understanding of

their strategies and ETC. Before going into the case description in Section 5, we describe the environment in the Russian manufacturing industry for ETC and the participation of companies in technology exchange. The study is mainly descriptive and explanatory because the sample of ETC companies is small for conducting reliable statistical analysis. Figure 1 describes the research design of this study.

4 ETC in Russia

The exchange of IP rights has increased substantially in recent years. In Russia, licensing in particular has increased dramatically. Figure 2 shows that the payments for IP have increased almost five-fold from 2005 to 2012. However, the receipts have increased only two-and-a-half-fold during the same time. This figure includes all IP rights such as patents, trademarks, copyrights, industrial processes and so on (World Bank, 2013).

Figure 2 Charges for the use of intellectual property* (see online version for colours)



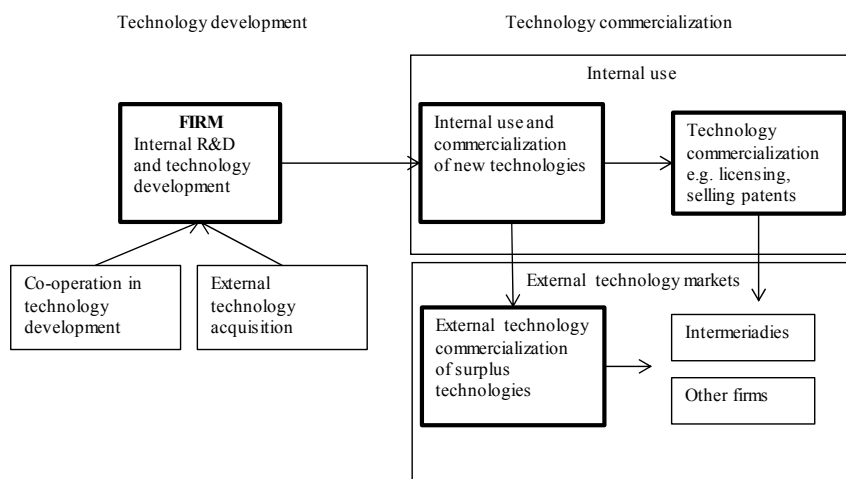
Notes: *Charges for the use of intellectual property are payments and receipts between residents and non-residents for the authorised use of proprietary rights (such as patents, trademarks, copyrights, industrial processes and designs including trade secrets, and franchises) and for the use, through licensing agreements, of produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast).

Source: World Bank (2013)

In this paper, we focus especially on the recognition and commercialisation of surplus technologies in the Russian manufacturing industry. These technologies result from internal technology development, but firms do not find any applications for them in their own business. ETC is good way to get some return for these technologies which have possibly required large investments in the R&D process. Figure 3 shows that firms have three ways to get value from the technologies they have developed. They can use it internally in their current business by embedding the technology in a final product or by commercialising the technologies (e.g., in form of licensing) or by selling the developed technologies to markets where other firms or intermediaries can find better business models and use for them (Chesbrough, 2003). However, companies need to be able to recognise and commercialise these technologies, which is challenging for many (e.g.,

Koruna, 2004). They need to find the right channels, and the right price for the technologies (Lichtenthaler and Ernst, 2008a). In the technology markets, there are intermediaries that can support companies in commercialising their technologies. Companies can also commercialise them straight to other firms that see potential in their technology.

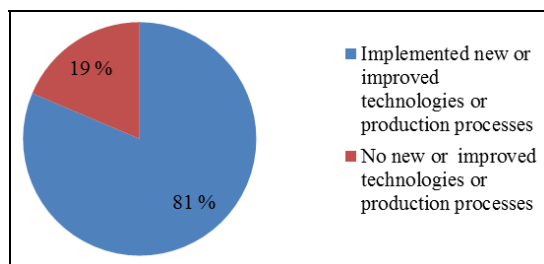
Figure 3 Technology development and commercialisation



Russian manufacturing firms are still relatively closed and the companies more likely rely on domestic technology sources and partners when developing new products and technologies (Smirnova et al., 2012). The Russian business environment is one key factor challenging companies to become more open in their activities (Podmetina et al., 2011; Väättänen et al., 2011; Hinkkanen et al., 2013). In particular, the IP protection mechanisms have a substantial effect on firms becoming more open in their innovation activities (Savitskaya and Podmetina, 2013).

The majority of surveyed Russian manufacturing firms (81%) implemented new or improved technologies in their operation during 2006–2008 (see Figure 4). The firms alone developed most of these implemented technologies, but different forms of cooperation, especially with domestic partners, have a role for some companies in technology development. Also, ETA seems to have established itself as a technology strategy for many (see Figure 5).

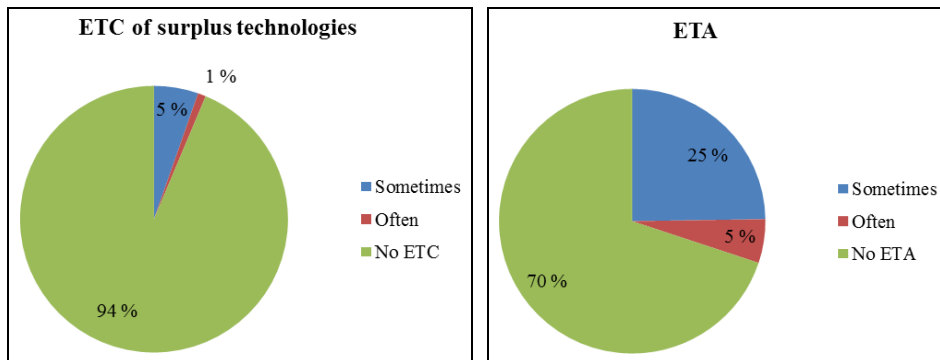
Figure 4 Implementation of technological innovations during 2006–2008 (out of 206 companies) (see online version for colours)



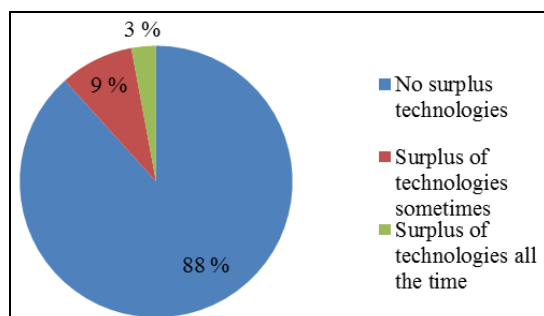
As a result of internal R&D, companies create and implement new technologies. A part of these, however, do not fit the companies' current business models, which leaves companies with 'surplus' technologies that do not have internal use. The identification of these technologies is part of a company's successful technology management when commercialisation is a strategic decision to gain returns on these technologies. As mentioned earlier, we study ETC specifically as the commercialisation of surplus technologies not used or commercialised internally.

ETC and the development of efficient markets for technology are important for companies so they can exploit technology and compete more efficiently. However, this is dependent on the open business models of companies. In the case of Russian manufacturing companies, compared to ETA, the share of ETC is clearly underdeveloped. Figure 5 shows the share of surveyed companies participating in technology exchange. Around 6% of surveyed companies reported selling surplus technologies (innovations, objects of IP, patents). This also shows that a minority of companies have identified and decided to sell technologies that do not fit with their core business. The results also show that companies doing ETC prefer domestic channels over foreign ones for commercialising technologies. In comparison, approximately 30% of companies reported acquiring technologies from external sources (ETA). The clear majority of companies did not participate in technology exchange.

Figure 5 Technology exchange; ETC and ETA (out of 206 companies) (see online version for colours)



From the surveyed companies, 13 (6.3%) were reported to sell their surplus technologies sometimes or often. On the other hand, the same amount of companies reported not commercialising these technologies even when they had them (6%). These companies have the capabilities to identify surplus technologies but they had chosen to keep the technologies in-house and not to seek any returns for these developed technologies. From the 206 surveyed companies, 24 (11.6%) reported having (sometimes or all the time) surplus technologies that could not be used inside the company (see Figure 6). In this study, we take a closer look at these 13 companies that reported selling their surplus technologies.

Figure 6 Surplus technologies (out of 206 companies) (see online version for colours)

The vast majority of companies report not having any surplus technologies. The capability to recognise all the technologies, and their possibilities, resulting from internal R&D is vital for companies (Cohen and Levinthal, 1990). In Russian firms, these capabilities can still be weak and all the surplus technologies are not recognised.

Based on the larger survey data, we explored whether ETC companies are over or underrepresented in certain fields (see Appendix). This comparison shows that there are three industries that are overrepresented: electronics and optical equipment, metallurgy, and IT and telecommunications industries. Most of the companies are from high or medium technology industries (based on R&D intensity)¹ and there were no companies from low technology sectors. Large companies (from 500 to 1000 employees) are also clearly overrepresented, as well as the Nizhniy Novgorod region, which is one of the centres of the IT industry in Russia. ETC companies also seem to have extensive experience in international operations, usually more than ten years, and they face competition and pressure especially from foreign companies or imports.

ETC companies with systematic R&D operations appear to be overrepresented compared to the whole sample. They are also more active in implementing new technologies. In technology development, these companies seem to have active cooperation with others and they also use external technologies more actively than the rest of the companies. In addition, the technologies developed are more likely new for the markets.

When the share of companies' commercialised technologies was compared to that of all the developed new technologies, it showed that out of 13 companies, five commercialised less than 10%, three companies commercialised 10 to 25%, and only two companies reported to commercialise more than 25% (one of them over 50%) of their new technologies. Three companies did not report any figure. Most of the companies reported selling these technologies forward as fully developed technologies including patents and manuals for implementation. Some of the companies also used an open source method or licensing.

The majority of companies do not have or recognise having surplus technologies. However, a minority of companies do commercialise the surplus technologies that are not used inside the company. Companies doing ETC are active in R&D and technology development, and use external sources and partners to support their operations. These companies, in general, have international experience.

To study ETC in Russia, we have selected one case company to illustrate the topic more closely. We study the company, their websites and company reports. The case was selected based on factors that indicate that ETC companies are clearly more active than companies in the survey in general. In addition to recognising and commercialising their surplus technologies and doing ETC, these factors are active ETA and active cooperation in technology development. Furthermore, the company conducts systematic R&D and develops technologies itself. The case is described next in Section 5.

5 Case of ETC in Russian manufacturing industry

The case company was selected based on the factors overrepresented among ETC companies compared to the whole sample: the company recognises and commercialises surplus technologies, it is active in ETA and it has cooperation in technology development. This company is a large privatised company that started its operations already in the Soviet Union era. It employs approximately 700 people and it operates as a supplier and manufacturer in the electronics industry. The company offers goods for industrial and consumer markets. Its core business is to manufacture electronic components for other product manufacturers to be used in televisions and radios, among other appliances. The company also manufactures a few simple products directly to markets. It offers part of its production process to its customers as a service as well, in which the customer's products will go through a line of advanced processing for which the case company has the technology.

The company reports that it supplies its products to over 1500 companies around the world. It has many years of experience in international operations in exporting. Its biggest single market is clearly Russia (with 40% market share) followed by CIS countries and Baltic markets, but the company also exports its products directly or indirectly to Europe, especially to German and Nordic customers, and to China.

The company has clearly confronted increasing global competition and it is investing in modernisation, innovation and market expansion. The company's aim for innovation is to sustain and increase its market share and to enter new markets domestically and internationally. It also wants to invest in increasing the production capacity. It feels pressure to have better control over the quality of goods; and also from domestic and foreign competitors, customers, and suppliers. It has active R&D departments to improve production technologies and develop new products, and uses active cooperation with suppliers and customers to develop and offer effective production and supply to its customers. It reports being open to partners and cooperation in NPD and also to cooperate with partners in the same industry from Asia. It claims to involve partners in long term cooperation in all areas in innovation from NPD to technology development and marketing.

The company in question is quite R&D intensive. It operates in high technology field and its ratio of R&D costs and company sales is between 5% and 10%. The company reports using around 40% of its total spending on R&D. It indicated that it has developed and introduced new innovations and improved technologies and processes for its production processes during the period 2006–2008.

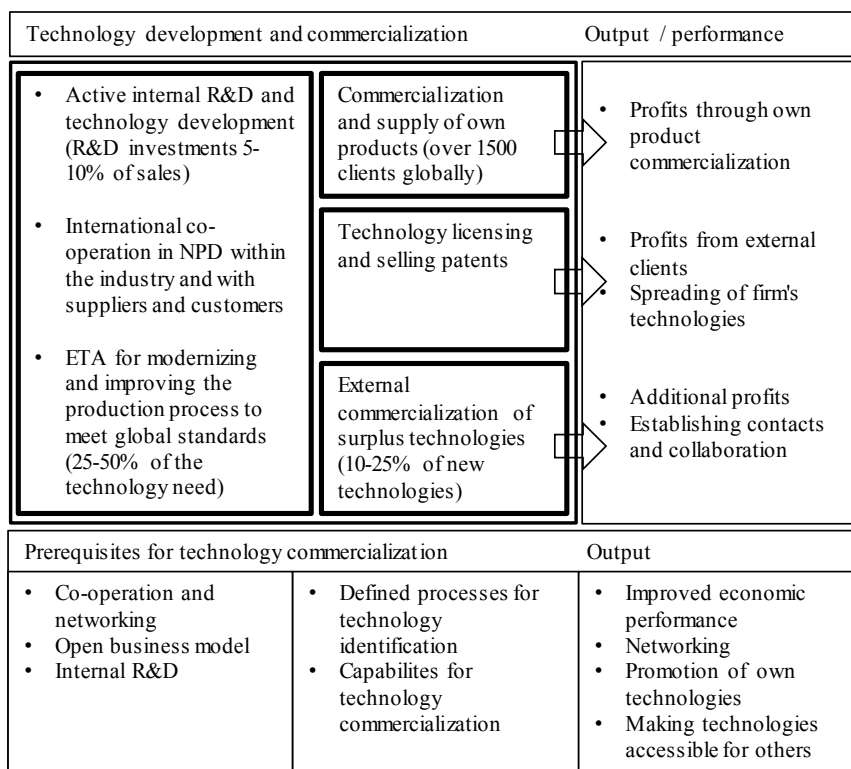
In addition to systematic R&D activities, the company is very active in acquiring external technologies (25 to 50% of the technology need). For it, ETA is an essential part

of modernising the production process. The company has also acquired technologies from external sources to meet international standards and to increase the output and competitiveness of production. It follows the model presented in Figure 3, where cooperation and ETA support internal R&D and technology development.

The company uses and commercialises its technologies internally in the form of products and patents offered to external clients as well. It reported that it has surplus technologies that it does not use itself, which it offers to external technology markets. By doing this, it can get some return on the technology development and R&D investments.

This company indicates that it sometimes commercialises its surplus technologies, which comprise 10 to 25% of all new technologies. This is above average among ETC companies. It also offers a variety of their patents and technologies for commercial use. These technologies and patents have been developed through their internal R&D. The company states that ETC will help them gain additional revenue, and establish new contacts with other companies. They feel that the external use of their technologies increases their success at the same rate as others implement their technologies. They use all available channels (e.g., markets for technologies, IP licensing), in domestic and foreign markets to promote their technologies. Figure 7 describes the technology development and commercialisation strategies and processes in the case company. It also shows how the company profits from the developed technologies when commercialising them.

Figure 7 Technology development and commercialisation in the case company



In general, ETC firms seem to prefer Russian channels to foreign ones in promoting their technologies. Our case company sells its technologies particularly through open source and in the form of patents. It feels that, as a result, the transparency of the company has increased through ETC and that the time for launching new products to markets has decreased. However, it feels that searching for customers is difficult in the case of ETC and technology markets. All of these results from the case company follow the answers of all survey companies conducting ETC. In addition, many of them report that the search for customers consumes too much time and that the technology markets are underdeveloped, which limits demand. Russian companies still rely heavily on domestic sources and channels in technology exchange.

The company has been able to increase its production substantially and it has introduced new production lines in recent years. Based on its own perception, the company has clearly performed better compared to their objectives and also to their main competitors. The case study company reports that its success mainly comes from effective R&D and the modernisation of production and processes.

This study has pointed out some strategies and strengths of companies active in technology exchange. These companies possess capabilities for identifying and selling their technologies externally and consequently, for getting additional revenue. In the process, their businesses have become more open and transparent, which can create new business opportunities and promote the companies' products and capabilities. Additionally, ETC helps companies to build networks and establish contacts with others. These companies usually have international operations and experience already. They compete against foreign competitors and imports for the quality of their products. They also cooperate in technology development to enhance their NPD process and use ETA to modernise their production for example. Currently, the underdeveloped technology markets limit the efficient exchange of technologies, especially in domestic markets. This results from the lack of ETC capabilities in companies as well. Table 2 summarises the main findings of this study.

Table 2 Summary of the findings

<i>Research proposition</i>	<i>Findings</i>
Research Proposition 1: An open business model and defined internal processes for technology identification positively affect a company's capabilities to commercialize and profit from developed surplus technologies.	<p>Prerequisites for building ETC capabilities:</p> <ul style="list-style-type: none"> • Defined technology management processes to identify internal and external technologies (ETA); active internal R&D, open business model; networking and co-operation in NPD <p>Commercialisation:</p> <ul style="list-style-type: none"> • Increased revenues and economic performance • Returns for the technology development investments • Establish new contacts and build networks • Increased transparency which can provide new business opportunities • Company's technologies become available for others which helps to promote the company • ETC processes are not familiar to the majority of companies and not all potential ETC possibilities are not exploited or even recognised internally in many cases.

Table 2 Summary of the findings (continued)

<i>Research proposition</i>	<i>Findings</i>
Research Proposition 2: Underdeveloped technology markets negatively affect the competitiveness of companies and limit the efficient exchange of technologies especially in emerging markets.	<ul style="list-style-type: none"> • Supply: the share of ETC is clearly smaller compared to ETA in Russian manufacturing companies • Demand: ETA is actively used to support the technology development and modernisation of production • Domestic technology markets and channels are favoured over foreign ones • Limited supply further decreases the attractiveness of technology markets and companies' participation in technology exchange • Companies see that, due to underdeveloped technology markets, ETC consumes too much time and the search for customers is difficult • Limited use of ETC and a lack of internal ETC capabilities in companies limit the supply to technology markets • Functioning markets for technology could increase companies' overall competitiveness.

6 Conclusions

Our study focuses on the technology markets and technology-oriented companies in Russian manufacturing industries. This study described how and which companies do participate in exchange and technology commercialisation, and how they benefit from it. It also describes the current situation in Russian technology markets and how companies see those markets in the case of ETC. The results illustrate several managerial implications of how companies can benefit from commercialising technologies. Managers often feel that ETC cannot provide any benefits and it requires excessive commitment and resources. They still need the proof that technology commercialisation can benefit their company and they need to know what the prerequisites for successful ETC are.

Our findings show that companies can substantially benefit from opening their business models and innovation management strategies. It is visible that open innovation activities (outward and inward) can offer enormous future potential for companies to exploit. However, the ETC of surplus technologies is used as a strategy in a small number of companies. Previous research has studied technology commercialisation, and especially what is required from companies for successful ETC (Anokhin et al., 2011; Zahra and Nielsen, 2002) and the important role of identifying the opportunities (Frishammar et al., 2012). This study shows that the majority of companies does not exchange technologies at all and ETC can be considered small-scale business compared to ETA among Russian manufacturing companies. The majority of companies do not recognise having surplus technologies even though they invest in R&D and implement new technologies actively. This leads to the assumption that the processes used to identify commercialisation opportunities are still underdeveloped.

A large share of companies conduct systematic R&D, and develop and implement new technologies continuously but a minority reports to have surplus technologies and an even smaller share reports exploiting the opportunity to commercialise them. ETC can, however, offer benefits to companies by creating additional returns for technology investments. It can also increase transparency and cooperation, and the use of and demand for their technologies. Our study shows that companies conducting ETC perform well in many fields. They generally have open business models. In addition to active internal R&D, they have cooperation in their technology development with external partners and stakeholders. They are also actively participating in technology exchange by acquiring and commercialising technologies. ETC seems to have spill-over effects that help companies become more open, build networks, and develop cooperation to increase their competitiveness. International connections and networks especially help companies to reach new technologies and increase the competitiveness and efficiency of companies and markets. These results support our *Research Proposition 1: An open business model and defined internal processes for technology identification positively affect a company's capabilities to commercialise and profit from developed surplus technologies.*

The Russian business environment is challenging companies to become more open in their activities (Podmetina et al., 2011; Savitskaya and Podmetina, 2013). Results show that Russian companies tend to prefer domestic markets for technologies. However, the domestic technology markets, especially the domestic market supply, seem to be underdeveloped and companies find it challenging to access them. This results in a vicious cycle where limited supply further decreases the attractiveness of technology markets and companies' participation to technology exchange. With more functioning markets for technology, companies could become more effective in their NPD and increase their overall competitiveness. ETA is actively used in a large share of companies to support technology development and the modernisation of production. The supply to the technology markets is limited by the lack of capabilities to conduct successful ETC. These results support our *Research Proposition 2: Underdeveloped technology markets negatively affect the competitiveness of companies and limit the efficient exchange of technologies especially in emerging markets.*

This study has contributed to theory development and pointed out several managerial implications about ETC in emerging market context. Companies that invest in R&D and have competitive NPD processes are needed to develop processes for technology commercialisation and for identifying misfit and surplus technologies internally. Many companies seem to lack the capabilities to identify technologies externally and especially internally. They appear to have more readiness for ETA but ETC is seen as a too-time-consuming and too difficult process in most cases. The development of functioning technology markets is essential for emerging markets and could offer good possibilities for many companies in the future. Commercialising the surplus technologies in particular can support the creation of new ventures (Chesbrough, 2003). This requires open business models, internal capabilities, and active technology exchange from companies. Market intermediaries can complement and support the companies' participation in markets for technology (Lichtenthaler and Ernst, 2008a). ETC has a decisive role in supporting technology exchange and technology markets. Ultimately, it can improve competitiveness, both for companies and for domestic industries.

This paper has contributed to enhancing the current understanding of the ETC environment in Russia and the extent of exploiting technology commercialisation opportunities in innovative Russian manufacturing companies. There are limitations in

this study, which has been mainly descriptive and explanatory. More research and data are needed to study the topic further with a statistically applicable sample. Future research should focus on technology management and how to support the building of capabilities needed to recognise the ETC possibilities internally. One important research focus will also be the current state, development, and operation mechanisms of markets for technology in emerging markets. These topics are important because functioning markets for technology and promotion ETC can offer a large number of new possibilities for companies to exploit. It can contribute on a national level to create new businesses and increase competitiveness, which is important in the case of emerging economies.

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Notes

- 1 OECD classification of technology orientation based on R&D intensity (OECD, 2013).

Appendix

Sample description of companies doing ETC

Industry	Out of 13 ETC firms		Out of 206 surveyed firms		Expected share out of 13 firms		Over-represented(+) / underrepresented(-)
	N	%	N	%	N	%	
Electronics and optics equipment	4	31%	15	7%	1	7%	+
Metallurgy	4	31%	36	17%	2	17%	+
IT and telecommunications	2	15%	21	10%	1	10%	+
Machine building	1	8%	28	14%	2	14%	-
Oil industry	1	8%	11	5%	1	5%	+/-
Other	1	8%	33	16%	2	16%	-
<i>Regions</i>							
Nizhny Novgorod and region	6	46%	28	14%	2	14%	+
Saint-Petersburg and region	4	31%	60	29%	4	29%	+/-
Samara and region	1	8%	23	11%	1	11%	+/-
Rostov-on-Don and region	1	8%	20	10%	1	10%	+/-
Saratov and region	1	8%	11	5%	1	5%	+/-
<i>Number of employees</i>							
less than 20	1	8%	11	5%	1	5%	+/-
from 100 to 250	2	15%	56	27%	4	27%	-
from 250 to 500	1	8%	24	12%	2	12%	-
from 500 to 1,000	6	46%	43	21%	3	21%	+
From 1,000 to 3,000	2	15%	27	13%	2	13%	+/-
<i>Ownership type</i>							
Joint stock companies	6	46%	100	49%	6	49%	+/-
Private	5	38%	78	38%	5	38%	+/-
Privatised companies	2	15%	26	13%	2	13%	+/-
<i>Ratio of R&D intensity = R&D spending / company's sales (%)</i>							
High-technology ¹ industries (R&D investments/company sales > 5%)	4	31%	43	21%	3	21%	+
Medium high-technology industries (R&D investments/company sales 3-5%)	3	23%	27	13%	2	13%	+
Medium low-technology industries (R&D investments/company sales 1.5-3%)	4	31%	68	33%	5	4	+/-
Low-technology industries (R&D investments/company sales < 1.5%)	0	0%	38	18%	2	18%	-

Note: ¹OECD classification of technology orientation based on R&D intensity (OECD, 2013).

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Technology Management Strategies in Emerging Markets

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Abstract: Technology management strategies and effective innovation activities are vital for companies in emerging economies to become more competitive. We study a sample of over 6000 manufacturing companies in developing and developed EU, Eastern European, and Central Asian countries. We claim that manufacturing firms in competitive economies are more active in R&D, together with the employment of external technologies as well as collaboration in the new product development process. The companies are tied to their host country and business environment and develop along with it. Firms can innovate by relying on internal R&D but this can also be complemented by acquiring external knowledge and technologies, and through collaboration. The results show that the firms in most competitive countries are active in using open technology management strategies. However, firms in the less developed environments are also actively employing these strategies, compared with firms in the countries shifting to the most competitive stage.

Keywords: Innovation; Emerging Markets; Technology Management; Open Innovation; New Product Development, Collaboration

1 Introduction

Firms' innovation and technology management strategies play a critical role in the success and performance of manufacturing companies in emerging markets. Companies in developing economies have to rethink their new product development, and innovation and technology strategies, in order to be able to improve their competitiveness and productivity compared with their rivals from developed economies, who are increasingly penetrating their home market. In addition to in-house R&D, companies need to seek actively ways to improve their innovation performance and processes. Collaboration and external knowledge and technology acquisition have proven one of the key actions to enhance their competitiveness.

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Innovation and technology management strategies, technology transfer and Open Innovation are widely discussed topics in the current management literature (e.g. Huizingh, 2011; West and Bogers, 2014; Bozeman et al., 2015). Developing economies have received less attention in this respect, even though such measures are essential for the future of their manufacturing industry competitiveness. Emerging markets have a different kind of business environment, which also leads to different strategies (Hoskisson, 2000; London and Hart, 2004). Innovation management has an essential role in firms in emerging markets. For example, Russia, which is among the big emerging markets, has achieved strong economic growth in the past decade; however, Russia presents a paradox where relatively high R&D investment and, for example, a highly educated workforce does not result in high innovation outputs. (EBRD, 2012; Filippov, 2011; Torvinen & Vääänen, 2013; Gurkov, 2004) The business environment in Russia is also challenging and firms are faced with, for example, a lack of institutional support in intellectual property rights, which is visible in many international reports (e.g. Schwab and Sala-i-Martin, 2014). Change is also required inside the companies and their operation. Open innovation strategies including active acquisition and commercialization of technologies, and connections to global and developed networks, are critical to increasing firm performance and competitiveness in developing markets.

Technology management strategies and the role of external collaboration have been studied from many perspectives but there are still gaps in the current literature. More quantitative research with large samples is needed and, for example, the importance of the business model, commercialization process of external innovations, and prerequisites and motivation for collaboration has received less attention in the recent research. (Huizingh, 2011; West and Bogers, 2014) Internal R&D, innovation and the capability to innovate have been recognized as key issues in improving company performance. In addition to their own R&D and capability building, companies need to seek actively ways to improve their innovation performance and processes. They also need to be able to exploit external knowledge and technologies by commercializing that knowledge in the new product development (NPD) process for competitive products offered to global markets. The NPD process delivers no value until the developed technologies are commercialized, which is often challenging for the companies concerned (Chesbrough, 2003).

Collaboration and external knowledge and technology acquisition have proven key actions in enhancing performance. By accessing a central network position and access to the knowledge of other organizations, companies can produce more innovations and improve their performance (Tsai, 2001) The home country network connections and a firm's internal capabilities are also key factors when examining the performance and competitiveness of the firms (Yiu, et al., 2007)

Manufacturing firms in developing markets are bound to their still developing business environment and clusters. Firm competitiveness and productivity depend on a firm's position in the markets, which is largely affected by the business environment at an industry and national level. Internationalization and international networks are one of the important issues in reducing home market constraints (Luo and Tung, 2007). The historical background of transitional economies with a high focus on science, technology, and research offers and creates high potential for innovation. However, in some of the countries, the underdeveloped innovation system, institutional environment and lack of intellectual property (IP) protection do not encourage companies to innovate. This also challenges companies to become more open in their technology strategies. We claim that

more competitive countries have a more sophisticated business environment that should encourage companies to become more open.

It is essential for manufacturing companies, especially in developing economies, to improve their R&D, NPD and management strategies to become more competitive and compete with their rivals from developed economies. Domestic manufacturing industry in many developing and emerging markets is in a challenging position set against foreign imports and multinational firms. Some countries have been able to improve their competitiveness and develop competitive industries and clusters. Some economies have faced clear challenges which are visible for example in the case of Russia (Gurkov, 2004). This also makes the Eastern European transitional economies a very interesting topic for more profound research because some of them seem to have fallen behind many other developing countries when it comes to innovation and globalization, while others have succeeded and are among the most competitive in the world.

In this paper, we study whether manufacturing companies in developing EU and Eastern European economies become more sophisticated in their technology management strategies, and whether that follows the development of competitiveness in the host economy. We assume that the firms located in the most competitive countries have the best opportunities and environment for more sophisticated technology management strategies. We study the issue by focusing on the firms' internal actions regarding NPD process and technology management strategies, focusing on internal R&D, external knowledge and technology acquisition, and interfirm collaboration. We employ manufacturing industry data based on the EBRD's and World Bank's Business Environment and Enterprise Performance Survey (BEEPS) of 2012-2013. The data set is extensive and covers altogether 15,902 enterprises in 30 countries in Eastern Europe and Central Asia, and thus offers a large and unique sample for this study. In this study, we focus on manufacturing industry data (6267 companies) and compare data from countries that are in different stages of economic development.

We present some descriptive statistics to illustrate the current situation in open technology management strategies between the countries. We also employ multinomial logistic regression analysis to see if the manufacturing companies are more sophisticated in their technology management strategies in the more competitive host economies.

This paper is structured as follows: the following section reviews the literature related to the research topic and introduces the research hypotheses. The third section describes the data and research methodology in more detail. The fourth section discloses the findings and discusses the research results. The fifth and final section presents conclusions on the issues discussed in this paper.

2 Literature review and hypotheses

Innovation is one of the key factors for manufacturing industry to focus on when the companies aim to improve productivity and competitiveness. We claim that open innovation strategies are essential to development. This is particularly important in developing economies, which are vulnerable to increasing global competition in the home and foreign markets. Internal R&D, external knowledge and technology acquisition, and NPD collaboration, are methods of operation characteristic to Open Innovation. Our hypotheses are also based on the claim that more competitive countries have a more developed business environment which should allow more open business strategies.

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Absorptive capacity is defined as the ability to acquire external information, assimilate it, and use it for commercial ends. The prerequisite for successful acquisition of external knowledge is the capabilities a company can achieve through investing in internal R&D. (Cohen and Levinthal, 1990; Zahra and George, 2002) Internal R&D plays a substantial role in the firm's new product development. In addition to in-house R&D, companies need to seek actively ways to improve their innovation performance and processes. Collaboration and external technology acquisition (ETA) have proven one of the key actions to enhance NPD and competitiveness. Open innovation (OI) and open business models, as opposed to a closed approach, often provide opportunities to improve performance (Chesbrough, 2003; Lichtenthaler and Lichtenthaler, 2009; Podmetina et al., 2011).

Hypothesis 1: The share of firms conducting internal R&D in new product development in manufacturing industry increases when a country becomes more competitive

Companies' absorptive capacity and capabilities play an essential role in innovations in developing economies. Indigenous innovations are still needed and foreign innovations and external technologies should be used to reinforce and complement technology development. (Fu et al., 2011) External technology acquisition does not offer significant improvement in firm performance as such, but is linked to the level of internal R&D efforts and R&D capacity (Tsai and Wang, 2008; Li et al., 2010; Jones et al., 2001; Berchicci, 2013). However, the managerial capabilities to integrate and transform the knowledge are critical (Kotabe, et al., 2011). Cassiman and Veugelers (2006) further highlight that internal R&D and ETA are complementary innovation activities but the degree of complementarity depends mainly on the firm's strategic environment, which requires careful management of the innovation process leading to gaining competitive advantages. When producing radical innovations, especially in the case of emerging markets, strategies from internal knowledge sharing to external knowledge acquisition differ, and are affected by the firm's existing knowledge base (Zhou and Li, 2012).

Technology transfer may help companies with limited R&D resources in emerging markets through catch-up, complement their internal R&D efforts, and improve performance. (Lin, 2003) However, it is important, especially for companies in developing nations, to operate in a modern institutional surrounding with good governance structures and supportive innovation systems in order to reap true benefits from international technology diffusion. (Fu et al., 2011; Pietrobelli & Rabellotti, 2011) Institutions and especially intellectual property protection mechanisms have a substantial effect on companies' involvement in open innovation practices (Savitskaya & Podmetina, 2013).

Hypothesis 2: The share of firms exploiting external knowledge and technology acquisition in new product development in manufacturing industry increases when a country becomes more competitive

There are many organizational forms of interfirm collaboration, such as R&D and technology exchange agreements, direct investments and collaboration, one directional technology flows, and collaborative customer-supplier relations. (Hagedoorn, 1990). Knowledge, technology, and technology transfer are complex concepts that are not easy

to define. Technology can be immaterial in the form of patents and licenses. It can also be tacit which is embodied in people or machines. This leads to the fact that technology can be transferred through many different channels. The most common channels for technology transfer are foreign investments, joint ventures, and licensing. It can also be embedded in long-term co-operation such as subcontracting, co-operative alliances, other contractual relationships or non-equity relationships. (Radosevic, 1999)

Since competition is becoming more knowledge-based, firms need to be able to convert knowledge into capabilities. Besides internal processes, a firm's network linkages and interorganizational learning become essential in developing capabilities and competences for innovation (Lane and Lubatkin, 1998) This is especially important for NPD success for firms in developing business environments (Smirnova et al., 2012). Tsai (2001) shows that the firm's absorptive capacity and internal learning, and access to knowledge through a central network position, have significant positive effect on innovation and performance. A company's interfirm alliances often lead to access to the knowledge of other companies. Large, innovative and competitive firms with vast technological resources are the most valuable partners, especially for young or small organizations (Stuart, 2000).

Hypothesis 3: The share of firms collaborating with customers and suppliers or academic and research institutions in new product development in manufacturing industry increases when a country becomes more competitive

3 Data and methodology

The data for this study comprise the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS) conducted in 2011-2014 by the European Bank for Reconstruction and Development (EBRD) and the World Bank Group (the World Bank). The survey takes in altogether 15,883 enterprises in 30 countries from Eastern Europe and Central Asia, including 4,220 enterprises in 37 regions in Russia. In this study, we employ data only from manufacturing companies. These data comprise 6,267 manufacturing companies from 30 countries. The survey includes an Innovation Module, covering product, process, organizational and marketing innovation, as well as management practices in manufacturing enterprises with at least 20 employees (50 employees in Russia).

We employ SPSS software to analyse the data. We study and compare the countries in transition and how they differ in their approach to innovation activities and strategies, presenting descriptive statistics to illustrate the current situation in open technology management strategies between the countries. We also employ multinomial logistic regression analysis to see if the manufacturing companies are more open in their technology management strategies in the more competitive host economies.

We study whether the manufacturing companies in developing EU and Eastern European economies become more open in their technology management strategies when the host economies become more competitive in global terms. Our hypotheses are based on the claim that more competitive countries have a more developed business environment, which should enable more open business strategies. We study the issue by focusing on the firms' internal actions regarding NPD process and technology

management strategies, focusing on internal R&D, external knowledge and technology acquisition, and interfirm collaboration.

Figure 1 below describes the conceptual model for this study. We claim that when the competitiveness of the business environment grows, the openness of technology management strategies increases in manufacturing industry in developing economies. This shift is verified by an increased level of internal R&D, external knowledge and technology acquisition, and collaboration.

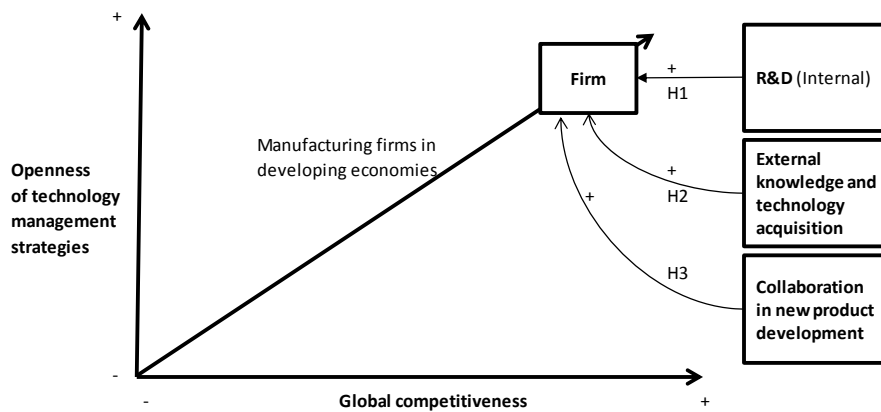


Figure 1. Conceptual model

Table 1 below describes the data and composition of manufacturing companies in different countries used in this study. These data indicate the size, distribution and host country of the companies included in the manufacturing module. The table also shows the development stage of the countries based on the Global Competitiveness Report (GCR) (Schwab and Sala-i-Martin, 2014). We divide the countries in their reference groups based on the stages of development in the GCR. The first stage of GCR ranking is *factor-driven economies*, the second stage *efficiency-driven economies*, and the third *innovation-driven economies*. There are also transition stages of development within these main stages of development for countries which are moving towards the next stage in global competitiveness. We have classified these countries on a scale of 1-5 based on the stage of development. The countries that have not been ranked in the GCR have been excluded from the regression analysis.

Table 2 describes the variables used in this study. In the multinomial logistic regression analysis, we employ a scale variable based on the GCR stage of development ranking as a dependent variable. We study the following factors separately: internal R&D, ETA, and NPD collaboration. For the analysis, we have also included the covariates firm age, firm size, and sales.

Table 1. Data sample used in this study (manufacturing only)

	Micro (<5)	Small (>=5 and <=19)	Medium (>=20 and <=99)	Large (>=100)	Total	Stage of development in GCR*
Albania	1	63	34	13	111	2
Armenia	2	45	38	26	111	2
Azerbaijan	0	50	59	13	122	1-2
Belarus	0	43	42	32	117	Not ranked
Bosnia and Herzegovina	5	53	41	18	117	Not ranked
Bulgaria	0	52	33	17	102	2
Croatia	0	62	35	22	119	2-3
Czech Republic	1	43	41	22	107	3
Estonia	2	44	26	15	87	3
FYR Macedonia	9	55	42	13	119	2
Georgia	0	61	36	16	113	2
Hungary	6	47	29	17	99	2-3
Kazakhstan	0	80	79	41	200	2-3
Kosovo	0	33	36	5	74	Not ranked
Kyrgyz Republic	1	39	45	19	104	1
Latvia	2	63	39	14	118	2-3
Lithuania	1	51	34	19	105	2-3
Moldova	1	55	36	17	109	1-2
Mongolia	3	55	49	13	120	1-2
Montenegro	3	29	10	6	48	2
Poland	4	78	60	42	184	2-3
Romania	6	70	63	38	177	2
Russia	1	501	560	259	1321	2-3
Serbia	2	60	36	15	113	2
Slovak Republic	30	39	24	6	99	3
Slovenia	3	45	23	14	85	3
Tajikistan	7	57	41	18	123	1
Turkey	14	381	427	274	1096	2-3
Ukraine	5	356	257	119	737	2
Uzbekistan	1	36	47	46	130	Not ranked
TOTAL	110	2646	2322	1189	6267	

Notes: * The countries are divided into stages of development based on GDP per capita (stage1: < 2000 US\$; stage 1-2: 2000-2999 US\$; stage 2: 3000-8999 US\$; stage 2-3: 9000-17000 US\$; stage 3: > 17000 US\$), and weighted attributes based on the level of development (See Schwab and Sala-i-Martin, 2014, pp. 9-11 for details)

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Table 2. Description of variables

<i>Dependent variable</i>		
GCR ranking	Countries grouped in their reference groups based on the Global Competitiveness Report 2014-2015	Categorical (scale 1-5) 1= factor-driven economies 2= transition stage 3= efficiency-driven economies 4= transition stage 5= innovation-driven economies
<i>Factors</i>		
Internal R&D	In-house R&D activity	Categorical (yes = 1, No = 2)
External technology acquisition (ETA)	Acquired external knowledge or technologies (includes licensing, patents, non-patented inventions, know-how)	Categorical (yes = 1, No = 2)
NPD collaboration	Collaboration in NPD process (domestic and foreign clients and suppliers or external academic or research institutions)	Categorical (Dummy; yes = 1, No = 2)
<i>Covariates</i>		
Firm age	Firm age	Continuous
Firm size	Number of full-time employees	Continuous
Sales	Sales (LCU)	Continuous
<i>Other</i>		
R&D intensity	R&D spending (LCU)/Sales (LCU)*100	Continuous
NPD performance	New products introduced during last 3 years	Categorical (yes = 1, No = 2)

4 Results and discussion

The innovation process is essential to the manufacturing firm's competitiveness. Today, companies should be able to shift from traditional closed innovation strategies to more open strategies that include external knowledge and technology acquisition, and active collaboration in NPD. Internal R&D plays a vital role in the companies to develop capabilities that enable the use of open strategies and assimilation of external knowledge and technologies. (e.g. Chesbrough, 2003; Cassiman and Veugelers, 2006) The data show that there are differences among transitional countries in innovation strategies but low-income countries seem to be generally less likely to engage in internal R&D and ETA, and if they do are more likely to invest in ETA. (EBRD, 2014) This make or buy decision is essential for many firms aiming to become more competitive. Figure 2 below shows the share of manufacturing companies in the countries that employ internal R&D compared to the acquisition of external knowledge or technologies.

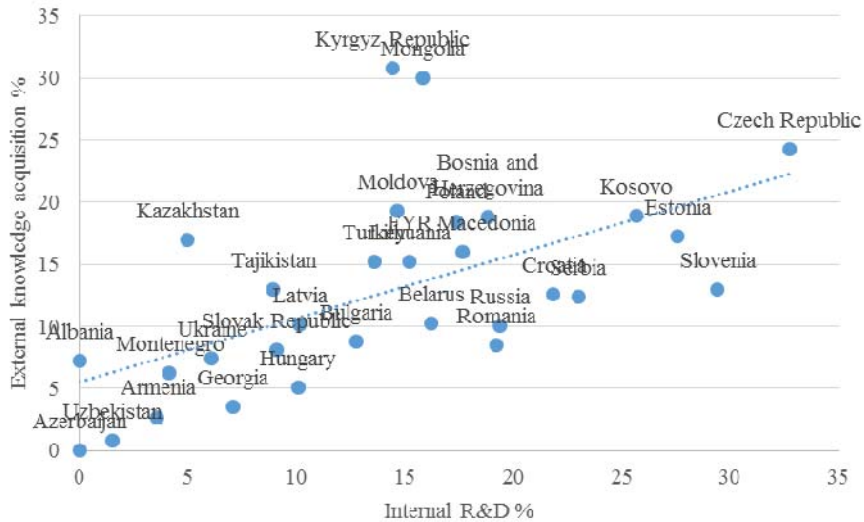


Figure 2. Share of internal R&D and acquisition of external knowledge (percentage of all companies)

Many studies have proved that a firm's network position and involvement in competitive industrial networks is beneficial for the focal firm. (e.g. Lane and Lubatkin, 1998; Stuart, 2000) Figure 3 below illustrates the firm's share of collaboration with clients or suppliers in domestic markets, compared with collaboration with partners abroad.

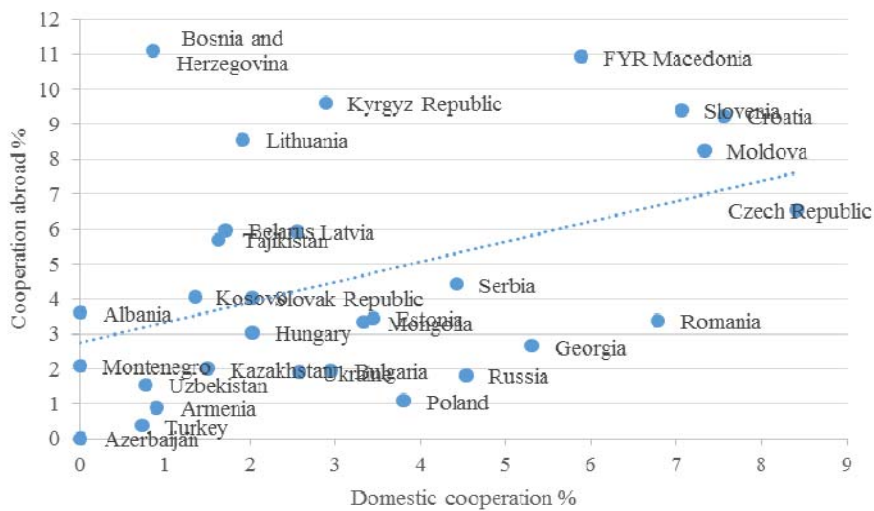


Figure 3. Share of collaboration with domestic partners or partners abroad in new product development (percentage of all companies)

Table 3 below shows that factor-driven economies are active in different innovation classes; however, the level decreases for the firms located in more competitive countries.

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Only the firms in the most innovation-driven economies can match and exceed the same level. We have also calculated R&D intensity as a ratio of R&D spending to sales, and present the mean values for companies in each stage of development. This indicates higher R&D intensity in groups 3-4 compared to the innovation-driven economies (group 5). The strategies seem to evolve alongside the developing environment. However, NPD performance shows that the factor-driven economies are active in commercializing their innovations. Productivity also increases when shifting to a more competitive economy. We do not employ R&D intensity and NPD performance indicators in the further analysis in this paper but they are good indicators of the productivity of the firms in different stages of development.

Table 3. R&D intensity and the share of companies conducting innovation activities

	R&D	ETA	NPD collaboration	R&D intensity (mean)	NPD performance
1 factor-driven economies	11.5% (26)	21.1% (48)	11.0% (25)	1.7%	33.0% (75)
2 transition stage	10.0% (35)	16.2% (57)	7.4% (26)	4.6%	23.6% (83)
3 efficiency-driven economies	11.1% (302)	10.9% (297)	4.5% (123)	6.3%	22.8% (623)
4 transition stage	17.8% (324)	11.8% (216)	7.3% (134)	4.3%	39.6% (723)
5 innovation-driven economies	24.6% (93)	15.9% (60)	11.6% (44)	3.5%	41.8% (158)

The descriptive statistics indicate that in the innovation-driven economies (group 5) there are firms which are active in R&D, ETA and NPD collaboration. We test this further by employing multinomial linear regression to see how the manufacturing companies compare in different stages of development, when looking at R&D, ETA, and NPD collaboration, to the innovation-driven economies. Table 4 below describes the correlations between the variables used in the regression analysis.

Table 4. Correlations

	Mean (SD)	1	2	3	4	5	6
1 R&D	1.06 (0.245)	1.0					
2 ETA	1.81 (0.390)	0.074*					
3 NPD collaboration	1.7635 (0.42504)	-0.057	0.094**				
4 LnFirmAge	2.7431 (0.59968)	-0.028	-0.056**	-0.023			
5 LnFirmSize	3.3742 (1.32463)	-0.072*	-0.086**	-0.037	0.293**		
6 LnFirmSales	15.9794 (2.90062)	0.022	-0.065**	-0.031	0.116**	0.507**	1

*p<.05, **p<.01

Multinomial logistic regression analysis is employed to study why companies are at a certain stage of development compared with others. In this case, we focus on the number of firms conducting R&D, ETA, or NPD collaboration, which we see as an indicator of the sophistication of innovation management strategies. As a reference group, we use in this analysis innovation-driven economies (group 5). Table 6 below shows the results of the multinomial linear regression analysis. We have used logarithmic transformation for the covariates (LnFirmSize, LnFirmAge, LnSales) to improve their normality. The minimum ratio of valid cases to the independent variable is satisfied in our tests. The model we have constructed has a statistically significant overall relationship and fit between the combination of independent variables and the dependent variable. Thus, our null hypothesis is rejected, and the existence of a relationship between the independent variables (R&D, ETA, NPD collaboration, including covariates; firm age, firm size, sales), and the dependent variable (stage of development) is supported. Also, the pseudo R square is relatively good.

There is a statistically significant individual relationship between the independent factors ETA and NPD collaboration and the dependent variable, except in the case of internal R&D. The selected covariates are significant in all cases with the dependent variable, and there is a relationship between firm age, firm size, firm sales and the stage of development.

The independent variable R&D is not significant in distinguishing the firms in transition stages of the dependent variable from the firms in innovation-driven economies, and the groups do not differentiate from the reference group. Independent variables ETA and NPD collaboration play a significant role in differentiating group 4 from the reference group. The values of B parameters with significant negative (or positive) coefficients decrease (or increase) the likelihood of that response category with respect to the reference category. Thus, the negative value B of the ETA and NPD collaboration corresponding to stage 4 indicates that any increase in the variable, value of innovation activity, would decrease the likelihood of being at stage 4 compared to the reference category of stage 5.

Furthermore, coefficients also show that LnFirmSize, LnFirmAge, LnSales seem to be good predictors in many of the development stages. We included these variables in the analysis to control for potential differences between different organizations.

Table 5 below also shows that there are no significant variances between the firms conducting R&D and the stage of development. However, for ETA and NPD collaboration there are significant variances between the development stages.

Table 5. ANOVA

	F	Df	MS	Sig.
R&D (internal)	0.116	4	0.007	0.977
ETA	4.609	4	0.714	0.001
NPD collaboration	4.089	4	0.728	0.003

Table 6. Regression results

	Factor			R&D			ETA			NPD collaboration			
		B	Std. Error	Exp(B)	B	Std. Error	Exp(B)	B	Std. Error	Exp(B)	B	Std. Error	Exp(B)
1 (factor-driven economies)	Intercept	0.693	2.139		2.221***	0.863		3.751***	1.324		3.751***	1.324	
	LnFirmAge	-0.831*	0.426	0.436	-1.026***	0.198	0.359	-1.433***	0.301	0.359	-1.433***	0.301	0.239
	LnFirmSize	0.129	0.213	1.138	0.212***	0.103	1.236	0.320**	0.151	1.236	0.320**	0.151	1.376
	LnSales	0.034	0.122	1.034	-0.051	0.053	0.951	-0.111	0.083	0.951	-0.111	0.083	0.895
	Factor (=I)	-0.812	0.912	0.444	0.362	0.261	1.436	0.275	0.351	1.436	0.275	0.351	1.317
2 (transition stage)	Intercept	-9.924***	2.170		-2.369***	0.832		-7.205***	1.497		-7.205***	1.497	
	LnFirmAge	-1.075***	0.382	0.341	-0.947***	0.179	0.388	-1.007***	0.289	0.388	-1.007***	0.289	0.365
	LnFirmSize	-0.681***	0.208	0.506	-0.180*	0.094	0.835	-0.628***	0.154	0.835	-0.628***	0.154	0.534
	LnSales	0.862***	0.126	2.368	0.336***	0.050	1.399	0.693***	0.090	1.399	0.693***	0.090	1.999
	Factor (=I)	-0.543	0.842	0.581	0.257	0.230	1.294	0.039	0.333	1.294	0.039	0.333	1.040
3 (efficiency-driven economies)	Intercept	4.004***	1.162		3.066***	0.571		3.267***	0.872		3.267***	0.872	
	LnFirmAge	-0.474**	0.215	0.622	-0.650***	0.127	0.522	-0.484***	0.184	0.522	-0.484***	0.184	0.617
	LnFirmSize	0.170	0.110	1.185	0.308***	0.068	1.361	0.101***	0.097	1.361	0.101***	0.097	1.106
	LnSales	-0.128**	0.060	0.880	-0.043	0.035	0.958	-0.052***	0.054	0.958	-0.052***	0.054	0.950
	Factor (=I)	-0.243	0.595	0.784	-0.127	0.178	0.881	-0.289	0.228	0.881	-0.289	0.228	0.749
4 (transition stage)	Intercept	-2.538**	1.237		-2.965***	0.621		-2.996***	0.929		-2.996***	0.929	
	LnFirmAge	-0.658***	0.223	0.518	-0.755***	0.134	0.470	-0.744***	0.189	0.470	-0.744***	0.189	0.475
	LnFirmSize	-0.361***	0.117	0.697	-0.212***	0.072	0.809	-0.277***	0.101	0.809	-0.277***	0.101	0.758
	LnSales	0.439***	0.069	1.550	0.452***	0.038	1.572	0.465***	0.059	1.572	0.465***	0.059	1.593
	Factor (=I)	-0.433	0.585	0.648	-0.455**	0.187	0.635	-0.518**	0.234	0.635	-0.518**	0.234	0.596
Model fit			Chi-square 194.674 (df 16) sig 0.000			Chi-square 612.794 (df 16) sig 0.000			Chi-square 316.975 (df 16) sig 0.000			Nagelkerke R Square 0.244	
			Nagelkerke R Square 0.270			Nagelkerke R Square 0.212			Nagelkerke R Square 0.244			N = 1248	
			N = 681			N = 2819			N = 1248				
Correct classification rate			1 (0.0%), 2 (2.9%), 3 (67.8%), 4 (83.4%), 5 (0.0%), overall (60.1%)			1 (0.0%), 2 (0.0%), 3 (76.2%), 4 (68.8%), 5 (0.0%), overall (58.2%)			1 (0.0%), 2 (0.0%), 3 (63.9%), 4 (80.9%), 5 (0.0%), overall (58.3%)				

Notes: Reference category for the equation is 5 (innovation-driven economies), *** p<.01, **p<.05, *p<.10

5 Conclusions

The results show that the level of R&D does not significantly differentiate in manufacturing companies between the development stages. However, it seems that ETA and NPD collaboration are factors that are more dependent on the business environment and development stage of the host economy. The regression analysis shows that there is a difference especially between the companies in the two most competitive groups of country at the level of ETA and NPD collaboration; by increasing the level they are more likely to be similar to the companies in the innovation-driven economies. The comparison to the reference group also indicates that the companies in less developed economies are active and open in innovation activities. There is a clear need for catch-up in competitiveness, and the companies are already using open strategies and a variety of methods to support their innovation activities. The results also indicate that open strategies are effective in catch-up but companies in the most developed environments still have to rely strongly on internal R&D. The lower level of internal R&D in the less developed countries can also be linked to the weak institutional environment in emerging markets, which does not encourage and support companies to innovate, and they choose to rely more on external technologies.

The analysis offered no support for *Hypothesis 1, The share of firms conducting internal R&D in new product development in manufacturing industry increases when a country becomes more competitive*, at any stage of development. This indicates that the share of firms conducting internal R&D does not change in manufacturing industry compared to the firms located in the innovation-driven countries.

The analysis offered support for *Hypothesis 2, The share of firms exploiting external knowledge and technology acquisition in new product development in manufacturing industry increases when a country becomes more competitive*, in the case of the second transition stage towards innovation-driven economies. There is significant difference in the share of firms conducting ETA, between the two most competitive groups of country, and the innovation-driven economies seem to be more active in ETA.

The analysis offered support for *Hypothesis 3, The share of firms collaborating with customers and suppliers or academic and research institutions in new product development in manufacturing industry increases when a country becomes more competitive*, in the case of the second transition stage towards innovation-driven economies. There is significant difference in the number of firms collaborating in NPD, between the two most competitive groups of country, and the innovation-driven economies seem to be more active in collaboration.

This study adds value to the technology management literature, especially by examining how open innovation and technology management strategies are applied in developing and emerging markets. The countries in this study have a different business and institutional environment, which clearly affects innovation and company strategies compared with developed countries. Open strategies are extremely important to manufacturing industries in these countries, in helping them become more competitive. However, it seems the issues are quite complex and the relationships not as straightforward as may be assumed. We believe there remains a gap in the current understanding of the role of business environment in the management strategies companies choose. While there are limitations to this study, we believe the topic is of

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interest and raises many topics for further research. This paper has identified new areas for research. One of the most interesting is the impact of the development of business environment on company performance, productivity and competitiveness. We aim to assemble a large sample of longitudinal panel data to study this issue further.

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